# Flint Mining and the Beginning of Farming in Southern England

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**Abstract**: Fieldwork in the mid-1980s at Neolithic flint-mining sites in West Sussex investigated previously unknown flint-working areas at both Long Down and Harrow Hill, showing that axeheads were the main product at both sites. Since then, the revision of radiocarbon dates using Bayesian analysis has revolutionised our understanding of the Neolithic period in Britain, demonstrating that flint mines are amongst the earliest known Neolithic sites in southern England: they appear sometime after mining took place on adjacent parts of the European continent and before causewayed enclosures were first constructed in southern England. Axeheads fabricated at the flint-mining sites were used as votive offerings, part of the interdependent belief system associated with Carinated Bowl pottery and cereal horticulture that was characteristic of the earliest Neolithic 'horizon' in southern England. Both were probably introduced by small-scale movements of farmers across the Channel from the European continent.

Keywords: flint mining, mines, flint, axeheads, votive offerings, farming

I met Jacek in the early 1990s when he was visiting and working at the British Museum in London. We had a shared interest through our respective excavations and research on Neolithic flint mining. I had worked as a field archaeologist in the mid-1980s and had undertaken fieldwork at some of the flint-mining sites in Sussex, including excavations at Long Down and Harrow Hill (West Sussex); I had also published an account of prehistoric mines in Britain (Holgate 1991). However, in 1987 I left the University College London Field Archaeology Unit and took up the position of Keeper of Archaeology at Luton Museum Service and had not yet written up my excavations at the Sussex flint-mining sites; I was struggling to find the time to publish the results of the fieldwork. I thoroughly enjoyed our discussions: Jacek is so knowledgeable, generous in sharing his ideas, enthusiastic and encouraging. At the time he was planning the Seventh International Flint Symposium that took place in Poland in September 1995. He invited me to give a paper at the Symposium but, having recently become Director of Luton Museum Service, I could not afford the time to attend the conference and present a paper. He did, however, encourage me to contribute an article on flint mining in Britain for publication in the volume of *Archaeologia Polona* dedicated to the theme of flint mining (Holgate 1995a) and to provide information on the excavations I had undertaken at Long Down and Harrow Hill to the updated catalogue of European flint mines published in the second part of the volume (Holgate 1995b, 1995c). I was delighted to have the opportunity to publish these accounts, as well as to assist with editing some of the papers for the volume.

Over four years ago I became a professional archaeologist again and resumed writing up my excavations at Long Down and Harrow Hill. I was fortunate to encounter Jon Baczkowski, a PhD student at Southampton University who wrote his MA thesis on the flint mines of southern England and their continental antecedents (Baczkowski 2014), and he agreed to collaborate on this project. He has carried out the majority of the writing-up work and our report is being published (Baczkowski and Holgate in print). I had been thinking of ways to write an article on some of the lines of enquiry arising from the Long Down and Harrow Hill excavations that were inappropriate to include in the excavation report; I was therefore delighted to be approached to contribute to this volume in recognition of Jacek's lifetime achievements, as this provided an ideal opportunity for me to both produce this article and acknowledge the help that Jacek gave me in the 1990s in sustaining my interest in Neolithic flint mining in southern England.

## The Sussex flint mines: results from the Long Down and Harrow Hill 1985–86 excavations

In the mid-1980s I undertook surface artefact collection surveys at the Neolithic flint-mining sites in West Sussex which were under cultivation: Long Down, West Stoke, Harrow Hill and Church Hill, Findon. I recorded previously unknown flint-working areas at both Long Down and Harrow Hill (Holgate 1995b, 1995c; Baczkowski and Holgate in print). I then undertook sample excavations of these flint-working areas in 1985–1986 to characterise and date them, and to establish their relationship with the immediately-adjacent flint-mining areas.

At Long Down, soft hammer struck axe-thinning and finishing flakes and roughouts from the production of bifacial implements were recovered from the oval-

shaped flint-working area: in one place *in situ* debitage had survived immediately below the plough soil, along with fragments of early Neolithic plain bowl pottery. The roughouts indicated that axes were the main type of implement being produced, with a small number of ovate/discoidal knife roughouts also being retrieved. The area was situated immediately to the east of the main cluster of flint mines, although there were two isolated shafts on the eastern edge of the working area. Three trenches were excavated across adjacent flint mines to obtain samples for palaeoenvironmental analysis and radiocarbon dating: one of these yielded further flint debitage (mainly cores, soft hammer struck axe-thinning and finishing flakes and axe roughouts), as well as fragments of Early Neolithic plain bowl pottery and the tine from an antler pick and an ox scapula 'shovel' which produced radiocarbon dates of 4900+/-100 cal BC and 5050+/-100 cal BC respectively (see Table 1).

The large, roughly circular flint-working area at Harrow Hill lies on the southern edge of the D-shaped cluster of flint mines. The sample excavations yielded soft hammer struck axe-thinning and finishing flakes, along with axe roughouts and preforms for mostly axes and a small number of sickles and ovates. Although completely truncated by recent ploughing, the flint-working area was partly overlying a band of open-cast quarries where flint seams had met the ground surface on the upper slopes of Harrow Hill around the outer periphery of the cluster of flint mines. The discovery of open-cast quarries at Harrow Hill is of particular importance as they are the only open-cast or drift mines to have been investigated at a prehistoric flint-mining site in southern England. It is suggested that the open-cast quarries pre-dated the flint mines and the flint-working area, although this was not confirmed by the results of the excavations.

There are three main conclusions to draw from the surface artefact collection surveys and excavations at Long Down and Harrow Hill undertaken in the mid-1980s. First, mined flint was taken to and flaked at a working area immediately adjacent to the mines. This practice also occurred at some of the flint-mining sites on the European continent, notably at Rijckholt-St. Geertruid in the Netherlands (Felder *et al.* 1998) and Spiennes in Belgium (Collet *et al.* 2008). Second, axe roughouts and preforms were the main products manufactured at both sites which were then taken off-site for use elsewhere. Besides their potential use as woodworking implements, a significant proportion was undoubtedly fabricated into ground and polished axes that had symbolic roles and were used for special functions, for example as votive offerings (Holgate 1995a: 158; Whittle 1995: 251; Topping 2004: 190). Third, the two radiocarbon dates obtained from mining tools recovered during the Long Down excavations in 1985 are consistent with the dates from red deer antler picks excavated at other flint-mining sites in southern England, i.e. 40th to 39th centuries cal BC (see Table 1). The date of 4050–3640 cal BC (95% probability) for the ox scapula links the flint miners with farming practices. Mining tools radiocarbon dated to the 45th to 43rd century cal BC have been excavated from flint-mining sites located in an arc from the Dutch Limburg to Normandy in France (see Table 1; Whittle *et al.* 2011: 257–60). Thus flint mining appeared in southern England sometime after mining was taking place on adjacent parts of the European continent (Baczkowski 2014: 149). The radiocarbon dating of flint-mining sites and the focus on flint axe production are two themes that will now be discussed further.

**The flint-mining sites in southern England: their chronology and relationship to other early Neolithic activities**

The application of Bayesian modelling has provided quantified, explicit, probabilistic date estimates, significantly improving the precision of radiocarbon dating. The recent application of this approach to the dating of causewayed enclosures and other sites previously considered to be contemporary has revolutionised the dating sequence for Neolithic Britain (Whittle *et al.* 2011). This study concluded that causewayed enclosures were initially constructed in the late 38th century cal BC, three centuries after the earliest known remains of Neolithic activity appear in southern England which date to the 41st century cal BC, and were in use until the late 36th century cal BC (Whittle *et al.* 2011: 683). Indeed, long barrows were also first constructed at least 100 years before causewayed enclosures first appeared. This suggests that the Neolithic period in southern England can potentially be conceptualised as an era when a series of well-defined developments took place sequentially.

The radiocarbon dating of mining tools, notably antler picks, from flint-mining sites in southern England, especially tools recovered from the base of mine shafts, provides reliable dates for when mining activity took place (see Table 1). Flint mining was possibly a seasonal activity, perhaps undertaken in late Summer/early Autumn, with one or two shafts being opened a year (Holgate 1995a: 153; Barber *et al.* 1999: 72). At Harrow Hill and Cissbury (West Sussex), where four antler picks from different shafts at these two sites have produced radiocarbon dates, flint mining appears to have begun by at least the 39th century cal BC, with mining continuing until the 37th century cal BC at Harrow Hill and the late 37th century cal BC at Cissbury. With between 120 and 140 shafts at each site, the dates are consistent with the possibility that one or two shafts were excavated at a time either periodically or when the need arose over a period of at least 150–200

Table 1. Radiocarbon dates for flint-mining sites in southern England, Normandy, Belgium and the Netherlands (after Whittle *et al.* 2011: 245–6 and 258–9; Barber *et al.* 1999: 81–2).

| Laboratory number | Material | Context | Radiocarbon age (BP) | Calibrated date range (cal BC (95% confidence) |
|---|---|---|---|---|
| Blackpatch, West Sussex | | | | |
| BM–290 | Red deer. Antler pick. | A gallery of shaft 4. | 5090+/-130 | 4240–3630 |
| Church Hill, West Sussex | | | | |
| BM–181 | Red deer. Antler pick. | Gallery. | 5340+/-150 | 4460–3790 |
| Cissbury, West Sussex | | | | |
| BM–183 | Red deer. Antler pick. | A gallery. | 4720+/-150 | 3800–3020 |
| BM–184 | Red deer. Antler pick. | A gallery. | 4650+/-150 | 3710–2910 |
| BM–185 | Red deer. Antler pick. | Shaft 6 (gallery?). | 4730+/-150 | 3900–3020 |
| BM–3082 | Red deer. Antler tine. | South gallery at base of mine shaft. | 5100+/-60 | 4040–3710 |
| Harrow Hill flint mines, West Sussex | | | | |
| BM–182 | Red deer. Antler pick. | Gallery. | 4930+/-150 | 4040–3360 |
| BM–2099R | Red deer. Antler. | Above floor on crawling floor to gallery 13 I. | 5040+/-120 | 4050–3630 |
| BM–3084 | Red deer. Antler. | Shaft 21, gallery 2. | 4880+/-30 | 3710–3630 |
| BM–3085 | Red deer. Antler. | Base of shaft 25. | 5070+/-50 | 3980–3710 |
| Long Down, West Sussex | | | | |
| OxA–1152 | Cattle. Scapula. | Upper fill of mine shaft. | 5050+/_100 | 4050–3640 |
| OxA–1151 | Red deer. Antler tine from pick. | Upper fill of mine shaft. | 4900+/_100 | 3950–3380 |
| Easton Down, Wiltshire | | | | |
| BM–190 | Antler pick. | Shaft. | 4480+/-150 | 3640–2770 |
| Martin's Clump, Hampshire | | | | |
| BM–3083 | Antler pick. | Shallow shaft. | 5150+/-70 | 4230–3780 |
| Bretteville-le-Rabet, Calvados | | | | |
| Ly–3680 | Antler implement | Shaft 9, La Fordelle. Base of backfill of galleried mine shaft 9. | 5560+/-190 | 4830–3970 |
| Camp à Cayaux, Spiennes, Hainaut | | | | |
| BM–289 | Antler pick. | Surface working floor at top of mine shaft, collected in mid-19th century. | 4230+/-130 | 3330–2470 |
| Petit Spiennes, Spiennes, Hainaut | | | | |
| Lv–1566 | 'Rake' made from distal part of an elk antler | Floor of gallery E10, opening from base of shaft 79.3, 9.75m deep. | 5510+/-55 | 4460–4250 |
| Sans Pareil, Mesvin, Hainaut | | | | |
| BM–417 | Antler pick. | Excavated 1957 from base of shaft 1, depth 4.2m. | 5131+/-123 | 4250–3650 |

years. Antler picks from Martin's Clump, Blackpatch and Church Hill, Findon produced late 40th to 39th centuries cal BC dates, slightly earlier than the 39th to 38th centuries cal BC dates obtained from the antler pick and ox scapula shovel excavated at Long Down from the upper fill of a mine shaft. It is thus likely that the flint mining sites which stretched in a line from Martin's Clump in eastern Hampshire to Cissbury in central Sussex were in use if not all at the same time, then certainly at overlapping periods during at least the late 40th to late 37th centuries cal BC. Mining at the Sussex sites appears to have been waning, or had even ceased, by the time that causewayed enclosures were first being constructed (Baczkowski and Holgate in print).

Paradoxically, whilst radiocarbon dating indicates that the flint-mining sites in southern England were in use during the early stage of the Neolithic period prior to the construction of causewayed enclosures, there are not many securely-dated contexts associated with other forms of early Neolithic activity in southern England contemporary with the flint-mining sites. There is a small group of contexts which contains a combination of Carinated Bowl pottery, flint and other stone axeheads, leaf-shaped flint arrowheads, cultivated cereal remains and domesticated animal bones with dates obtained from either samples of these items or associated wooden structural remains which fall between the 41st and 39th centuries cal BC (Whittle *et al.* 2011). These sites include Yabsley Street, Blackwell in London (an adult inhumation, Carinated Bowl pottery and flintwork with an associated oak plank producing a 41st century BC date); White Horse Stone in Kent (a rectangular, post-built house and Bowl pottery with associated cultivated cereal remains and domesticated cattle bone producing late 41st to early 40th centuries cal BC dates); Fir Tree Field shaft, Dorset (a hearth, Bowl pottery and ground flint axehead fragment with associated domesticated cattle bone producing 39th century cal BC dates); and the Sweet Track, Somerset (wooden trackway, Carinated Bowl pottery, ground jadetite axehead, flint perform axe and leaf-shaped arrowheads dated by dendrochronology to the late 39th century cal BC). Also dated to this stage are human bones associated with the initial phase of burial at the Coldrum megalithic chambered tomb in Kent, radiocarbon dated to the 39th century cal BC, and the megalithic tomb at Broadsands in Devon, where excavations produced probable Carinated Bowl pottery and human bones which produced late 39th–38th centuries cal BC dates for the construction and initial use of the monument (Whittle *et al.* 2011). Other contexts in southern England which probably date to this time are several examples of pits or other features with Carinated Bowl pottery, and occasionally cultivated cereal remains, domesticated animal bone and/or flintwork (e.g. Rowden, Dorset: Cleal 2004: 187). Recent studies of Carinated Bowl pottery confirm that carination was the 'core' feature of the pottery vessels produced by the early users of pottery in Britain, pre-dating the range of decorated and other distinctive wares which appeared around the time that the causewayed enclosures were first being constructed, suggesting that these phenomena could equate to a 'horizon' of rapid change and development (Cleal 2004: 180).

Thus the earliest known Neolithic sites in southern England, besides the flint-mining sites, to have produced reliable radiocarbon dates range from a rectangular building and pits associated with cultivated cereal remains and domesticated animal bone to human burials (including in the earliest megalithic tombs) and contexts where a selected range of objects, notably Carinated Bowl pottery and axeheads, had been deposited as votive offerings. These items have long been considered to form the 'things and practices' associated with the beginning of the Neolithic period in Britain (Whittle *et al.* 2011: 730–731). The midden-like deposits found within the pits have been interpreted as the result of feasting and/or domestic activity, potentially reflecting an early pattern of use which may have been superceded by the activities which took place at causewayed enclosures (Cleal 2004: 180; Barclay 2014). Tantilisingly, pits at Grovehurst in Kent yielded Bowl pottery, domestic cattle bone, flintwork, four ground axeheads, four whole or fragmentary single-piece flint sickles and possibly quernstones and rubbers (Payne 1880); although this assemblage cannot be dated with precision, it indicates that perhaps flint sickles and quernstones could also be considered as early Neolithic 'things and practices'.

**The flint-mining sites in southern England: their role in the establishment of farming in Britain**

The early Neolithic stage in southern England is currently considered to extend from the 41st to 38th centuries cal BC, at which point causewayed enclosures and new styles of pottery came into existence. Key characteristics of the earliest Neolithic 'horizon' currently dated between the 41st and 39th centuries cal BC, besides the introduction of cultivated cereals and domesticated animals, are Carinated Bowl pottery, flint mining and the manufacture of axeheads, along with the votive deposition of Carinated Bowls and axeheads.

The preceding Mesolithic period was one where hunters and gatherers were exploiting similar sources of flint as those in use during the early Neolithic period, and the blade industries which predominated during both the late Mesolithic and early Neolithic periods are virtually indistinguishable, with the exemption of the specific technologies used for fabricating axeheads and projectile points. Wood, bone and antler working practices are also similar. Much of southern Britain was settled: for example the whole area of dry land central Southern England was exploited at some moment during the late Mesolithic period (Jacobi 1981; Gardiner 1984; Holgate 2003); 'such a pattern leaves no obvious areas whose uptake by early farmers will not have impinged in some way upon pre-existing patterns of territoriality' (Jacobi 1981: 23). At the end of the late Mesolithic period and the time when the earliest Neolithic activities took place witnessed marine transgression and rising water levels in low-lying areas (Coles 1998: 77; Holgate 2004: 25–26): for example, it has been estimated that three-quarters of the former Thames floodplain landscape was lost to wetlands between the 47th and early 39th centuries cal BC (Bates and Whittaker 2004: 60–61). The changing configuration

of coastal and low-lying area in southern England provides the backdrop to the beginning of the Neolithic period. In comparison with Mesolithic subsistence practices, cultivating cereals requires an investment on immobile resources, and the concomitant ecological and social transformation of the landscape. Other than the post-built structure at White Horse Stone in Kent, the remains of potential early Neolithic domestic sites are insubstantial (cf. Holgate 1995a: 157–158). The flint-mining sites, and the ensuing megalithic monuments constructed in the 39th century, provide an element of permanence in southern England for the communities practising Neolithic horticulture.

Alongside cereal horticulture, one of the defining characteristics of the earliest Neolithic stage is votive deposition. This practice is exemplified by the two complete, unhafted axeheads in pristine condition that were deliberately deposited in shallow water beside the late 39th century cal BC wooden catwalk structure known as the Sweet Track in the Somerset Levels: one was a polished jadeitite axehead of Alpine origin and the other a flaked flint axehead attributed to a Sussex flint-mining source by trace element analysis (Craddock *et al.* 1983) and macroscopic examination (Holgate 1988: 70). Fragments of Carinated Bowl, in some instances fragments from the same vessel were found distributed some distance from each other on either side of the trackway, and leaf-shaped arrowheads had also been deposited (Coles and Orme 1976). Axeheads from watery contexts and the caches of flint axeheads from dry land in the Thames basin are also likely to be examples of votive offerings, a significant proportion of which probably date to the first quarter of the 4th millennium cal BC (Holgate 1988: 116).

The inception of farming in southern England manifests itself as the introduction of new subsistence practices and the transformation of certain resources from the earth, predominantly flint and clay, into items that were returned to the earth as part of an interdependent belief system (Kinnes 2004: 194–195). This included the extraction of 'special' flint from selective, permanently-maintained flint-mining sites to fabricate axeheads which became valued items symbolic of the earth (Holgate 1995a: 158; Whittle 1995: 251–253; Topping 2004: 187; Sheridan and Pétrequin 2014: 380–381). These were then circulated amongst the early farming communities and offered back to the earth as votive offerings to ensure the continued fertility of their animals and crops (cf. Ebbeson 1993; Whittle 1995: 254).

There has been considerable debate in recent years regarding the origins of Neolithic activities in Britain. Views differ as to whether there was a single or multiple places of introduction (cf. Whittle *et al.* 2011; Sheridan and Pétrequin 2014). However, the consensus is that small-scale movements of farmers across the Channel from the European continent introduced novel items and new technologies to a largely receptive indigenous population already conscious of their existence (cf. Kinnes 2004: 194). Given the relatively close proximity of flint-mining sites in Normandy, Belgium and the Netherlands pre-dating the southern England flint-mining sites it has been suggested that fully-developed mining techniques were introduced to Britain 'with the transit of people from Continental Europe and may have been implemented to claim territory, enforce cultural beliefs, or to trade new types of lithic tools, complementary to new agricultural techniques' (Baczkowski 2014: 149). As there are safe cross-channel seafaring routes from Normandy and the Seine estuary to the Solent (Macgrail 1993: 200), it is possible that specialist, perhaps itinerant, flint miners from northern France introduced communities in central southern England to flint mining. Alternatively, as with the reintroduction of viticulture in southern England in recent years, local communities could have acquired and assimilated the plant stock, technology and rituals associated with cereal production and consumption by visiting farming communities occupying adjacent parts of the European Continent.

This account of the emergence of farming and flint mining in southern England by the start of the 4th millennium cal BC stems from the completion of research-led excavations at two of the Sussex flint-mining sites, the recent application of improved scientific dating analysis and recent archaeological discoveries resulting from developer-funded fieldwork in the last 25 years co-ordinated through the planning system (Historic England 2015). It is to be hoped that increasing numbers of securely-dated contexts associated with the earliest Neolithic 'horizon' in southern Britain become available for study in the foreseeable future to throw further light on the role flint mining played in the early development of farming communities in Britain.

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# Women´s Work? Findings from the Neolithic Chert Mines in the 'Krumlovský les', South Moravia

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**Abstract**: Krumlovský les revealed one of the largest mining fields in Europe dated from the Mesolithic to the Hallstatt period. Quarrying culminated in the Early Bronze Age, when the local Jurassic chert, re-deposited in the Miocene sands, was extracted from hundreds of shafts up to 8m deep, with most of the production material left at the site. The largest shafts of the Late Lengyel culture were located on a slope below a re-deposited boulder. Shaft no. 4 yielded two skeletons of females; the lower one had a newborn placed on her breasts. Both women were found to be the shortest of the then population as a whole, and they were weak, diseased, and poorly fed during their childhood. By contrast, as adults they were fed with meat and carried out heavy work, which is corroborated by strongly marked muscle attachments and vertebral degeneration. The hypothesis is that the patriarchy extracted labor (also) from lower status individuals who toiled in the mines. However ritual aspects cannot be excluded: in some lands, the Earth is of female gender, and as such will more willingly accept women than men... but why exactly the smallest ones?

Keywords: Krumlovský les, Southern Moravia, Lengyel Culture (LGK), chert quarrying, burials

## Chert mining in Krumlovský les

The vast forested area of 'Krumlovský les' (the Krumlov Forest) in South Moravia is known for its prehistoric mining, as it is rich in the outcrops of Jurassic chert that is re-deposited in Miocene sands (Fig. 1). The quality of the local stone was only mediocre, but in spite of that it was the reason for an intensive settlement of this area from the Middle Palaeolithic. The oldest documented mining activity in this region dates to the Mesolithic. In the Bell Beaker period quarrying continued to increase in importance; local production radically increased and exports diminished. This is yet more clearly expressed in the Early Bronze Age (the Únětice Culture), when mining ceased. There were hundreds of shafts in this area, filled and surrounded with thousands of tons of chipped industrial waste, indicating that nearly all the production remained in place. It is quite obvious that since this period, at the latest, this old extraction landscape was not important because of its lithic resources, but because of its past. Extraction at this site lasted until the Hallstatt period. Narrow and deep shafts (up to 8m in depth) were mostly excavated through the backfill of ancient shafts without reaching an intact seam. Sometimes hoards of lithic materials, mostly older in origin than the shafts, are found at their bottoms (Oliva 2010: 378, 381 ff).

## Shafts of the Middle Neolithic

Mining in the Late Lengyel period (*c.* 4200 cal BC) is the most interesting topic of this contribution. The most significant Late Lengyel dated features were discovered in trench VI–9. This cuts into the rather steep slope below a chert-breccia boulder in the eastern part of the zone VI. The meter-high boulder lies on re-located loam containing many flakes, and so it was no doubt placed there by human hands. Certainly the most important shaft is no. 4. It is located *c.* 8m below the megalith previously mentioned. In this shaft, a late Lengyel pedestalled bowl was registered at a depth of 2m. Strikingly, it was found in a single piece, oriented vertically in a 'functional' position (Fig. 2). The concentration of charcoal in the immediate area of the upper part of the bowl supplied a radiocarbon date (GrN–27500) of 5490±60 years before present (44350±70 cal BC 68%). It is interesting that besides this bowl, there were no other shards. Approximately 15cm below the pedestalled bowl lay a large flat stone. From a depth of 5m we removed only the sandy filling of the prehistoric shaft with very sparse evidence of chipped stone industry, without major concentrations. The backfill was separated from the intact Miocene sand by a white lime crust. At a depth of 510–520cm near the north edge of the shaft was registered a complete skeleton of a hare in anatomical order. The circular cross-section of the shaft, 100–120cm wide, continued down to a depth of 6m, where it formed a bell-like enlargement, at the level where small chert pebbles began to appear in the extracted sand. The size of the pebbles did not exceed 10cm. The northern undercutting reached some 40cm further than the southern one (15–20cm).

The first human skeleton emerged in the initial widening at a depth of 6 meters and belonged to a young woman, who originally lay in a horizontal, tightly flexed position, on her back. Quite possibly she was subsequently placed on her right side facing the

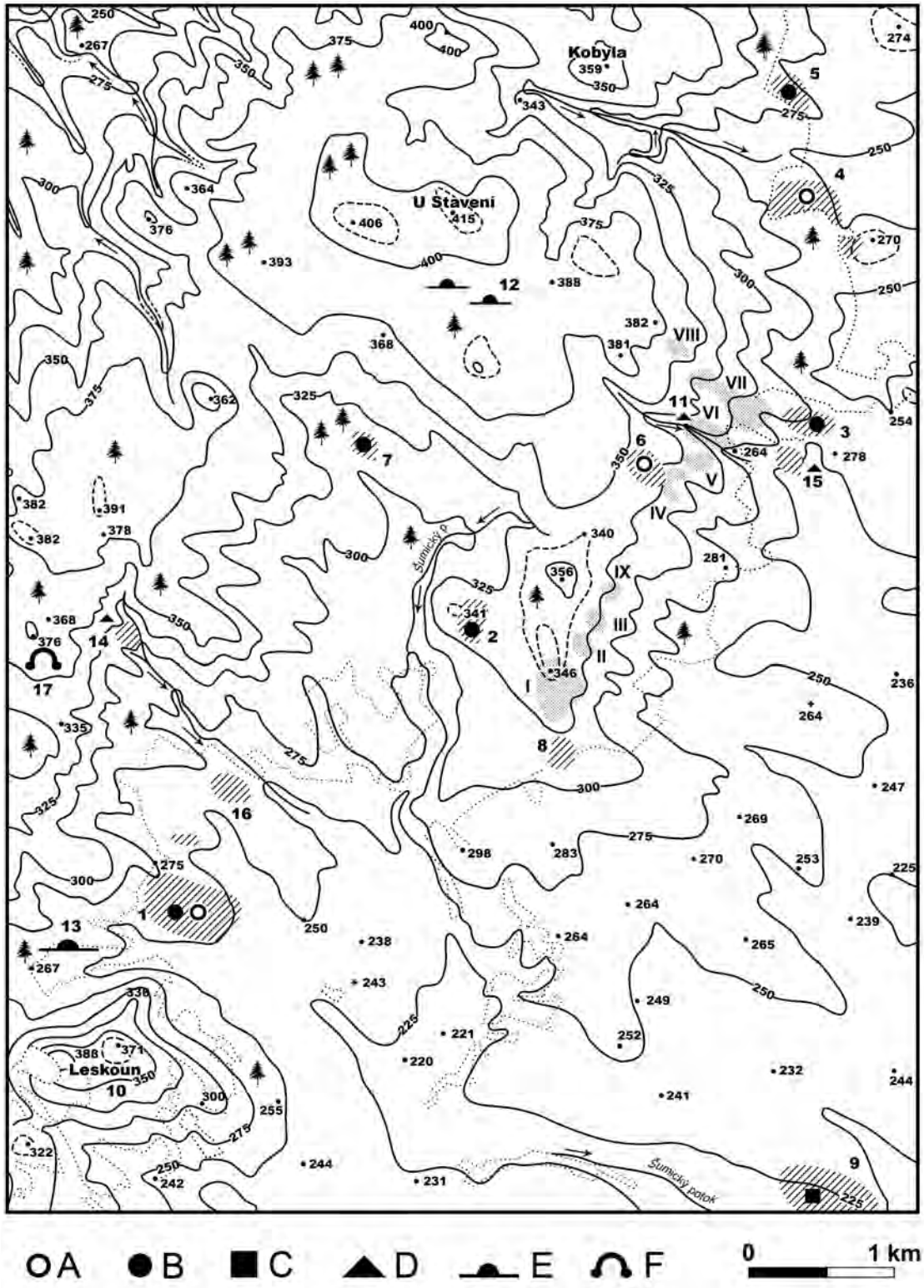


Fig. 1. Prehistoric settlements and extraction areas (I–IX) in Krumlov forest. A–LBK, B–Lengyel culture, C–Early Bronze Age, D–Hallstatt Age, E–burial mounds, F–hoard of bars. 1–Vedrovice, Znojmo district [(settlement and burial site LBK, 2 rondels Moravian Painted Pottery culture (MMK)], 2–Moravský Krumlov – Vysoká hora, Znojmo district, 3–Jezeřany-Maršovice – Na Kocourkách, Znojmo district, 4–Nové Bránice – V Končinách, Brno district, 5–Nové Bránice B, Brno district, 6–Moravský Krumlov – traces of a MMK settlement over area V, Znojmo district, 7–Moravský Krumlov – Dlouhá louka, Znojmo district, 8–Moravský Krumlov – polycultural settlement near area I, Znojmo district, 9–Kubšice – Nad Lukama, Znojmo district, 10–Olbramovice – fortification Leskoun, Znojmo district, 11–Moravský Krumlov – Horákov settlement in mining area VI, Znojmo district, 12–Hallstatt mounds near Stavení (not visible today), 13–Urnfield mound below the Leskoun hillfort, 14–Late Hallstatt hillfort in Mokrý žleb, 15–settlement Maršovice – Jalovčiny, 16–Hallstatt site at Vedrovice, Znojmo district, 17–hoard of bronze bars of the Únětice Culture below the rocky outcrop. The dotted line indicates the forest edge. Drawn: T. Janků.

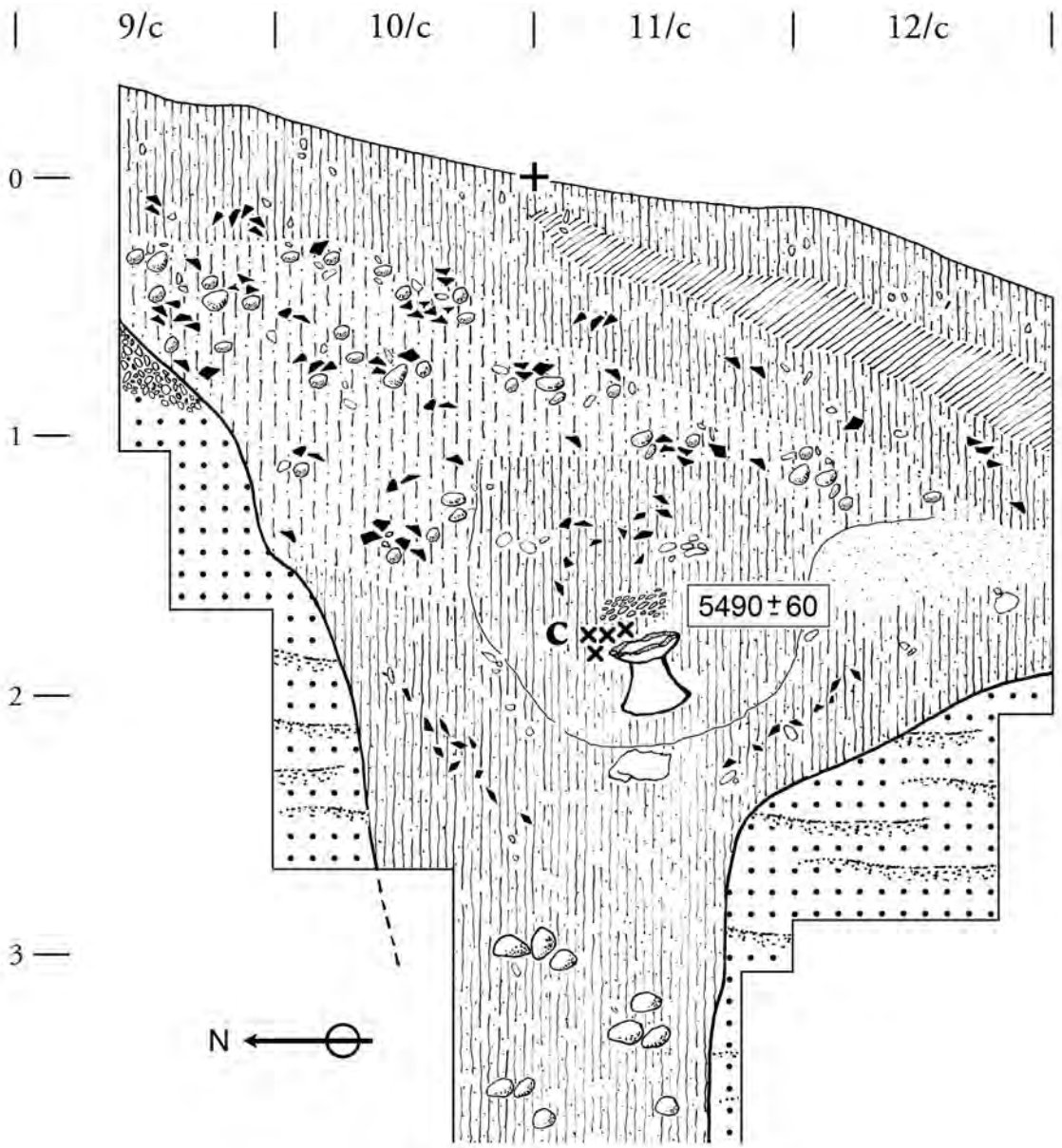


Fig. 2. Upper part of Late Lengyel Shaft 4, indicating the position of the pedestalled bowl. Drawn: T. Janků.

wall of the pit. The skeleton suffered displacement of the thorax, disarticulation of the knees, and movement of one scapula (Fig. 3). We can attribute all of these phenomena to the pressure of sediment. But the pressure of sediment cannot explain the position of the cranium: the cranium faced the opposite direction to what one would expect. It was facing towards the center of the shaft and slightly downward. The shoulder joint was found *c.* 50cm from the remainder of the skeleton, with the elbow extended posteriorly behind, from the vertebral column. This unusual disposition suggests that the body may have been placed into the pit in pieces, and makes probable the assumption that the woman was, indeed, sacrificed. Radiometric analysis of human bone provided the following date: GrA–22839: 5380±50 BP (4210±90 cal BC 68%). Near the disarticulated upper limb we found two chert hammerstones. Immediately adjacent to the skeleton lay four cores, a blade flake and a smaller flake. Another skeleton was found nearly 1m deeper than the preceding skeleton. This one lay anatomically undisturbed, but it was placed in a highly unusual position. The body of this young woman was laid on her back, which was arched to accommodate the shape of the northern enlargement (Fig. 4). Her hands were clasped behind her head and she faced slightly to the left. The open jaws were evidently related to the post-mortem decay of the associated soft tissues. At the left breast of the woman was the head of a newborn, his or her legs were found in the pelvic region. An incomplete skeleton of a small dog was found some 30cm above the cranium of this woman (Fig. 5). The post-cranial skeleton undoubtedly belonged to the

Fig. 3. The upper skeleton in Trench VI–9–1, Shaft 4 (LGK). Photo: M. Oliva.

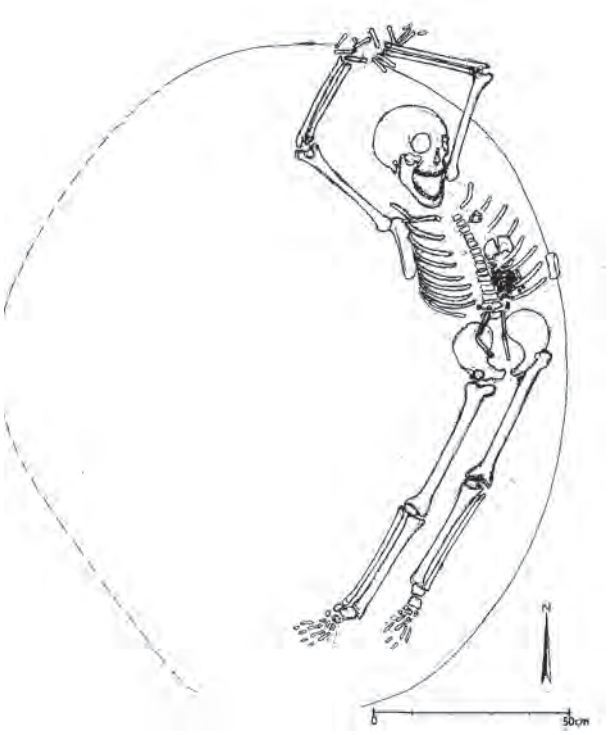

Fig. 4. The lower two skeletons, those of a woman and an infant, in Trench VI–9–1, Shaft 4 (LGK). Drawn: T. Janků.

cranium and mandible of the dog that lay at the same level in the western extension somewhat more to the south. Two small slender bones, evidently from the hind limb of a green frog, were found over the clasped hands of the female body. Near the skeleton lay three precores (one of them weighed 1.6kg), three flakes, and a hammerstone. Removal of the fill of the undercutting was stopped about 20cm below the lower skeleton, and we removed sand from the center of the shaft only.

Fig. 5. The upper thorax of the lower skeleton, a woman with a newborn child on her breast. Above the cranium is a partial dog skeleton. Photo: M. Oliva.

From the lowest part of the shaft at a depth of 700–750cm, came 39 artefacts, of which 22 are waste, seven flakes, and six unworked raw material pieces. On the bottom itself lay the jaw of a pig. The slightly concave bottom of the pit was encountered at a depth of 740–750cm. It consisted of calcified detritic sediment of a rusty brown colour that was much hardened. Drilling down 60cm more the floor was of the same nature. This sediment was undoubtedly too hard for the tools of prehistoric miners to penetrate, which may be why the shaft was not deepened further – but the sediment above consisted of fine, light sand mixed with chert pebbles that was easily dug away. However, the undercutting expanded only to a distance of 35cm from the perpendicular wall. Layers were visible in the rusty sand in the profile of the lower 2m of the filling; the backfill rose upward and abutted the northern wall, where the two skeletons were located. These strata indicate that the shaft was intentionally filled in, as the extracted sand fell mostly along the southern wall – it was simply easier to throw the fill down the slope.

These finds represent the first time that a shaft in which human remains in unusual burial positions was discovered in Central Europe. Prior to this, other extraction shafts have only yielded either individual skeletons, or regular burials with grave goods (as, for instance, at Mauer, near Vienna; Ruttkay 1970).

**Physical condition of the buried women**

The upper female died at the age of 30–35, the lower one was aged 35–40. Both females were gracile with distinct muscle topography. Their statures were estimated at 148 and 146cm, respectively, which means that both females were the shortest of all individuals examined from the Moravian Lengyel Culture period. The mean body height of other LGK-females is 155.54cm (Dočkalová and Čižmář 2008: 73; Tvrdý 2010: 408). Both women have delivered, as indicated by the strong development

Fig. 6. The lower female skeleton, ulnae with distinct muscle attachments. Left ulna with unhealed fracture. Photo: Z. Tvrdý.

of the *sulcus preauricularis* on both hip bones. Enamel hypoplasia on the incissors and Harris lines on the tibiae (Dočkalová and Čižmář 2008: 56 and Fig. 49; Tvrdý 2010: 406, 408) show evidence of stress experienced by both individuals during their growth and development. The health condition of the lower woman was poorer than that of the upper one. She suffered from iron deficiency, evident from the porotic hyperostosis on the occipital part of cranium, and her left ulna had been broken and healed with pseudoarthrosis (Tvrdý 2010: 406). Both skeletons show evidence of hard physical activity, i.e. distinct muscle topography (Fig. 6), Schmorl's nodes on lumbar vertebrae, and osteophytes (Tvrdý 2010). Such phenomena were not uncommon in the then population (Dočkalová and Čižmář 2008: 72–74), however their common occurrence on one skeleton is quite exceptional.

The skeletal remains were analysed for carbon, nitrogen and strontium isotopic composition ($^{13}C/^{12}C$, $^{15}N/^{14}N$ and $^{87}Sr/^{86}Sr$ ratios) to determine their origin, diet, and living environment. The women were well-fed during the last year of their lives according to the carbon and nitrogen isotopic analyses. They had eaten animal proteins, as well as plant food, including berries rich in minerals and vitamins. The meat eaten originated mostly from sheep/goats and pigs (Nývltová-Fišáková 2010). The micro-abrasion analyses of tooth crowns also support these results (Jarošová 2010). Strontium isotopic ratios of the analysed remains of these women are within the range of the local Neolithic population, known mainly from the Vedrovice Linearbandkeramik Culture (LBK) cemetery. This means that the females could have spent all their lives in the surroundings of the Krumlovský les.

Cross-sections of the mandibular first molar roots were used to ascertain the season of death of both women found in shaft 4 of the prehistoric mining area of the Krumlovský les. According to analyses of dental cement microstructures they both died in spring. This fact suggests that they both died either at the same time or in the same season, within one year or over several years (Nývltová-Fišáková 2010).

The results of the DNA analysis (Šerý 2010) demonstrate that the skeletal remains of both females are related, and may represent a mother and a daughter, or two sisters. The skeletal remains of the child differ in five alleles from both of the female skeletons, a fact which absolutely rules out the possibility of any affinity between the child and the females.

**Discussion**

The unusual physical characteristics of the females buried in shaft 4 suggest that individuals of small stature and poor health were (probably) subjected to strenuous work in these mine shafts and suffered poor nutrition in their youth. The extremely small and gracile stature of the women, hypoplastic dental defects and anaemia testify to this. In contrast, they also possess well-developed muscle attachments and degenerative conditions of the vertebrae: The women were no doubt provided with a substantial meat diet in adulthood in order to withstand the exhausting manual labor.

We must admit we have no clear explanation for these facts. From the viewpoint of division of labour it is certainly paradoxical that the hardest work in the mines would be carried out by the shortest and the least healthy. It is generally assumed – at least according to traditional views – that the physical role of men in the late Neolithic was favored, as a consequence of the need of male strength to perform newly emerging work requirements, such as ploughing and mining (Neustupný 1967). From a purely ergonomic point of view, the small stature in the miners would be advantageous, since they would more easily fit into the narrow shafts. But it is important to remember that in the Krumlovský les the shafts are wider than those at Abensberg-Arnhofen, where it is assumed that mining was done by children (Rind 2014). Another reason that women performed such labor may be based on religious beliefs – in Africa, for instance in Katakana and Zambia, women allegedly worked in the mines because they are more easily accepted by the Earth, since it is likewise of female gender (Kandert 2010: 107). The third explanation invokes simple human ruthlessness: the hardest work is not carried out by the strongest, but by those who can be coerced into it most easily. Naturally, we can lighten this somewhat brutal statement by some kind of explanation of a socio-ritual nature. The women, although perhaps of local origin, might have been destined to such toil by some circumstance that remains unknown to us. Moreover, we cannot assume that these two women are representative of the whole population carrying out the mining. This is not

necessarily the case. However, it would still be striking that both individuals buried in the shaft were indeed the shortest adult members of the then population as we know it. The ununitedbroken fracture of the forearm found in the lower-most female (about parry fractures: Judd 2008) may have meant that she was unfit for work for a number of months, and this might have been the reason why she was eventually put to death.

By way of conclusion a few examples of similar attitudes to female labour have previously been found elsewhere. The study of muscle attachments in the adult population from the Iron Age cemetery in Hallstatt revealed that men showed traces of exertion typical for quarrying, while in women these were caused by the strain from hauling bags with salt into the valley (Pany 2005). Carrying commodities is often a task left to women, since such activities are not prestigious ones. In Africa a husband riding a donkey is often seen by the side of his wife, walking with vessels of water (as witnessed by visitors).

Quite possibly the growth of the prestigious role of men, which was typical for the Eneolithic (Neustupný ed. 2013), did not always arise from their ability to carry out the newly demanded heavy labour, such as ploughing, extraction, digging fortification moats, and mounding up of ramparts, but also from the possibility of being able to coerce someone into such work, thereby demonstrating male superiority. Some of these new activities were useful for the community (e.g. ploughing), while others more likely came into existence to increase the prestigious roles of individuals. This includes the exploitation of flint that made possible the manufacture and distribution of attractive tools and weapons. At the same time, such quarrying brought opportunities to manage extensive activities and to control the distribution of prestigious products. Without doubt, it mattered more who managed this activity than who performed it. It seems that the division of labour can be very ambiguous in these early societies.

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