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Recent discoveries of human skeletons in the flint mine shafts of Spiennes: casualties or burials?

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Abstract

Since 1997, new archaeological research on the Neolithic mining area of Spiennes led to the discovery of two human skeletons in shaft ST11 and one in shaft ST6. Radiocarbon dating confirms their Neolithic age. This preliminary contribution shortly reviews the state of knowledge about human remains found at Spiennes, focusing particularly on recent discoveries.

Keywords: Flint mine, Neolithic, human remains, burial, relegation grave.

Résumé

Les recherches archéologiques menées depuis 1997 dans les zones minières de Spiennes ont conduit à la découverte de deux squelettes humains dans le puits ST11 et d'un squelette dans le puits ST6. Les datations au radiocarbone ont confirmé leur âge néolithique. Cette contribution préliminaire passe en revue brièvement l'état des connaissances sur les restes humains trouvés à Spiennes, en s'intéressant en particulier aux découvertes récentes.

***Mots-clés** : Minière à silex, Néolithique, restes humains, inhumation, sépulture de relégation.*

1. INTRODUCTION

Around 190 Neolithic flint mines have been recognised, from Scandinavia to Italy and from Belarus to Portugal as a pan-European phenomenon. Some of these mines have yielded isolated human bones and nearly complete skeletons, for instance Krumlovsky lès (Czech Republic), Vienna Mauer (Austria), Cissbury and Grime's Graves (UK) and Kleinkems (Germany).

In Belgium and neighbouring Dutch Limburg, three mining areas have yielded human remains, providing a major source of information about Neolithic societies.

a) The Maastricht area in the Netherlands and the adjacent Belgian Geer Valley. As Skull 1 unearthed in 1965 in the Neolithic Rijckholt-St. Geertruid mines, near Maastricht, has been discarded on the basis of a radiocarbon date (DE GROOTH *et al.*, 2011), the skull discovered by J. Hamal-Nandrin in the 'Schone Grub', a dry valley bisecting the Rijckholt mining area, is the only human remain which has been directly dated to the Neolithic period: 3840 ± 35 BP (GrA-26908; DE GROOTH *et al.*, 2011).

b) The central area, north of the city of Huy, where a burial was excavated in the village of Avennes, in 1945 (DESTEXHE-JAMOTTE, 1947). The discovery took place in a large mining site, in a pit which may be the top part of a mine shaft. The burial contained the bones of an adult man and two children, all in anatomical connection. A radiocarbon date by AMS was obtained using an adult cuneiform bone; OxA-6450: 4555 ± 60 BP, i.e. between 3500 and 3030 cal BC at 2 σ situating the individual between the very end of the Middle Neolithic and the beginning of the Late Neolithic (TOUSSAINT, 1998).

c) The region of Mons, where the mining area of Spiennes alone has produced relatively numerous human bones over the past 150 years; these findings are presented with more details in this paper. Thanks to radiocarbon dating, the so-called 'buried Neolithic flint miners' discovered in Strépy and Obourg are now rejected as a hoax (DE HEINZELIN *et al.*, 1993).

In Spiennes itself, contextual information about the discovered human remains is often very deficient. In fact, only the most recent excavations, undertaken since 1997 under the authority of the Public Service of Wallonia, provide satisfactory data in relation to the modern standards of archaeological and anthropological field research. For this reason, with the aim of improving the knowledge of the anthropology of the Neolithic populations of Spiennes as well as the methods of introduction of human bones into the mine shafts, an interdisciplinary research program was undertaken since 1997 under the authority of the Public Service of Wallonia. These new investigations relate mainly to the skeletons discovered in 1997 in shaft ST11 but also to the skeleton being currently excavated in shaft ST6. F. Hubert's discoveries in 1965 and the SRPH's discoveries in 1979, which had not really been studied so far, are also briefly presented, while earlier discoveries, discussed in various articles (among others COLMAN, 1957; DE HEINZELIN *et al.*, 1993), are simply summarised.

Research is being developed in three areas: firstly, archaeothanatology which aims to decode the nature of bone deposits (deliberate

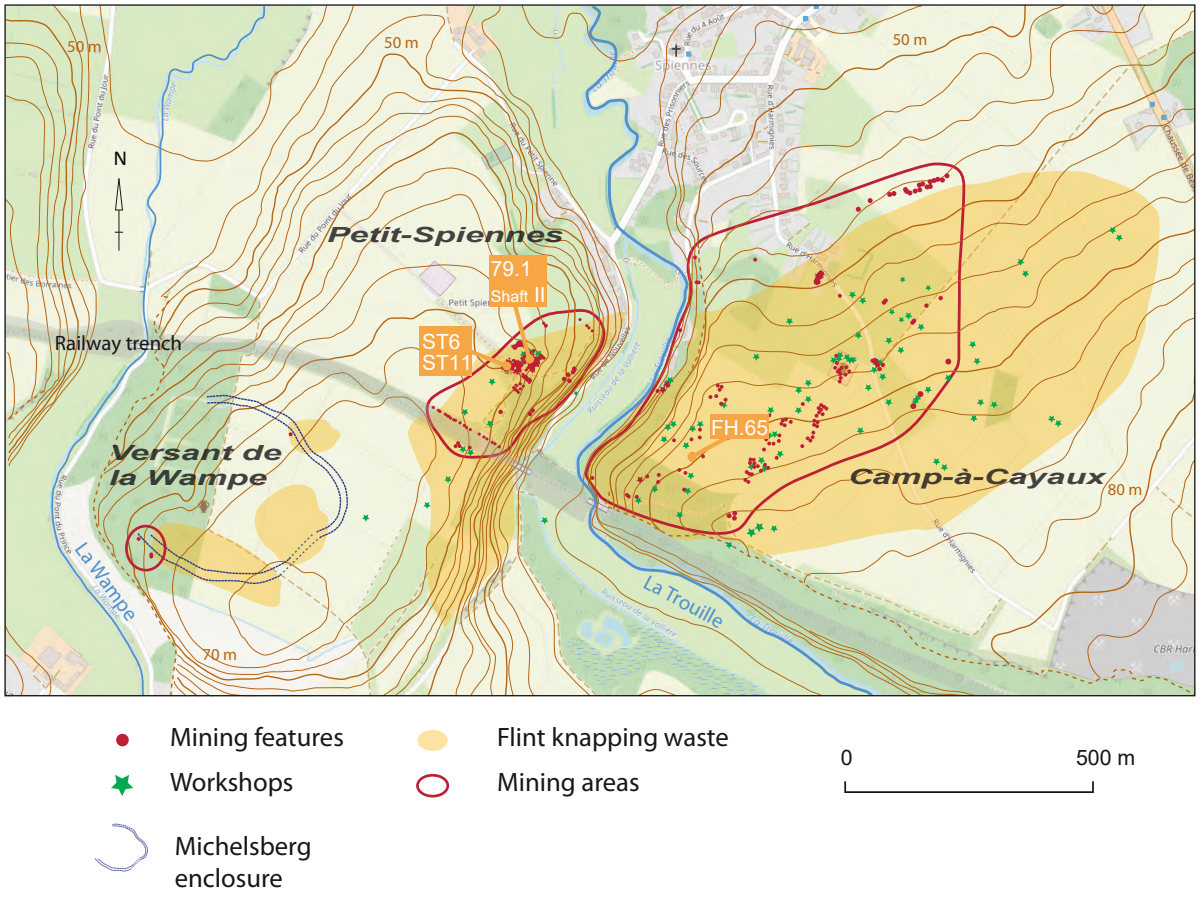


Fig. 1 – Map of the three mining areas of the Neolithic flint mines of Spiennes with location of the human remains from recent shaft excavations. FH65: excavation by F. Hubert in 1965, shaft II & 79.1: excavation by the Society for Prehistoric Research in Hainaut from 1953 to 2010, ST6 & ST11: excavation by the Walloon Heritage Agency from 1997 to 2004 and from 2013 to 2019. Background map: OpenStreetMap, licence Open Data Commons Open Database.

character of the deposits or not, cause of death, type of funerary deposits, primary or secondary burials...); secondly, 'classical' anthropological studies (number of subjects, age, sex, stature, activity markers, pathology...); thirdly, biological and geochemical analysis (14C, isotopic determination of C and N or strontium, palaeogenetics...).

2. The mining area of Spiennes

The mining area of Spiennes (COLLET, 2016) is located approximately 5 km south-east of the city of Mons (Province of Hainaut, Belgium). It comprises of three Neolithic mining areas (Fig. 1). They are called 'Camp-à-Cayaux', 'Petit-Spiennes' and 'Versant de la Wampe'. The Interpretation Centre of 'Petit-Spiennes' is situated 50° 25' 12.032" N, 3° 58' 56.971" E by the geographical coordinate system, while the Archaeological Research Centre of 'Camp-à-Cayaux' is 50° 25' 11.013" N, 3° 59' 29.137" E. It was estimated that as many as 15 to 20,000 shafts could have been dug covering an area of around 50 to 100 ha, exploited in the three zones of Spiennes, from approximately 4350 cal BC to at least 2800 cal BC, and possibly to 2300/2200 cal BC.

'Camp-à-Cayaux' and 'Petit-Spiennes' have yielded human remains, exhumed from the mid-19th century to the last few years. These are isolated bones or skeletons of varying completeness.

In addition to the 14C dates obtained from fauna, charcoal and antler tools (COLLET *et al.*, 2008b), 17 radiocarbon dates were obtained from these human bones (Fig. 2), of which 12, were presented in a first article (TOUSSAINT *et al.*, 2010). Of these 17 dates, 16 correspond to the Neolithic period, while the last one confirms the long-suspected attribution to the Merovingian of the skeletons found in 1919 in the slope of the 'Camp-à-Cayaux' (RUTOT, 1920; DE HEINZELIN *et al.*, 1993). Precisely, all the Neolithic dates obtained on human bones range between 5160 ± 45 BP (OxA-8874) and 3775 ± 40 BP (GrA-50661), or in calibrated dates at 2 σ between 4049 and 3803 cal BC and between 2338 and 2030 cal BC (Fig. 2). They overlap with the 24 dates obtained on other material from the mines and related sites (COLLET *et al.*, 2008b; COLLET, 2016) and confirm that the mines of Spiennes have been active in both the Middle Neolithic and the Late and Final Neolithic.

The Spiennes mining complex also included a ditched enclosure in the 'Versant de la Wampe' mining area, composed of two concentric ditches and banks. No human bone has been reported so far in this area. The associated archaeological material found in the enclosure can be attributed to the Michelsberg culture (HUBERT, 1971) and, more specifically, to the 'Central Scheldt basin group' (VANMONTFORT, 2004, p. 342), connected with the Michelsberg culture groups from the Paris Basin, the Middle Meuse and the Rhine Basin. As the potteries of the enclosure do not show real difference with those found in the mining areas, and according to some 14C dates, the settlement looks contemporaneous with at least part of the mining activity at Spiennes (COLLET *et al.*, 2008a).

3. Human bones found from at least 1867 to around 1960

Some human bones belonging to the partial skeleton of a child from 3 to 6 years were identified as early as 1867 in one of the mining shafts probably found in the trench dug during the construction of a railway, near 'Petit-Spiennes' ('Spiennes C'; DE HEINZELIN *et al.*, 1993). Other human remains could even have been found earlier (HUBERT, 1988, p. 15) or possibly just before 1875, such as the cranial fragments and long bones known as 'Spiennes Y' belonging to at least two individuals, but from uncertain provenance (DE HEINZELIN *et al.*, 1993).

During the last decades of the 19th century and the first of the 20th century, extensive mining excavations were carried out and several human remains were discovered but without accurate stratigraphical and archaeological contexts. They can be divided into two series:

a) More or less isolated skulls.
On several occasions, more or less isolated skulls, cranial fragments and mandibles were

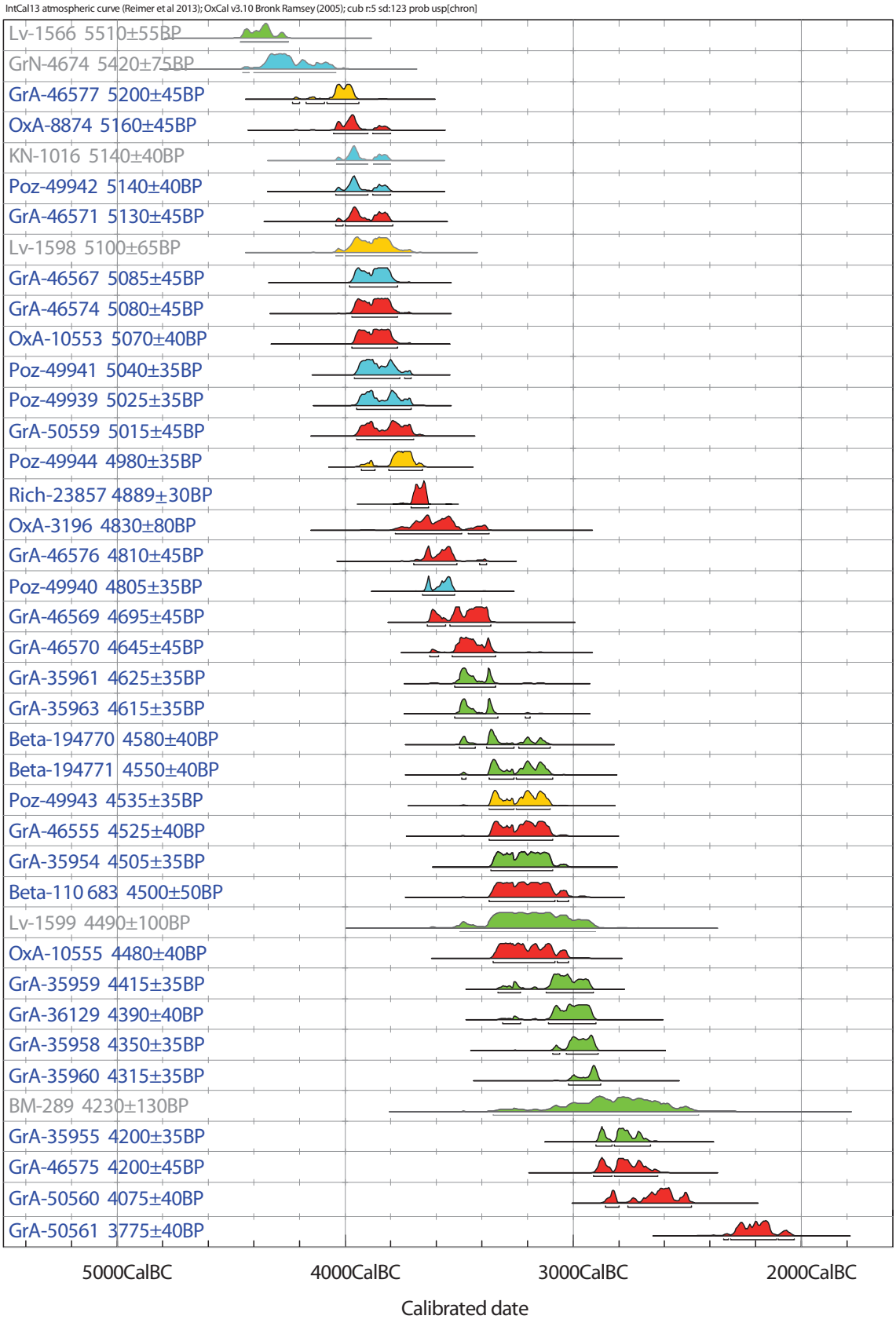


Fig. 2 – Radiocarbon dates of the Neolithic flint mines of Spiennes. Dates obtained on human bones are in red, animal bones in yellow, charcoal in blue, antlers in green. Date references in light grey outline correspond to conventional dates and dark blue outline to AMS dates.

exhumed in the upper part of mine shafts at Spiennes. Their findings are not very precise. Four of these discoveries have led to numerous discussions. During excavations of features 3 ('Spiennes I & J' of DE HEINZELIN *et al.*, 1993) and 5 ('Spiennes L') at 'Camp-à-Cayaux', A. de Loë and E. Rahir (1929, p. 55) discovered three skulls without mandibles and interpreted them as 'secondary burials' with grave goods. Following the discovery in 1953 of a new skull without mandible, J. Verheyleweghen (1962) again vigorously defended this idea. Such an interpretation has been strongly contested, notably by P. Colman (1957) and J. de Heinzelin *et al.* (1993) and is now completely rejected, based on many arguments. The relationship between the isolated skulls and what is considered as grave goods is far from established. Secondly, these artefacts offer nothing particular which would guarantee its funerary character itself. Thirdly the shafts in which skulls were interpreted as second degree deposits were only partially excavated. It is therefore possible that the rest of the skeletons still lay in the shafts. Fourthly, the stratigraphy with almost horizontal layers proposed by the former excavators is

Fig. 3 – Spiennes 'Camp-à-Cayaux': sketch of the arrangement of skeletons D & E exhumed in 1911 by the digger C. Stevens on behalf of the Natural History Museum (now Royal Belgian Institute of Natural Sciences).

clearly fanciful in view of those observed in more recently excavated features which eliminates any form of a serious guarantee regarding the context of these skulls. Fifthly, while the isolated skulls are interpreted as secondary burials, the isolated postcranial bones are not, which is inconsistent.

b) Partial or fairly complete skeletons.

In January 1911, C. Stevens unearthed a relatively complete adult skeleton and a child of about twelve years in a pit with vertical walls, possibly the upper part of a mine shaft. Only a brief sketch has been produced (Fig. 3). It shows the adult ('Spiennes D') lying at 1.43 m deep, on its back, legs down. The skeleton of the child ('Spiennes E') was extended with head at the opposite side of the pit, slightly oblique to the axis of the adult body. The inaccuracy of the sketch makes it impossible to determine whether there was a real interconnection between the two skeletons. Curiously, however, the radiocarbon dates of the two Neolithic skeletons differ from 300 years BP and their calibrations, both at 1 and 2 σ, do not overlap. These two skeletons could correspond to burials largely more or less *in situ* (probable anatomical connections...). A triangular arrowhead has been found under the adult skeleton, which could either play in favour of funerary material or be linked to an injury.

4. HUMAN REMAINS OF THE 1965 EXCAVATION BY F. HUBERT (FH65)

A small series of 82 human bones, often reduced to fragments, was discovered at 'Camp-à-Cayaux' in the upper part of the shaft no 3/ workshop no III during the 1965 field campaign of the *Service national des Fouilles*, at depths ranging from ± 125 cm to ± 165 cm (Fig. 4). These fragments were not identified as human during the excavation. They are preserved in the store rooms of the Walloon Heritage Agency of the Public

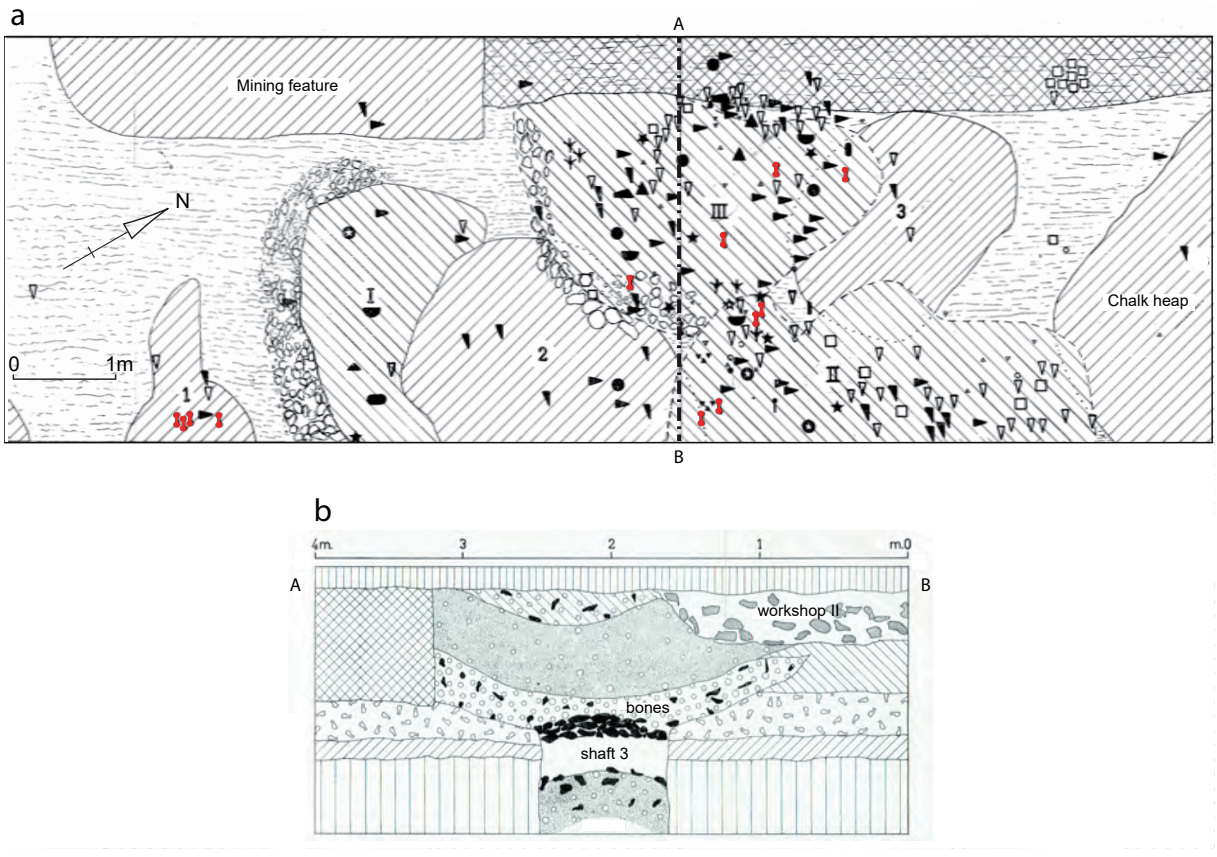


Fig. 4 – Excavation of the summit part of the shaft 3 and workshop III at Spiennes 'Camp-à-Cayaux', by F. Hubert, a: plan; b: section. Red symbols: bones; the other symbols correspond to the different types of material (flint, sandstone fragments and deer antlers), after HUBERT, 1969, p. 22.

Service of Wallonia, mixed with six animal bones, in two boxes with labels written by F. Hubert, the excavator (HUBERT, 1969).

After refitting the 82 fragments, the collection contains only 22 identifiable bones, but all of them are incomplete with respect to their original anatomical state, as well as ten unidentifiable fragments. The intensity of fragmentation is therefore maximal. These 22 elements represent only 10.7 % of the 206 bones of an adult skeleton (BASS, 1971). Given the young age of the subject, in which all three parts of the long bones have not yet been welded together, this proportion is even smaller.

The skull and pelvis are not represented in the collection. The shoulder girdle is attested by the left clavicle and the left scapula, the arm by the two humerus, the forearm by the right radius and the right ulna. The two lower limbs are represented, on the right by the tibia and fibula, on the left by the femur and fibula. The ossicles of the hands and the feet are not preserved. Fourteen elements come from the left side of the body, five from the right side and three indeterminate.

All these remains come from a single juvenile individual. In the absence of teeth, it is difficult to estimate its age. He or she was approximately ten years old, given the dimensions of the long bones in comparison with sets of bones of known age. Trying to determine the sex of an immature skeleton by strictly anthropological methods is almost impossible, especially in the absence of the pelvis; this has not been attempted here.

No excavation plans and photographs of the *in situ* human bones have been made. It is therefore not possible to verify the presence or absence of anatomical connections and the spatial proximity of bones belonging to the same areas of the body thus making it impossible to determine whether or not the human bones found in 1965 correspond to a burial site.

A human rib was used to obtain a radiocarbon date by AMS: 5080 ± 45 BP (GrA-46574), i.e. 3953-3804 cal BC after calibration at 2 σ and 3971-3775 at 1 σ.

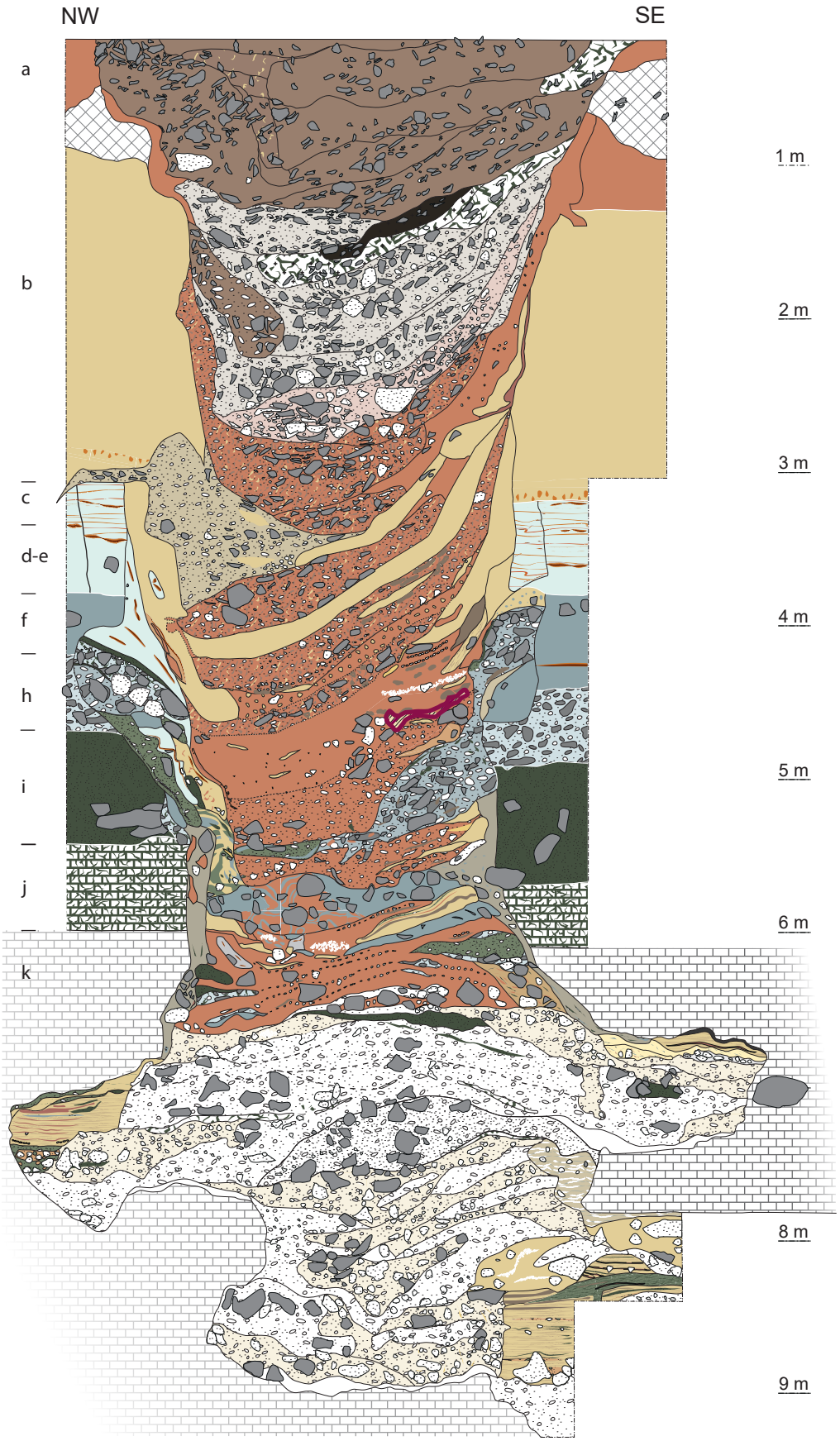
5. EXCAVATIONS OF THE SRPH (79.1)

A few human remains were discovered in a deposit interpreted as a mudflow (*coulée boueuse*) overlying the chalky mining waste at the base of shaft 79.1 of the SRPH (Society for Prehistoric Research in Hainaut) excavation at 'Petit-Spiennes' (GOSSELIN, 1986, p. 148). In the SRPH collections, only two documents are currently present (in 2017), the posterior half of an adult left calcaneus and an intact fourth left metatarsal. Only the base of the latter is still preserved, the body and head of the bone being used to obtain the AMS OxA-8874 date at 5160 ± 45 BP, or at 2 σ between 4050 and 3800 cal BC (COLLET *et al.*, 2011). Contra Gautier (in GOSSELIN, 1986, p. 148), it is not possible to be sure of the number of individuals represented by the two bones. They may very well have belonged to one individual as well as to two different individuals. Both bones are clearly adult and, at least for the metatarsal, could have belonged to a male because of its dimensions well above the female average and close to the male average of Mountrakis *et al.* (2010). There is no serious element to determine the cause of the introduction of the bones into the shaft.

At least two human remains belonging to the upper limb were also excavated in shaft II of the SRPH excavations. These are an ulna and a radius that have not been presented to us for study. Colman (1957, p. 252) mentions the additional discovery of a femur and a tibia: either these two bones have been lost or are hidden in museum collections, or there have been erroneous anatomical determinations in the field of the two previous bones.

6. RECENT DISCOVERIES: 1997 ONWARDS

The excavations conducted recently at 'Petit-Spiennes' by H. Collet and the Public Service of Wallonia involved three mine shafts which were excavated almost exhaustively to the bottom: ST6 (1999-2004 and 2014-ongoing), ST11 (1997-1999) and ST20 (1999-2004 and 2013). The first two have each delivered a nearly complete adult skeleton, accompanied by a newborn in the case of ST11.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6.1. Survey methods

Accurate and detailed recording of the archaeological context is essential to have the slightest chance of decoding, at least in part, the phenomena responsible for the arrival of the human bones in mine shafts.

To this end, the digging of the ST11 adult skeleton in 1997 was carried out in collaboration between the archaeological team in charge of the site and the anthropologist. A natural-sized drawing of the skeleton has been done. Several photographic records were also made. All bones, even the smallest fragments, have been accurately identified *in situ*. Details of their morphology (epiphyses, faces, processes and furrows, ridges, crests ...), their lateralisation, the state of the connections (both labile and persistent), the displacements, the morphology of the breaks and the state of conservation of each bone have been precisely recorded.

The excavation of the ST6 skeleton in 2014-2019 applied the same principles, but with two notable improvements. In addition to the systematic presence of the anthropologist at each stage of the bone survey, the excavation involved a geologist who focused on deciphering the numerous layers of the feature and interpreting the various sedimentary processes. The ultimate goal is to better understand the detailed history of the filling of the shaft, including the history of the introduction of human bones, taking into account the data from all the involved disciplines. Secondly, instead of making a plan on paper, digital photographs of each bone were transferred to a tablet on which the anthropologist and geologist recorded details of their anatomical and stratigraphic observations, while the archaeological team specifically used the total station in order to reconstruct a general plan and 3D views during the post-digging process.

6.2. The skeletons of shaft ST11 and their context

Two human skeletons were discovered in the ST11 shaft: an almost complete adult (TOUSSAINT *et al.*, 1997; COLLET & TOUSSAINT, 1998) and some fragments of a newborn (COLLET & VAN NEER, 2002). A 14C date by AMS was performed using the left cuboid of the adult skeleton; Beta-110683: 4500 ± 50 BP, i.e. between 3338 and 3103 cal BC after calibration at 1 σ and between 3362 and 3027 cal BC at 2 σ. The perinatal skeleton was also subjected to an AMS dating made from a right humerus: GrA-46555: 4525 ± 40 BP, i.e. between 3353 and 3114 cal BC after calibration at 1 σ and between 3363 and 3097 cal BC at 2 σ.

On the basis of the degree of closure of the seven sites of the vault of R. Meindl and C. Lovejoy (1985), the adult, possibly a male, corresponds to an average age at death of 45.2 ± 12.6 years. Examination of the right sacroiliac surface by the method of A. Schmitt (2005) gives a higher age that has 90 % chance of matching a subject over 60 years of age at death. Regardless of the estimation method, the deceased of the ST11 was therefore an elderly adult.

Most of the adult bones were arranged in an inclined plane at about 40° on an elongated surface of about 2 m in length, 40 to 60 cm in width and hardly more than 30 cm thick, at depths ranging from ~4 m to ~5.5 m (Fig. 5, Fig. 6). The thickness of the bone cluster was visibly lower than that of a body not yet decomposed. Decomposition obviously occurred in the shaft, as evidenced by the presence of numerous bones from all parts of the skeleton and their anatomical position.

The position of the skeleton was clearly recognisable with the lower limbs located at the top to the south-southwest of the deposit and the

Fig. 5 – (opposite page) Petit-Spiennes, mining shaft ST11. Section with position of some of the human bones discovered (purple hatched area) and stratigraphic context; a: clayey silt (Bt horizon); b: loess; c: silt and silty sand; d-e: light grey sandy silt; f: greenish grey clayey/sandy silt; h: flint blocks and chalk nodules in grey to greenish grey sandy matrix; i: dark green sandy matrix; j: *in situ* weathered chalk; k: *in situ* chalk.

Fig. 6 – 'Petit-Spiennes', mining shaft ST11. The adult skeleton being excavated.

head at the base to the north-northeast. However, many positional anomalies were present due to displacements of bones and sediments. In fact, it is possible to distinguish three areas in the distribution of bones:

- In the upper part of the bone deposit, the distal zone of the lower limbs (fibulas, tibias, patellas and bones of the feet) largely dislocated but some bones are matched;
- In the intermediate area of the bone deposit, the part of the skeleton that best respects the anatomical distribution of a skeleton, appearing in some sectors in more or less strict connection and crushed in place. This area includes the femurs, the coxal bones, the left part of the rib cage, the left scapula as well as the lumbar vertebrae and part of the thoracic vertebrae.
- In the lower part of the bone deposit, the right part of the chest and the area of the head and right arm; these bones are disconnected but still have some anatomical proximity.

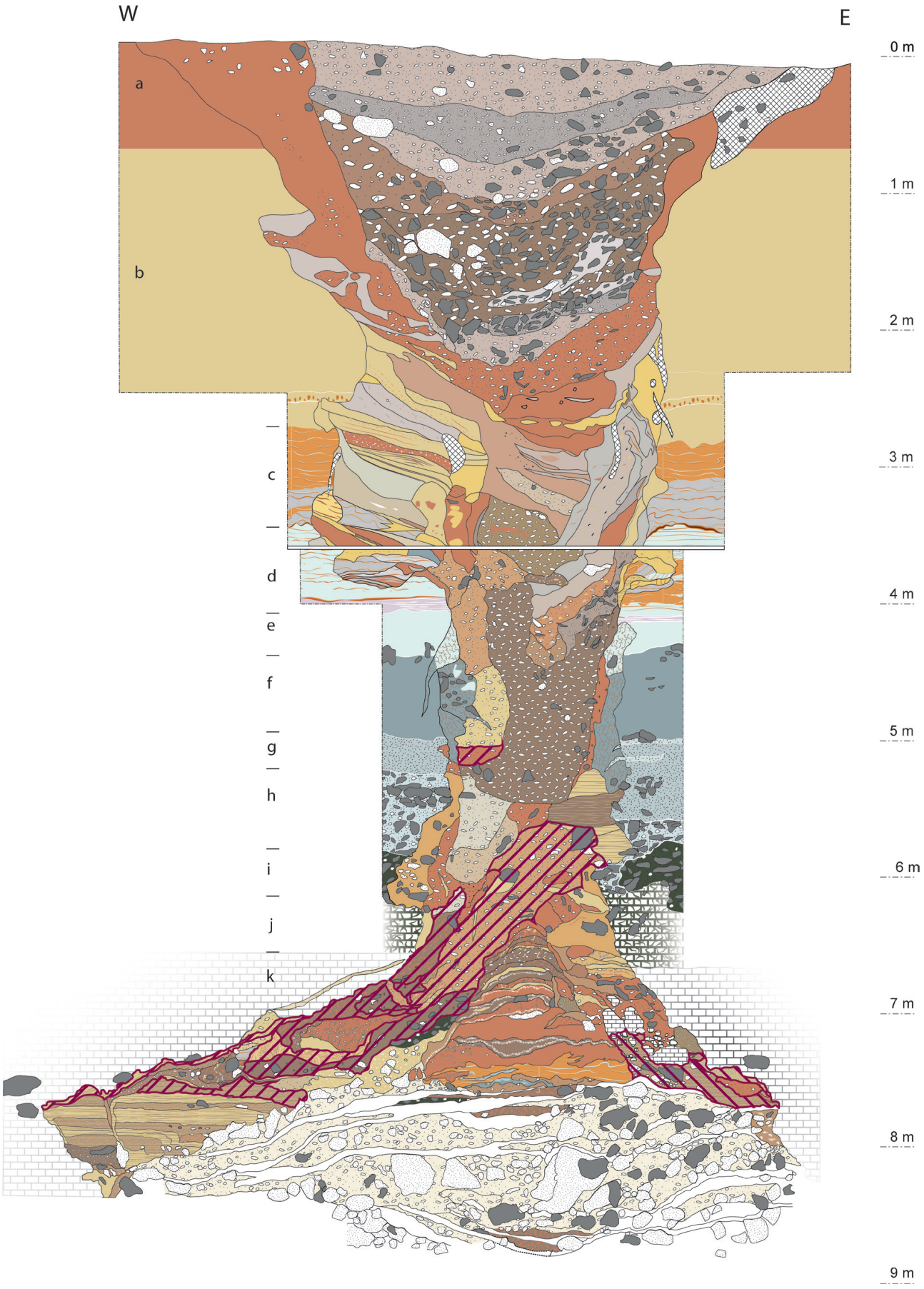
The bones of the new born were discovered in a small area between 4.8 and 5.2 m in depth, well apart from the adult skeleton, while a single bone moved down up to about 6.2-6.4 m in depth. Unfortunately the human bones of the perinatal were not recognised *in situ*, preventing a study of its disposition.

6.3. The skeleton of shaft ST6 and its context

From the summer of 2014 until the end of 2019, human bones were unearthed at the bottom of the ST6 shaft and in the upper part of the filling of the galleries. The anthropological excavation, which will be continued in 2020, is conducted by the Public Service of Wallonia in collaboration with the SRPH (LAVACHERY *et al.*, 2015; COLLET *et al.*, 2016).

All bones discovered so far belong to a single adult individual, probably a man. Because many cranial fragments are still missing, it is not possible to estimate the degree of closure of many diagnostic anatomical sites used by R. Meindl and C. Lovejoy (1985). At most, it can be noted that the degree of closure of the sutures of ST6 individual is less than in ST11, which would argue in favour of a slightly younger subject. Examination of the two sacroiliac surfaces by the method of A. Schmitt (2005) gives a subject who has 99 % chance of being over 50 years old at death.

Fig. 7 – (opposite page) 'Petit-Spiennes', mining shaft ST6. Section with position of layers including human bones (purple hatched area) and stratigraphic context; a: clayey silt (Bt horizon); b: loess; c: cryoturbated unit composed of silt and silty sand passing to pure sand at the bottom (the sand part corresponds to SG unit of Di Modica *et al.*, 2014); d: alternating thin layers of sandy silt and clayey silt from light grey to light pink in colour (SLAS unit); e: light grey sandy silt (LHGC unit); f: greenish grey clayey/sandy silt (LGV unit); g: beige-yellow coarse and medium coarse cross-bedded sands (SGC unit); h: flint blocks and chalk nodules in grey to greenish grey sandy matrix (K unit); i: flint blocks and chalk nodules in a dark green sandy matrix; j: *in situ* weathered chalk; k: *in situ* chalk. For more details about units K to SG, see DI MODICA *et al.*, 2014.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At the present state of excavation, the human bones have been found from depths 5.5 to 7.9 m (Fig. 7, Fig. 8). These remains have been unearthed from several distinct stratigraphic units. Taking into account the spatial and stratigraphic distribution of the remains, as well as the study of the sedimentary processes (including dry grain flow, run-off, and debris flow), it is clear that the human body underwent a complex history, including several phases of redistribution. Given the available data, our best hypothesis is that the body was introduced in the shaft (accidentally or deliberately) and that complex post-sedimentary processes affecting the shaft filling lead to a

Fig. 8 – 'Petit-Spiennes', mining shaft ST6. Human bones in various stratigraphic contexts; a: tibia fragment found at 5.5 m deep (item no 353), b: tibia fragment found at 7.65 m deep (item no 680), c: sacrum articulated to lumbar vertebrae found between 7 and 7.2 m deep (items no 622 and 638-642).

multi-phased reworking of the corpse. In the near future, a combination of the available stratigraphic records, the anthropological data, and the exact spatial position of all the human remains should allow determining with more details the succession of events, and should help better deciphering the mode of introduction of the human body in the ST6 feature.

All the anatomical areas of the skeleton are present: skull, shoulder girdle, trunk (ribs and vertebrae), upper limbs and hands as well as to lower limbs and feet. Most of these are disconnected. However the sacrum and the two coxal bones were still in connection, a little open, and the sacrum articulated to the lumbar vertebrae.

6.4. Musculoskeletal Stress Markers (MSM)

The study of the morphology and development of areas of muscle attachment to bone, often referred to as musculoskeletal stress markers, or MSM, is frequently used to determine occupational patterns and sociocultural divisions of activity in populations (i.e. CAPASSO *et al.*, 1999; MARIOTTI *et al.*, 2007; VILLOTTE, 2009). In fact, when a muscle is heavily used, its insertions on the bones are supposed to become stronger. However, some studies suggest that MSMs are also age structured within human groups (TAKIGAWA, 2014).

The bones of ST6 and ST11 show various well-developed insertions. For example, the humerus of ST6 presents a strong deltoid tuberosity. So, the deltoid muscle was powerful and well adapted to hard work. This muscle originates in three distinct sets of fibres which arise from the clavicle and scapula, forming the rounded contour of the shoulder, then converging toward their insertion on the deltoid tuberosity on the middle of the lateral aspect of the body of the humerus. When all its fibres contract simultaneously, the deltoid is the prime mover of arm abduction, the movement away from the midline of the body.

Another example, the ST11 adult individual exhibits a very strongly developed, and very unusual, coracoid tuberosity on the lateral part of both clavicles. The conoid process is also slightly developed. In addition, both shoulder blades show bony developments on the coracoid process. The coracoclavicular ligament serves to connect the clavicle with the coracoid process of the scapula. It consists of two parts, the trapezoid ligament in front, which inserts into the coracoid tuberosity, and the conoid ligament behind (Fig. 9). Since this tuberosity is strong, it means that the trapezoid ligament of ST11 was powerful. Other strong insertions can be observed on other bones, for instance on both ST11 radiuses.

To conclude, the results of the MSM examination, especially the coracoid tuberosity and the conoid process of both clavicles as well as the coracoid process of the shoulder blades of ST11, seem to indicate that the Spiennes people could have been involved in hard physical work which is compatible, among other possibilities, with mining activities.

6.5. How did the human bones arrive in the mine shafts?

In an attempt to understand the reasons for the introduction of the skeletons into the ST11 and ST6 shafts an elimination procedure was adopted.

a) The various causes of *unintentional introduction* have to be rejected:

- Various indices advocate against a mining accident. Indeed, the first bones of the adult skeleton of ST11 appeared at 4 m in depth, in the middle part of the access shaft, above the exploitation level. Furthermore the stratigraphy of ST11 does not show significant collapses in the shaft walls. Such an initial position of the corpse implies an arrival after the end of mining operations. In ST6, the bones were also discovered in layers posterior to the mining operations. Finally, the bones found in ST11 and ST6 do not show traces of fracture on fresh bone.
- An accidental fall in the shafts is equally unlikely in the absence of fracture on fresh bone.
- There is no evidence of animal intake. There are no bite marks.
- There is also no evidence of an introduction of the body through sedimentary processes from outside the shafts, for example, a mud or

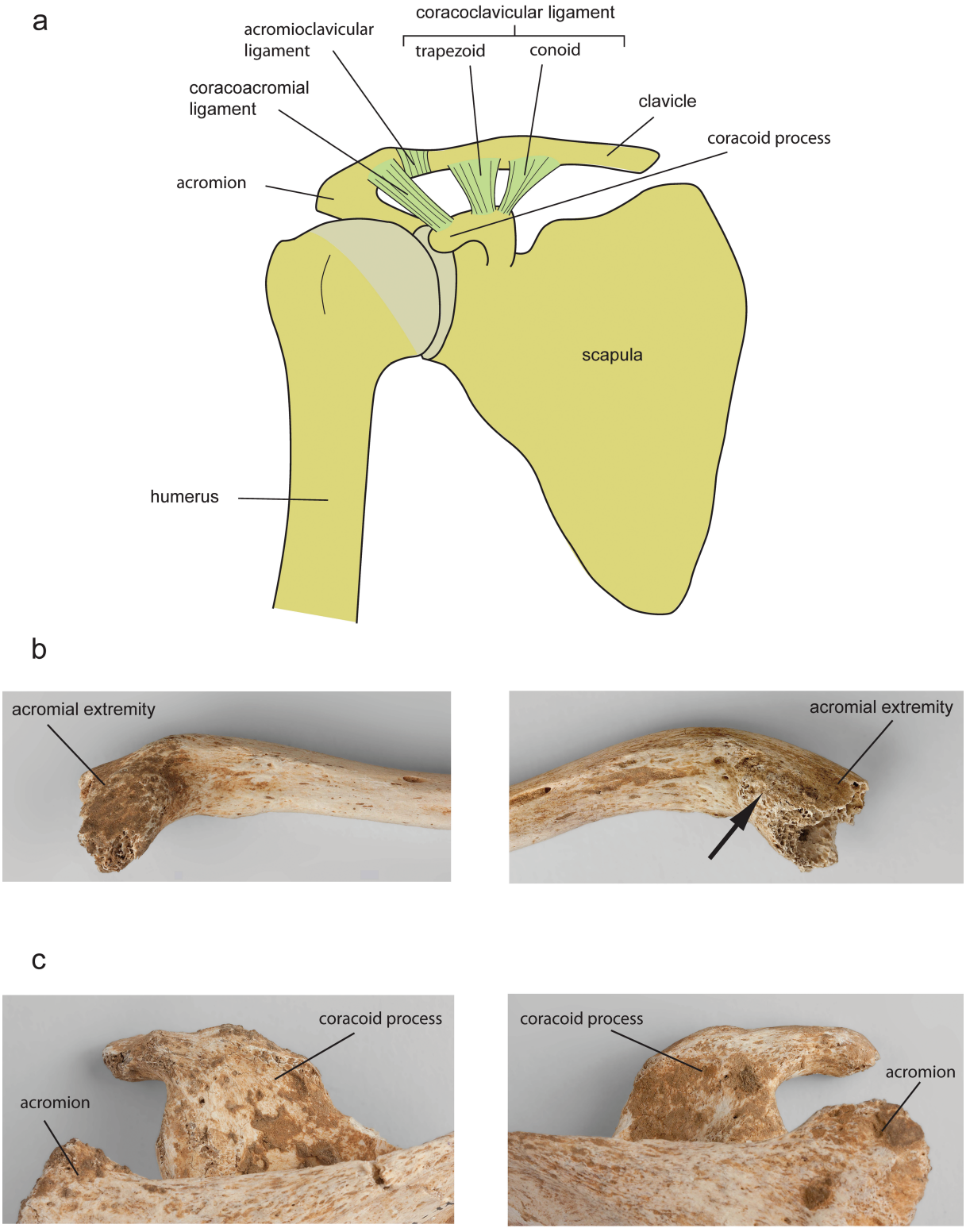

Fig. 9 – Musculoskeletal Stress Markers; a: theoretical front view of a right scapula, clavicle and humerus, with representation of some of the ligaments involved on the 'Petit Spiennes' ST11 skeleton, b: left and right ST11 clavicules, c: left and right ST11 scapulae with the coracoid process and the acromion process.

water flow that would have reworked a burial that was originally constructed on the ground surface near the mine shafts.

b) In the absence of any argument suggesting an introduction without human intent, it is legitimate to consider that the bodies were deliberately introduced into the ST11 and ST6 mine shafts. The question then arises as to whether such an introduction was of a burial nature or not.

b 1) An *anthropic non-sepulchral introduction* can result from a variety of causes:

- The corpse may have been considered as waste and thrown into a shaft during the backfilling process, without any sepulchral intention, for example after a fight, a crime or an execution; the bones of the ST11, adult and newborn skeletons, and those of ST6 show no signs of violence in favour of this hypothesis;
- The elimination of residues of cannibalism is also not conceivable for ST11 and ST6 because of (1) the anatomical connections and the almost intact preservation of the majority of the shafts of the long bones; (2) the absence of cutting incisions on the skulls and long bones of the skeletons and (3) the absence of fractures characteristic of fresh bones on both adult skeletons;
- The introduction of the bodies into the mine shafts could also reflect their rejection by the society, a sort of banishment of corpses, a voluntary act ('relegation graves') but without the violence of execution or cannibalism. In the cases of ST6 and ST11, such an interpretation is possible but is not directly demonstrable.

b 2) *Burial*?

Some indications of possible funerary gestures are observable for the adult skeleton of ST11. This includes the flexing position of the legs on the thighs and the possible flexion of the right forearm. These positions of the long bones of the upper and lower limbs on the left side is compatible with the foetal disposition of many prehistoric burials, notably Neolithic; by contrast, in the case of ST6, the strong dispersion of the bones prevents any discussion on this specific point.

Such a sepulchral interpretation of ST11 fits in well with the general context of the anthropological discoveries formerly made in Spiennes; and indeed, the relative frequency of more or less complete skeletons on the mining area, all deprived of any trace of violence, could indicate that the practice of burial, was present in the mining area (mainly 'Spiennes D and E' of DE HEINZELIN *et al.*, 1993).

On the other hand ST11 did not deliver any obvious grave goods accompanying the deceased; the flints and fragments of red deer antler tools found nearby the human bones could result from mining and knapping activities. It should be noted, however, that the presence of grave goods is not an essential condition for the recognition of a burial site; in the Meuse Basin, a few dozen kilometres east of Spiennes, the majority of the hundreds of Neolithic burial sites in karst environments deliver very few if any artefacts associated with the bones (TOUSSAINT, 1995, 2009).

So is ST11 an intentional burial or not? As none of the listed clues are decisive, it is difficult to conclude with certainty. The combination of these indices could be in favour of the burial hypothesis but a banishment of corpses by societies is also possible.

7. CONCLUSION AND PROSPECTS

Human bones have been regularly discovered in the Neolithic mining site of Spiennes since the first researches undertaken in the 19th century, both in the shafts themselves and in the large workshops that overcome them. Some of these bones are more or less isolated; others come from relatively complete skeletons.

However, most of the anthropological discoveries made so far are ancient and have yielded little precise data on stratigraphy and spatial relationships between discoveries, and evaluating the possible sepulchral nature of these discoveries is challenging. The importance cannot be overemphasised of the recent excavations which, mainly in 1997-1999 and 2014-2019, produced many bones belonging to three individuals, two in the ST11 shaft and one in the ST6; indeed these new discoveries yielded numerous stratigraphic, archaeological, anthropological, chronological or archaeozoological information.

However, they are far from solving the numerous questions raised by the human remains of the site, in particular as regards the reasons why the bones were introduced into the filling of mine shafts.

In this respect, the detailed analysis makes it possible to reject an unintentional introduction of skeletons into the shafts. Among the intentional causes, the majority of those that are non-sepulchral (crime, cannibalism...) do not apply to the bones of ST11, and possibly to those of ST6; in this category, it is only possible to evoke a banishment, a rejection by society. In the current state of research, sepulchral intentionality is also an entirely possible hypothesis.

It is highly likely that there are still many human remains to be discovered in the Neolithic mining site of Spiennes. Indeed, some excavations have been limited; thus, for example, only the upper part of the shaft excavated in 1965 has been explored and it is quite possible that at least some of the other bones of the skeleton are present in the filling of the lower part of the shaft. The same situation could prevail for the skull discovered in 1953 by J. Verheyleweghen, as indeed for many previous findings carried out in the 1920s. Moreover, the number of anthropological discoveries compared with the number of features excavated since the 19th century in Spiennes is not so few, contrary to what has sometimes been believed (COLMAN, 1957). From this point on and to the extent that it is estimated that up to 20,000 shafts were dug on the site throughout the Neolithic period, it is more than evident that future research will still yield many anthropological discoveries which should shed light on the biological and cultural aspects of the miners of Spiennes. Such findings, which will not fail to integrate the latest developments in research methods, will also enable us to better understand the causes of the introduction of human remains in mining by enriching the corpus of the bones recorded with maximum accuracy, the decoding of which is mainly based on the recent findings of 1997-1999 and 2014-2019.

Finally, the anthropological analysis of the human bones of Spiennes has so far not developed its full potential. What remains now is to develop a biological approach based on the most recent techniques in, amongst others, palaeogenetics and biogeochemistry. DNA analysis could not only refine the determination of the sex of the deceased; it could also determine whether the newborn and adult found in the ST11 shafts are related, or whether the ST6 and ST11 skeletons have a family relationship. Ongoing geochemical analyses are being conducted to assess the nature of the food supply (C & N) or possible population displacements (N). Indeed, it is clearly by combining the results of archaeology, geology, classical anthropology, archaeothanatology and geochemical and genetic analyses that it will be possible in the near future to better understand the significance of all the discoveries of human bones made at Spiennes in the past 150 years.

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