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The Oldest Hammer-Axes of the Corded Ware Culture in Bohemia

Pavel Burgert[a], Miroslav Dobeš[b] and Antonín Přichystal[c]

The aim of this study is to analyse hammer-axes assigned to the so-called A-horizon of the Corded Ware Culture (*c.* 3000–2350 BC). The focus area is Bohemia. The main emphasis is placed on the raw materials of these artefacts, which were analysed non-destructively using optical stereomicroscopy, X-ray diffraction and magnetic susceptibility measurements. Although archaeogenetic analyses indicate that the Corded Ware Culture arrived in Bohemia as an intrusive element, the raw material spectrum demonstrates continuity with sources exploited in preceding periods. In particular, Jizera Mountains-type (Jizerské hory) metabasite is the principal material of the assemblage of 32 analysed artefacts. The other raw materials used most likely also originate within the Bohemian Massif. These results thus point to a continuity in the use of raw material sources and distribution networks.

KEY-WORDS: Corded Ware Culture, A-type hammer-axes, archaeogenetics, raw material sourcing, Jizera Mountains-type metabasite, Bohemia

INTRODUCTION[1]

The Corded Ware Culture (*c.* 3000–2350 BC; hereinafter CW) has been a significant subject of Central European archaeological research since the late nineteenth century (Götze 1891; for Bohemia see Stocký 1929: 88–101, pl. LXV–LXXXI; Buchvaldek

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1 The authors would like to thank all staff members of museums and collection institutions who assisted in tracing the finds and kindly made them available for study and documentation. Their large number is reflected in the catalogue of this paper. The authors dedicate this article to the forthcoming life anniversary of Vít Vokolek (b. 1936), a distinguished Czech archaeologist.

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1967; 1986a; Neustupný 2013; for the broader European context see Heyd *et al.*, 2021). This prominence is due, among other factors, to its hypothesised central role in the dissemination of Indo-European languages (Brami 2021). Over the past decade, scholarship has drawn upon groundbreaking findings in archaeogenetics (Allentoft *et al.*, 2015; Haak *et al.*, 2015), which have definitively resolved the question of the origin of the CW bearers in favour of a migration from Eastern Europe, an interpretation already proposed by I. Borkovskyj (1933; 1934) and T. Sulimirski (1933). Nevertheless, the biological ancestry of a population and its material culture are inherently distinct phenomena, which may coincide yet do not necessarily do so. Consequently, the origins of specific aspects of CW material culture remain a matter of ongoing investigation, frequently yielding conflicting interpretations.

One of the characteristic artefacts of Corded Ware material culture is the stone hammer-axes, which has given the group its alternative designation – the *Battle Axe culture*. A type distributed more or less throughout the entire CW oecumene is the so-called *A-type hammer-axe*, a typical representative of the aforementioned artefacts. As will be demonstrated below, interpretations of its origin and chronological position within the CW framework are often contradictory. In this context, particular attention has been paid to aspects that have previously received limited emphasis, namely the raw material composition and, where possible, the manufacturing details of the studied artefacts. Such data may contribute to addressing questions related to the mobility and modes of penetration of incoming communities and their relationship to preceding Neolithic settlement.

The geographical scope of this study is confined to Bohemia (Fig. 1). The aim was to locate and examine all available CW *A-type hammer-axes* from this region. For each specimen, a metric analysis was conducted, accompanied by newly standardised graphic and photographic documentation. Subsequently, the raw material was determined through petrographic analysis.

A-TYPE HAMMER-AXES: DEFINITION, CHRONOLOGY, ORIGIN

The term "A-type hammer-axe" was first introduced into the literature by P. V. Glob (1945: 17–19), who placed it at the beginning of the typological sequence of Scandinavian hammer-axes and thus at the outset of the development of the Scandinavian Single Grave culture, which he interpreted as an expression of an Indo-European population arriving from the east. In terms of formal characteristics, these are stone specimens that, in lateral view, exhibit a slightly curved axis or a slightly convex upper surface, a straight butt end, and a dropped blade edge. In plan view, the body of the

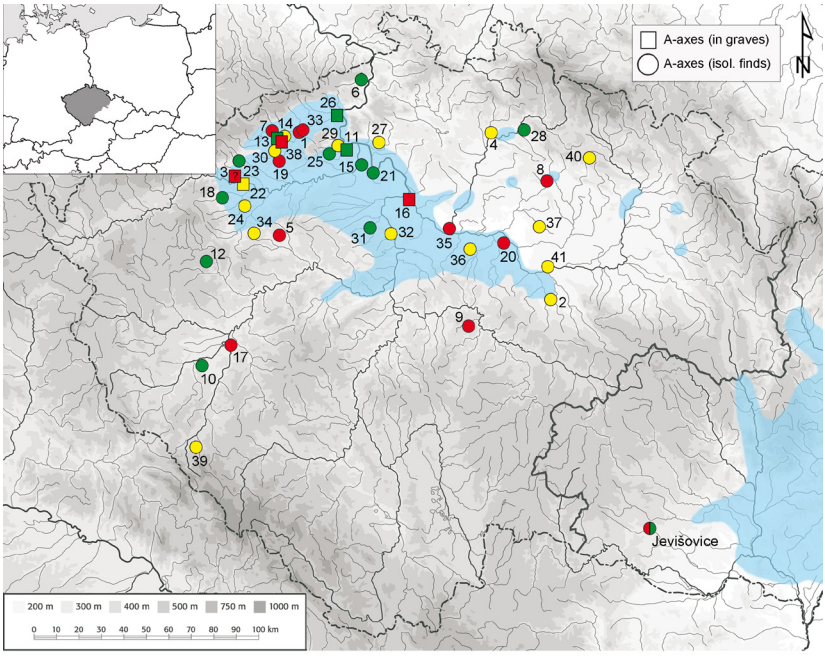

Fig. 1. Distribution of A-type hammer-axes in Bohemia according to find context (isolated find or grave context) and one of three morphological-evidential groups. Red indicates A-type hammer-axes approaching the typological ideal ("true" examples); green indicates less formally worked specimens ("degenerate" examples); yellow marks the remainder (hybrid forms, typologically inconspicuous fragments and unidentified hammer-axes mentioned only in Buchvaldek 1967: 163, Abb. 24). The numbering of the points corresponds to the numbering of sites in the catalogue. In blue is depicted the settlement oecumene of the Corded Ware Culture in Bohemia and Moravia.

hammer-axe is smoothly thickened at the shaft hole, while the butt end is essentially cylindrical. In cross-section, the artefact is oval to slightly flattened. Notably, Scandinavian specimens often display a longitudinal central ridge on the upper surface, sometimes expressed as a pair of shallow grooves or simply as a ridged, roof-like edge. In addition to these "true" A-type hammer-axes, the assemblage also includes "degenerate" pieces, whose main feature is the absence of the dropped blade edge and a more or less straight lateral axis; altogether, four variants of the A-type hammer-axe are generally distinguished (Brandt 1967: 43–49, Taf. 6.).

This type occurs, with varying degrees of frequency, throughout the entire Corded Ware complex, including the Scandinavian Single Grave culture. From the outset (see above), it has been associated with the penetration of Indo-Europeans from the east

into Central Europe and, alongside specific types of amphorae and beakers, has been regarded as part of the so-called A-horizon – that is, a pan-European, earliest horizon of the Corded Ware Culture in Europe (Struve 1955: 13–14, 27–29, 98–119). The notion of a uniform initial A-horizon has subsequently been called into question, particularly in the context of research seeking prototypes for A-type hammer-axes within the local Central European cultural milieu at the turn of the 4th to 3rd millennia BC (for the latest overview of interpretations, see Schultrich 2022).

In the current discourse, the problem of A-type hammer-axes is primarily linked to two questions: what chronological position these hammer-axes occupy within the Corded Ware Culture, and where their origins are to be sought.

Despite doubts about their occurrence already in the earliest Corded Ware contexts (Hübner 2005: 143–146; Furholt 2014: 73; Schultrich 2022: 49–50), evidence from Central Europe increasingly confirms that they indeed belong to its initial phase. In Bohemia, their chronological position within the Early Corded Ware Culture has recently been demonstrated by a male burial from Obříství, in which an A-type hammer-axe was found together with a beaker, a belt clasp and a silicite blade. The radiocarbon date for this assemblage oscillates around 2900 BC (Dobeš *et al*., 2023: 103–105, figs 2 and 3). A hammer-axe of similar age, with an interval extending slightly, due to the calibration plateau, down to around 2700 BC, was part of the grave goods of a ploughed-out barrow burial at Żygląd in the Kuyavian-Pomeranian Voivodeship (4265±35 BP = 3005–2703 BC 2σ; Kurzyk 2011: 463, ryc. 4–5). The occurrence of such finds in Layer B at Jevišovice (Medunová-Benešová 1972: 144–154, Taf. 91–93, for details see below) may also be cited as valid evidence; this context belongs to the post-Baden eponymous culture dated just before and overlapping with the Early Corded Ware (Peška 2013: 23–52, tab. 3 and 5; Peška 2021: 514, fig. 3 and 22). A similar pattern can be observed in the occasional occurrence of these hammer-axes within the Złota culture, which falls within roughly the same chronological framework (site Grodzisko I, Graves 17 and 43, Krzak 1961: 17, 43, ryc. 48c and 100b; for absolute dating of the Złota culture see Włodarczak 2019: 190–191, tab. 4, ryc. 7). Noteworthy is also their appearance already in the earliest dendro-dated layers of the western Swiss Lüscherz group in the mid-28th century BC, where, as in the Złota culture, one can observe a blending of indigenous Neolithic/Eneolithic elements with Corded Ware traits. Paradoxically, A-type hammer-axes are not particularly common on settlements of the eastern Swiss "pure" Corded Ware, being attested there mostly as isolated finds (Strahm 1971: 40, 134–135, Taf. 17:31, Karte 1; Winiger 1993: 37–88, Abb. 20, 24, 39–41; Hafner and Suter 2003: 14–15, Abb. 7).

Their occurrence within these marginal groups, which are culturally and genetically derived from the preceding local development of entirely different traditions, is

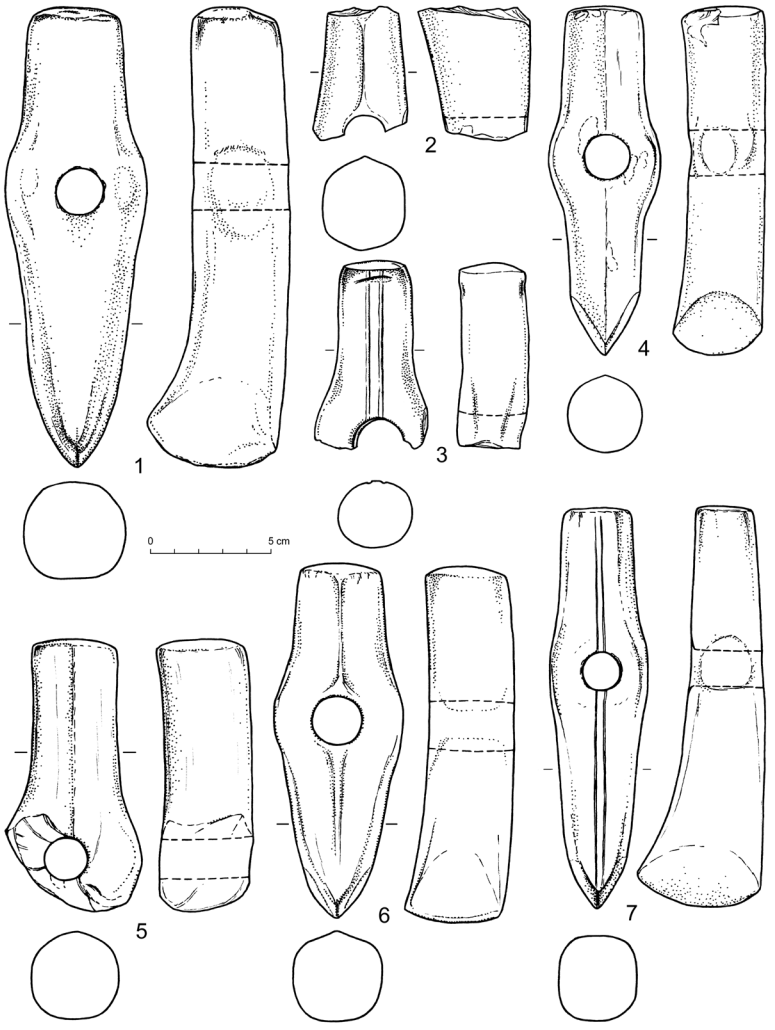

Fig. 2. A-type hammer-axes from Bohemia. 1 – Čermníky, Nr. 3; 2 – Žalov, Nr. 32; 3 – Dolní Jiřetín, Nr. 7; 4 – Roudnice nad Labem, Nr. 21; 5 – Přední Lhota, Nr. 20; 6 – Chrášťany, Nr. 5; 7 – Jičíněves, Nr. 8. Drawing: L. Raslová.

best explained by the mediating role of Corded Ware communities during the initial stage of their spread across Europe. The A-type hammer-axe is also the only type distributed across the entire territory of this cultural complex; other types are more or

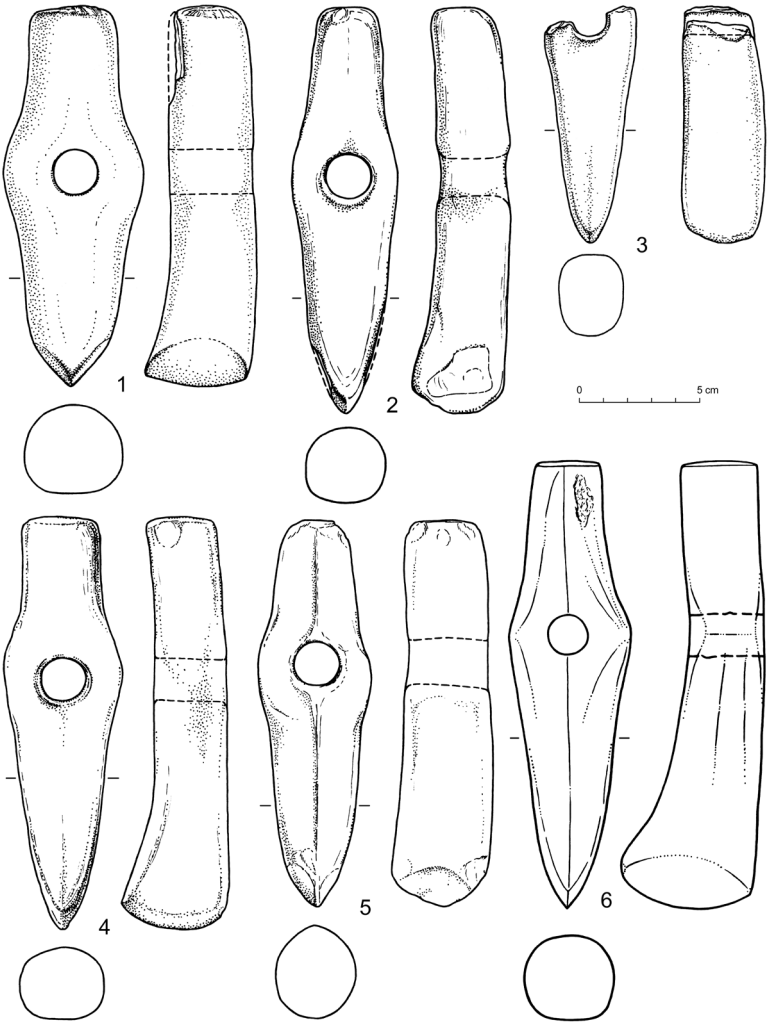

Fig. 3. A-type hammer-axes from Bohemia. 1 – Lbosín, Nr. 9; 2 – Plzeň, Nr. 17; 3 – Děčín District (?), Nr. 6; 4 – Polerady, Nr. 19; 5 – Spořice, Nr. 23; 6 – Obříství, Nr. 16. Drawing: L. Raslová.

less localised, and in the context of the demonstrable demographic diffusion of Corded Ware bearers, it is hardly conceivable that they could have preceded the A-type.

A separate question, of course, is where the inspiration for this particular hammer-axe type is to be sought. This issue is, and will remain, difficult to resolve, as

the hammer-axe – whether as a warrior's symbol, a mark of social rank or an insignia of power – is a chronologically and geographically fairly universal artefact, and in the 3rd millennium BC, artefacts stylistically similar to A-type hammer-axes can be found across wide areas of Europe (and the Near East – Heyd 2016: 75, Abb. 11; Klimscha 2016: 91–94). In addition to classic three-dimensional artefacts, depictions can also be identified in this horizon in Central and Southeastern Europe, appearing on anthropomorphic stelae/menhirs, which further highlight the hammer-axe's role as an indicator of social status (Kerig 2010; Alexandrov 2021: 283, 296, fig. 19; Gogăltan 2021: 254, pl. 3). The relatively frequent longitudinal ridge on the upper side of A-type hammer-axes, or its imitation in the form of grooves, is commonly interpreted as a reflection of metal hammer-axes cast in two-part moulds. This technology, too, was already widespread in Europe around 3000 BC, meaning that no geographically more specific source of inspiration can be pointed out (cf., Hell 1943; Maran 2008; Dani and Kulcsár 2021: 336–337, fig. 6; Schultrich 2022: 62–65, Abb. 9–10).

THE ISSUE OF A-TYPE HAMMER-AXES IN BOHEMIA

As in other parts of Europe, the foundation for the study of hammer-axes of the Corded Ware Culture in Bohemia was laid by the work of P. V. Glob (1945). The first to draw attention to their occurrence was M. Buchvaldek, who linked them to other finds assigned to the earliest, that is, pan-European horizon of the Corded Ware Culture. By the late 1950s, he had recorded a total of ten specimens. In addition to defining their shape, he also pointed out other consistent features, namely the clear traces of drilling and the direction of drilling from the upper side, similar to the Scandinavian examples (Buchvaldek 1957: 368, 377, fig. 155). He returned to this topic a few years later when publishing one typical example (Buchvaldek 1964), but above all in his monograph on the Corded Ware Culture in Bohemia (1967). At that time, the author had access to 31 specimens displaying features of the A-type. He later revisited them while defending the concept of the A-horizon in discussions of the European Corded Ware (Buchvaldek 1971: 556–559; 1986b: 147–148; 1997: 47–49), but he never published them comprehensively. Both older and more recent specimens have thus occasionally appeared either in catalogues of the Corded Ware published in the journal *Praehistorica* (specific references are given below for individual specimens) or as part of overview studies (Dobeš *et al.*, 2021: 496–498, fig. 4, 7–9). It should be noted that Czech scholarship has never really questioned the A-type hammer-axes as part of the earliest horizon of the Corded Ware Culture in Europe, although this has always been viewed within the context

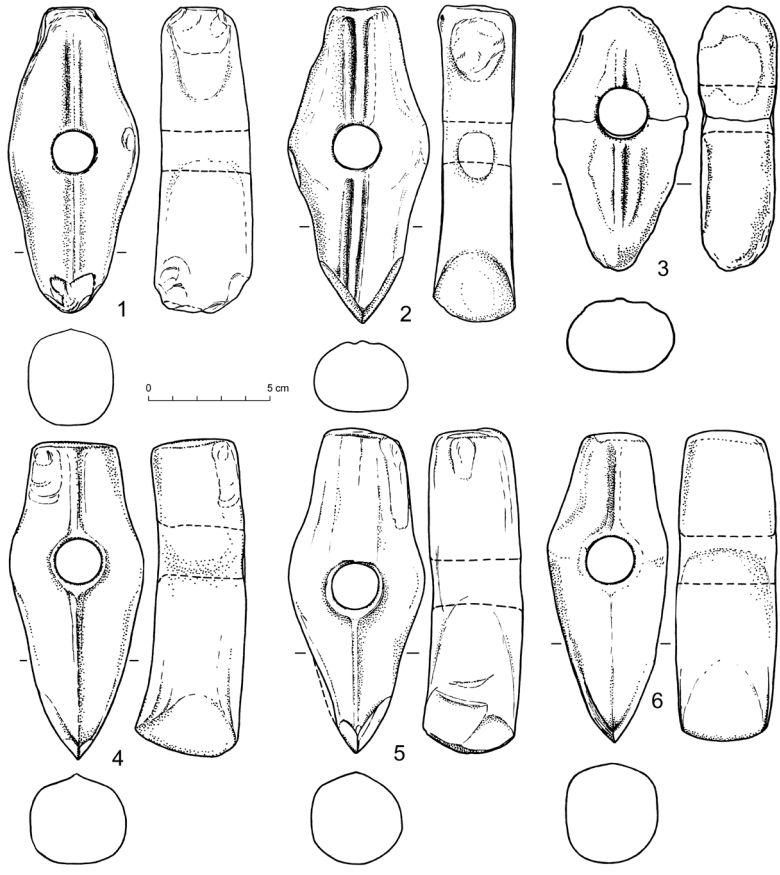

Fig. 4. A-type hammer-axes from Bohemia. 1 – Nové Dvory, Nr. 15; 2 – Podlesice, Nr. 18; 3 – Most, Nr. 13; 4 – Bílina, Nr. 1; 5 – Třebenice, Nr. 25; 6 – Močidlec, Nr. 12. Drawing: L. Raslová.

of a fundamentally different understanding of the genesis and, to some extent, the chronology of this cultural complex (Neustupný 2013: 132–133).

CATALOGUE OF A-TYPE HAMMER-AXES OF THE CORDED WARE CULTURE FROM BOHEMIA

The following catalogue summarises the available information on finds of A-type hammer-axes from the territory of Bohemia (Figs 2–8 and 11). In the first section (I),

artefacts that were available for closer examination are listed in alphabetical order. The statistical analysis of raw materials presented in previous chapters is based on this part of the catalogue. The second section (II) includes a smaller number of hammer-axes that could not be traced; the data for these entries are derived from the literature. The catalogue is linked to Fig. 1.

The primary source of information for this catalogue was the list of A-type hammer-axes presented in map form by M. Buchvaldek in his foundational monograph on the Corded Ware Culture in Bohemia (Buchvaldek 1967: 163, Karte 24). At present, 41 items have been identified, although some may be considered typologically ambiguous, so-called hybrids (see detailed classification in Fig. 1).

Abbreviations used in the catalogue: *AAH* – A-type hammer-axe; č. př. – accession number; *DE* – density; *inv. č.* – inventory number; *M* – museum; *MS* – Magnetic susceptibility; *NM Praha* – National Museum Prague; *r* – reconstructed dimension; *OS* – Optical stereomicroscopy; *SGS* – silicites of glacigene or glacial sediments; *u* – preserved dimension; *XRD* – X-ray diffraction.

I. ANALYSED A-TYPE HAMMER-AXES

1. Bílina, Teplice District (Fig. 4:4)
Find circumstances: Windmühle location, isolated find from 1938.
Dimensions and weight: 140 × 56 × 38 mm, 470 g.
Surface: Smoothed; traces of earlier pecking visible in places; an imitation seam runs along the longitudinal axis on the upper side. Grinding marks are apparent – fine striations oriented in various directions.
Shaft hole: Indistinct V-shaped bore, most likely drilled from the top; Ø 21 mm (top), 20 mm (bottom); pronounced drilling traces only superficially smoothed. A small ledge is present at the bottom exit of the borehole.
Raw material: Tertiary porphyritic basaltoid, partially hydrothermally altered.
Analytical methods used: OS, MS, XRD, DE.
Repository: Bílina M, inv. no. 129 (4023).
References: Buchvaldek 1967: 163, Karte 24:2; Buchvaldek and Velímský 1987: 79–80, fig. 25:1.

2. Čáslav, Kutná Hora District (Fig. 7:3)
Find circumstances: Balkán IV Street; found in a "cultural pit" during sewer works in 1936.
Dimensions and weight: 153 × 50 × 30 mm, 398 g.

Surface: Carefully smoothed; no visible traces of pecking. One side of the blade preserves part of the original surface, left unground – clearly an attempt to correct a shaping imperfection in the blank. Grinding traces visible: fine, parallel striations oriented almost exclusively transversely to the hammer-axe's main axis.
Shaft hole: V-shaped to asymmetrical X-shaped bore, evidently drilled from the top; Ø 23 mm (top), 19 mm (bottom); borehole clearly ground down, though its original irregularities remain visible.
Raw material: Jizera Mountains-type (Jizerské hory) metabasite.
Analytical methods used: OS, MS, XRD.
Repository: Čáslav M, inv. no. 1291 (old number).
References: Buchvaldek 1967: 163, Karte 24:24; Zápotocký 2002: 161, fig. 16:1.

3. Čermníky, Chomutov District (Fig. 2:1)
Find circumstances: Probable grave (?) find from a field owned by Mr Gassauer, dating to the 1880s; donated by the landowner.
Dimensions and weight: 191 × 58 × 38 mm, 728 g.
Surface: Incompletely smoothed traces of pecking, which appear on the surface with varying intensity. Grinding marks are visible: fine, parallel striations oriented transversely to the artefact's longitudinal axis, also present on the blade.
Shaft hole: V-shaped bore drilled from the top; Ø 19 mm (top), 18 mm (bottom); bore traces are finer but clearly visible, partially smoothed.
Raw material: Porphyritic microdiorite.
Analytical methods used: OS, MS, XRD, DE.
Repository: Chomutov M, inv. no. 841.
References: Buchvaldek 1967: 163, Karte 24:5; Dobeš 1993: 177, fig. 2.

4. Chocnějovice, Mladá Boleslav District (Fig. 6:5)
Find circumstances: Isolated find north of the village near the hamlet of Sovinky; collected by the priest Kára.
Dimensions and weight: 157 × 42 × 34 mm, 420 g.
Surface: Carelessly smoothed; several areas show incompletely erased pecking marks. Occasional transverse parallel grinding striations are visible.
Shaft hole: Indistinct V-shaped bore, drilled from the top; Ø 18 mm (top), 17 mm (bottom). Very fine parallel striations, in places seemingly overlaid with a thin crust obscuring the bore marks (secondary? varnish? crust resulting from contact with the haft?).
Raw material: Tertiary porphyritic basaltoid.
Analytical methods used: OS, MS.

Repository: Turnov M, inv. no. A590.
References: Filip 1947: 107, pl. 16:17; Buchvaldek 1967: 163, Karte 24:17 (as atypical AAH); Kalferst and Prostředník 1993: 31, pl. IV:1; Prostředník and Šída 2004: 317, 346, fig. 22:1.

5. Chrášťany, Rakovník District (Fig. 2:6)
Find circumstances: Isolated find from the cadastral area of the village, donated by Prof. Haken.
Dimensions and weight: 147 × 53 × 34 mm, 428 g.
Surface: Carefully smoothed; occasional small traces of pecking visible in places. Grinding marks visible: fine parallel striations, predominantly transverse.
Shaft hole: Slightly widened bore internally; Ø 20 mm (top), 18 mm (bottom), approximately 24 mm in the middle; distinct drilling traces, only lightly ground over.
Raw material: Tertiary porphyritic basaltoid, probably hydrothermally altered (low magnetic susceptibility).
Analytical methods used: OS, MS.
Repository: NM Praha, inv. no. 19491.
References: Buchvaldek 1967: 163, Karte 24:8.

6. Děčín District (?) (Fig. 3:3)
Find circumstances: Dredged from the Elbe River; purchased from the estate of Jul. Michel.
Dimensions and weight: u100 × r40 × 30 mm, 200 g.
Surface: Originally probably smoothed; secondarily abraded by water. No observable or preserved grinding traces.
Shaft hole: Symmetrical (?) irregular bore; Ø approx. 16 mm; coarse drilling traces heavily abraded due to secondary water exposure.
Raw material: Tertiary basaltoid?
Analytical methods used: OS, MS, DE.
Repository: Děčín M, inv. no. L1.
References: Buchvaldek 1967: 163.

7. Dolní Jiřetín, Most District (Fig. 2:3)
Find circumstances: Isolated find from the village's cadastral area.
Dimensions and weight: u80 × r50 × 29 mm, 142 g.
Surface: Carefully smoothed, only occasional small traces of pecking visible in places; on the upper side of the butt end, two parallel grooves along the axis of the

artefact, 1–1.5 mm wide. Grinding marks visible: fine parallel striations oriented in all directions.

Shaft hole: X-shaped bore; Ø approx. 21 mm; drilling traces almost entirely smoothed out. Along the vertical axis of the bore, fine parallel smoothing traces of the originally rough surface are visible (the X-shaped profile of the hole may have resulted from bilateral smoothing of an originally one-sided bore).

Raw material: Serpentinite.

Analytical methods used: OS, MS, XRD, DE.

Repository: Duchcov M, inv. no. 1551 (B122-2/85).

References: Buchvaldek 1967: 163, Karte 24:3; Dobeš and Buchvaldek 1993: 200, fig. 1.

8. Jičíněves, Jičín District (Fig. 2:7)

Find circumstances: Isolated find from the village's cadastral area, purchased by the museum from Fr. Papoušek in 1955 along with other items from the Jičín region.

Dimensions and weight: 166 × 41 × 29 mm, 401 g.

Surface: Smoothed, with only occasional remnants of the original surface of the blank visible; no pecking observed. On the upper side, two parallel grooves along the axis of the artefact, 1 mm wide. Grinding marks occasionally visible, almost imperceptible, mostly transverse to the main longitudinal axis of the artefact.

Shaft hole: Slight V-shaped bore, drilled from the top; Ø 15 mm (top), 14 mm (bottom); distinct drilling traces, only roughly smoothed (ground along the bore axis, as observed in other hammer-axes).

Raw material: Jizera Mountains-type (Jizerské hory) metabasite.

Analytical methods used: OS, MS, XRD, DE.

Repository: Jihlava M, inv. no. 251 (3/91).

References: Šebela 1993.

9. Lbosín, Benešov District (Fig. 3:1)

Find circumstances: Limestone quarry near the village; isolated find by J. Filas in 1942.

Dimensions and weight: 167 × 61 × 38 mm, 560 g.

Surface: Very finely pecked (?) or possibly corroded (?), carelessly smoothed, with smoothing particularly evident on the butt end. Any grinding traces are indistinct, possibly removed by corrosion (?).

Shaft hole: Symmetrical; Ø 19 mm (top), 19 mm (bottom); fine drilling traces clearly visible (closely spaced concentric rings), not smoothed.

Raw material: Palaeozoic amphibole diorite (?).

Analytical methods used: OS, MS.

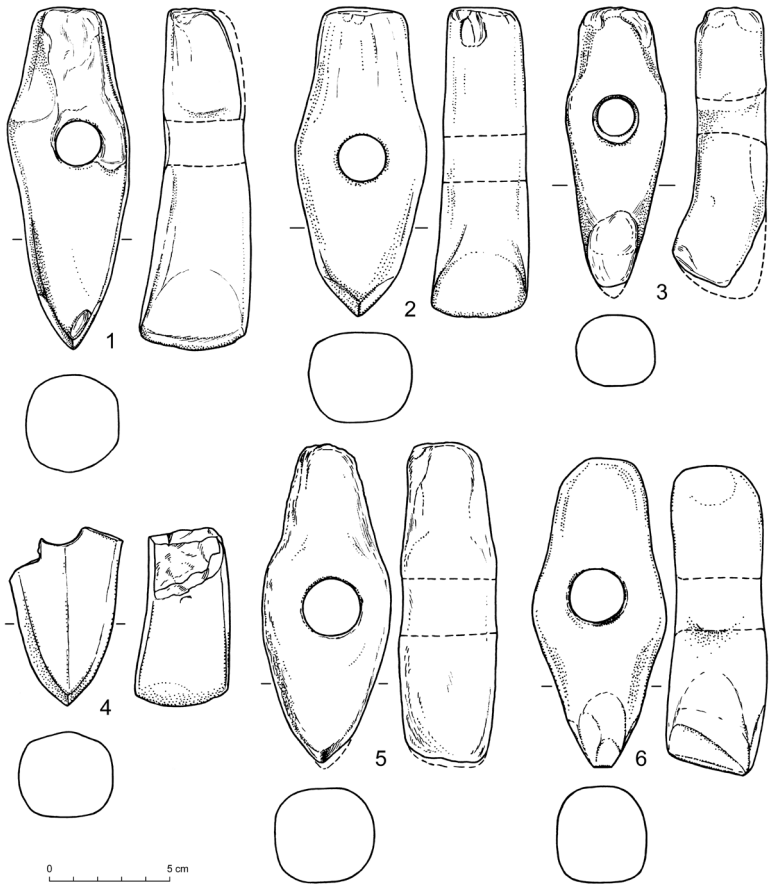

Fig. 5. A-type hammer-axes from Bohemia. 1 – Trmice, Nr. 26; 2 – Lovosice, Nr. 11; 3 – Losina, Nr. 10; 4 – Vchynice, Nr. 29; 5 – Most, Nr. 14; 6 – Zákolany, Nr. 31. Drawing: L. Raslová.

Repository: Vlašim M, inv. no. 100045.
References: Buchvaldek 1964: 107 with fig.; Buchvaldek 1967: 163, Karte 24:25.

10. Losina, Plzeň-jih District (Fig. 5:3)
Find circumstances: Isolated find from the village's cadastral area; donated by E. Liška in 1965.
Dimensions and weight: 116 × 42 × 28 mm, 208 g.
Surface: Ground, corroded. Due to corrosion, grinding traces are no longer visible. Both the blade and the butt are heavily battered.

Shaft hole: Asymmetrical X-shaped bore, primarily drilled from the top; Ø 17–18 mm (top), 15 mm (inner), 13 mm (middle); drilling traces distinct, not smoothed.
Raw material: Palaeozoic porphyritic microdiorite (?).
Analytical methods used: OS, MS.
Repository: Stříbro M, inv. no. A647, reg. no. 776/65.
References: Buchvaldek 1992: 17; Metlička *et al.*, 2007: 110, fig. 4:6.

11. Lovosice, Litoměřice District (Fig. 5:2)
Find circumstances: Grave find from the Reiser brickyard; a "cauldron-shaped pit" with a "sitting crouched skeleton"; fill consisted of loam with ash and charcoal. The hammer-axe was reportedly found beneath the skeleton; no other finds were recorded. Information obtained from workers and the finds secured by R. von Weinzierl in 1884.
Dimensions and weight: 128 × 54 × 34 mm, 396 g.
Surface: Imperfectly smoothed; any traces of surface pecking are nearly polished over but still visible across most of the surface. Grinding traces are occasionally visible, both transverse and longitudinal (coarser?).
Shaft hole: V-shaped bore, drilled from the top; Ø 21 mm (top), 19 mm (bottom); originally pronounced drilling traces are partially smoothed.
Raw material: Chloritized biotite amphibolite.
Analytical methods used: OS, MS, XRD.
Repository: Teplice Museum, inv. no. K7170, W469.
References: von Weinzierl 1894: 145, figs 102–103; Buchvaldek 1967: 142 (73/68): 163, Karte 24:12.

12. Močidlec, Karlovy Vary District (Fig. 4:6)
Find circumstances: Isolated find from the village's cadastral area, made before 1940.
Dimensions and weight: 134 × 52 × 42 mm, 462 g.
Surface: Smoothed; any traces of surface pecking are nearly obliterated. On the top side along the artefact's longitudinal axis is an imitation seam, an edge. Grinding traces are visible: fine, parallel striations, mostly transverse.
Shaft hole: Symmetrical bore; the drilling direction is unclear; Ø 20 mm (top), 20 mm (bottom); the bore is clearly ground (fine striations along the vertical axis), but the original rough irregularities are still clearly apparent.
Raw material: Palaeozoic or Proterozoic diabase/dolerite.
Analytical methods used: OS, MS.
Repository: Karlovy Vary Museum, inv. no. A280.
References: Anonymus 1941: 111; Metlička *et al.*, 2007: 110, fig. 3:4.

13. Most, Most District (Fig. 4:3)
Find circumstances: Grave find scattered by an excavator near the marshalling yard in 1931. In addition to the hammer-axe, two blades from SGS likely originate from the same context.
Dimensions and weight: u115 × u61 × 33 mm, 334 g.
Surface: Originally smoothed; a rib is present along the longitudinal axis on the top side; secondarily heavily chipped/reused, especially the butt and the blade. Traces of grinding are indistinct; only a small patch of the original surface is preserved.
Shaft hole: V-shaped bore, probably drilled from the top; Ø 22 mm (top), 20 mm (bottom); originally distinct drilling traces are partially smoothed; surface partially flaked off (weathering?).
Raw material: Tertiary porphyritic basaltoid.
Analytical methods used: OS, MS, DE.
Repository: Most Museum, inv. no. P33a (reg. no. 2357/90).
References: Buchvaldek 1967: 163, Karte 24:27; Dobeš and Buchvaldek 1993: 208, fig. 12.

14. Most, Most District (Fig. 5:5)
Find circumstances: Location "Henkerteich", near the former gasworks of Most, isolated find from 1895.
Dimensions and weight: 132 × 53 × 37 mm, 364 g.
Surface: Heavily corroded; the original surface has not been preserved and cannot be observed.
Shaft hole: Symmetrical bore, corroded, all features only faintly visible; probably drilled from the top; Ø 24 mm (top), 23–25 mm (bottom); a small step is present on the underside, suggesting the bore "slipped" in its final stage (?).
Raw material: Biotite gneiss?
Analytical methods used: OS, MS.
Repository: Most Museum, inv. no. 179 (reg. nos. 5827, 2350/90).
References: Buchvaldek 1967: 163, Karte 24:27 (as atypical AAH); Dobeš and Buchvaldek 1993: 214, fig. 19.

15. Nové Dvory, Litoměřice District (Fig. 4:1)
Find circumstances: Isolated find from the village's cadastral area, donated by Husák in 1896.
Dimensions and weight: 133 × 57 × 38 mm, 448 g.
Surface: Fine pecking across the surface; along a slightly raised seam in the longitudinal axis of the axe, only roughly smoothed in two narrow strips (2 × approx. 5 mm).

Shaft hole: Slight V-shaped bore, drilled from the top; Ø 20 mm (top), 18 mm (bottom); distinct drilling traces, only roughly smoothed.
Raw material: Fine-grained diorite?
Analytical methods used: OS, MS, XRD, DE.
Repository: Roudnice Museum, inv. no. st. no. 34, reg. no. 65.
References: Buchvaldek 1967: 163, Karte 24:14.

16. Obříství, Mělník District (Fig. 3:6 and 7:1)
Find circumstances: Inhumation grave 166 discovered during rescue excavation in 2011. It contained remains of a male (adultus II – maturus, 35–50 years) and grave goods including the hammer-axe, two antler strap fasteners, a beaker, and a piece of silicite.
Dimensions and weight: 186 × 51 × 31 mm, 548 g.
Surface: Perfectly smoothed; no traces of pecking observed. A seam-like ridge runs along the top side in the longitudinal axis of the artefact, with faint facets occasionally formed by grinding. Traces of grinding visible: fine parallel striations, predominantly transverse.
Shaft hole: Symmetrical bore, probably drilled from the bottom; Ø 16 mm (top), 17 mm (bottom); distinct drilling traces, not smoothed.
Raw material: Jizera Mountains-type (Jizerské hory) metabasite.
Analytical methods used: OS, MS.
Repository: Institute of Archaeology Prague, inv. no. OB11/546.
References: Dobeš *et al.*, 2023: 103–105, figs 2–4.
Note: Radiocarbon date: MAMS-30795, 4259±23 BP, 2912–2786 BC (2σ).

17. Plzeň-Hradiště, Plzeň District (Fig. 3:2)
Find circumstances: Isolated find by Mr Dědek around 1926, between the Úhlava River and Pod Bručnou Street.
Dimensions and weight: 178 × 48 × 29 mm, 384 g.
Surface: Heavily corroded, including the inner walls of the shaft hole; any further surface modifications cannot be observed.
Shaft hole: Symmetrical bore, probably drilled from the top; Ø 20 mm (top), 20 mm (bottom).
Raw material: Proterozoic greywacke.
Analytical methods used: OS, MS, DE.
Repository: Plzeň M, inv. no. P8687.
References: Buchvaldek 1967: 163, Karte 24:9, pl. XIX:1; Buchvaldek 1992: 17, fig. 1:1; Metlička *et al.*, 2007: 110, fig. 4:1.

18. Podlesice, Chomutov District (Fig. 4:2)
Find circumstances: Isolated find from the village's cadastral area, originally part of Fr. Steiner's collection.
Dimensions and weight: 138 × 59 × 29 mm, 396 g.
Surface: Smoothed; pecking traces visible across the surface (or perhaps a result of the stone's texture during grinding?). A longitudinal seam on the top of the artefact is asymmetrically positioned, not aligned with the central axis. The blade is centred, but the front of the artefact is secondarily shortened, the hammer-axe has been reworked. Grinding marks are transverse on the body and longitudinal on the blade and part of the side.
Shaft hole: X-shaped bore with a central step, drilled from the bottom and later redrilled from the top halfway through? Ø 19 mm (top and bottom), 17 mm (centre); coarsely made and only partially polished.
Raw material: Partly altered metamorphosed Palaeozoic diorite/diabase.
Analytical methods used: OS, MS, XRD, DE.
Repository: Chomutov M, inv. no. 924 (St5).
References: Buchvaldek 1967: 163, Karte 24:6; Dobeš 1997: 82, fig. 6.

19. Polerady, Most District (Fig. 3:4 and 7:4)
Find circumstances: Isolated find from the village's cadastral area, acquired by A. Pobel in 1900.
Dimensions and weight: 185 × 53 × 30 mm, 444 g.
Surface: Originally probably carefully polished, only remnants preserved. Most of the surface is secondarily chipped (an oblique lamination seam is visible on the upper side, indicating secondary corrosion). There was likely also a longitudinal seam/ridge on the top originally. Traces of grinding are visible in the preserved areas: fine parallel striations, predominantly transverse.
Shaft hole: Symmetrical bore, drilling direction indeterminable; Ø 19 mm (top), 19 mm (bottom); roughly made, incompletely ground out (drill marks still visible), in places also chipped like the rest of the artefact surface.
Raw material: Proterozoic greywacke.
Analytical methods used: OS, MS, DE.
Repository: Teplice M, inv. no. K2667 (31-4/75).
References: Buchvaldek 1967: 163, Karte 24:4; Dobeš and Buchvaldek 1993: 218, fig. 23.

20. Přední Lhota, Nymburk District (Fig. 2:5)
Find circumstances: Isolated find from the village's cadastral area.
Dimensions and weight: approx. 112 × approx. 60 × 37 mm, 326 g.

Surface: Lightly corroded, originally carefully polished. A ridge imitating a seam runs along the longitudinal axis on the upper side of the artefact. Traces of grinding are not observable due to corrosion.
Shaft hole: Symmetrical bore, drilling direction indeterminable; Ø 16 mm (bottom), diameter from the top not measurable; fine drill traces (tightly spaced concentric rings) well visible, unpolished.
Raw material: Jizera Mountains-type (Jizerské hory) metabasite.
Analytical methods used: OS, MS.
Repository: Charles University, Prague (possibly Poděbrady M), inv. no. P160.
References: Buchvaldek 1967: 163, Karte 24:21.

21. Roudnice nad Labem, Litoměřice District (Fig. 2:4)
Find circumstances: Isolated find from the village's cadastral area.
Dimensions and weight: 145 × 46 × 30 mm, 331 g.
Surface: Polished, with only minor remnants of the original rough surface and pecking visible in places; almost imperceptible facets, the most distinct of which forms a longitudinal seam on the upper side. Fine grinding marks, mostly transverse, clearly visible.
Shaft hole: Slight V-shaped bore, drilled from the top; Ø 18 mm (top), 17 mm (bottom); very prominent drilling traces, only superficially ground (as in other axe-hammers, grinding along the axis of the bore).
Raw material: Jizera Mountains-type (Jizerské hory) metabasite.
Analytical methods used: OS, MS, XRD, DE.
Repository: Roudnice M, inv. no. 53.
References: Buchvaldek 1967: 163, Karte 24:15; Buchvaldek 2002: 65, fig. 3.

22. Roztyly, Louny District (Fig. 6:1)
Find circumstances: Inhumation grave 8A discovered in a sandpit near the village in 2002. It contained the remains of a male (based on the flexed position on the right side) and grave goods including an axe-hammer and a blade of the Corded Ware type. The grave was disturbed by a feature of the same type belonging to the Únětice culture.
Dimensions and weight: 161 × 55 × 41 mm, 592 g.
Surface: Pecked overall, only very roughly and superficially smoothed.
Shaft hole: Symmetrical bore, drilling direction undetermined; Ø 18 mm from both sides; faint fine drilling traces visible, no signs of additional grinding.
Raw material: Porphyritic microdiorite.
Analytical methods used: OS, MS, XRD, DE.
Repository: Žatec M, reg. no. 15/00-125.
References: Holodňák and Holodňáková 2002: 136, fig. 2:5.

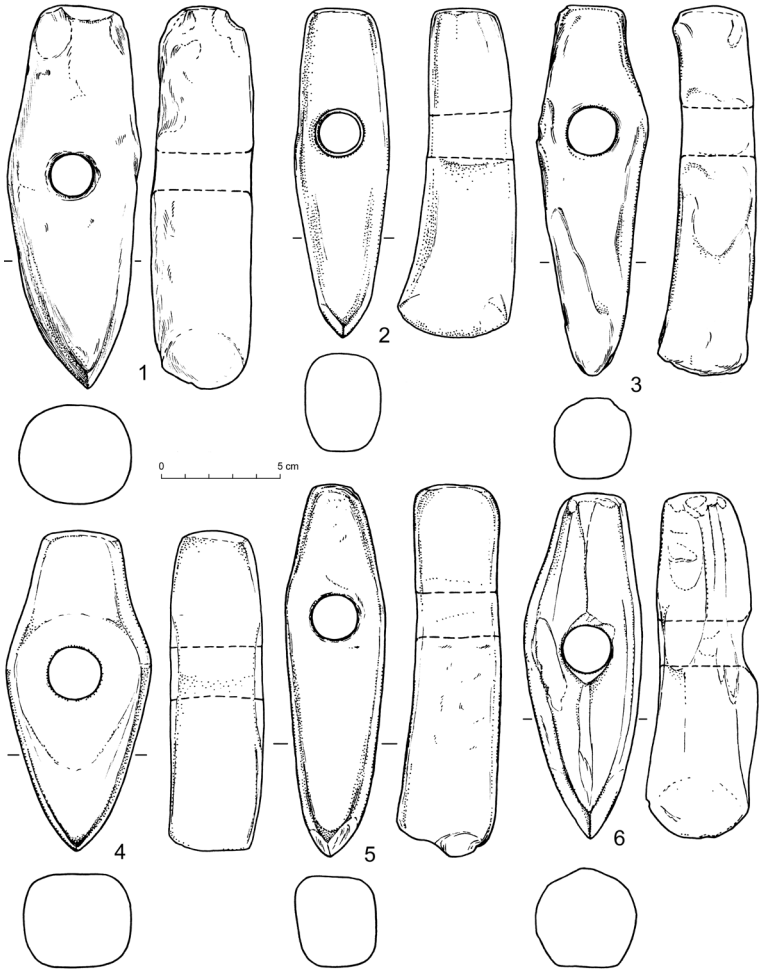

Fig. 6. A-type hammer-axes from Bohemia. 1 – Roztyly, Nr. 22; 2 – Trnová, Nr. 27; 3 – Turnov, Nr. 28; 4 – Velebudice, Nr. 30; 5 – Chocnějovice, Nr. 4; 6 – Sýrovice, Nr. 24. Drawing: L. Raslová.

23. Spořice, Chomutov District (Fig. 3:5)

Find circumstances: Isolated find from the village's cadastral area, originally from the collection of H. Palme.

Dimensions and weight: 167 × 50 × 37 mm, 458 g.

Surface: Smoothed; traces of possible pecking visible in several places. In the longitudinal axis of the artefact, an imitation seam (a ridge) is present on the upper side, and

also on the bottom of the butt end. In places, the surface is secondarily naturally flaked. Grinding traces visible: fine parallel striations, predominantly transverse.
Shaft hole: Symmetrical drilling, probably from the top; Ø 20 mm from the top, 18 mm from the bottom; coarse drilling marks, only roughly smoothed.
Raw material: Serpentinite (?)
Analytical methods used: OS, MS.
Repository: Děčín M, inv. no. Ar4424, Palme L/7, cat. no. 1/86.
References: Buchvaldek 1967: 163, Karte 24:1, pl. XIX:2 (as Děčínsko?).

24. Sýrovice, Louny District (Fig. 6:6)
Find circumstances: Isolated find from the village's cadastral area, from Mr Schuh's sandpit, originally from the collection of Fr. Steiner.
Dimensions and weight: 147 × 48 × 35 mm, 446 g.
Surface: Smoothed (with faint facets); no traces of possible pecking observed. In several places, unpolished traces of more roughly hewn preform. Grinding traces visible: fine parallel striations, a combination of longitudinal and transverse.
Shaft hole: Multi-phase drilling? There is a small step in the middle, probably primarily drilled from the top; Ø 20 mm from the top, 19 mm from the bottom; coarse drilling marks, only faintly smoothed.
Raw material: Jizera Mountains-type (Jizerské hory) metabasite.
Analytical methods used: OS, MS, XRD, DE.
Repository: Chomutov M, inv. no. 920 (St355).
References: Dobeš 1997: 83, Fig. 8.

25. Třebenice, Litoměřice District (Fig. 4:5)
Find circumstances: Isolated find from the village's cadastral area.
Dimensions and weight: 138 × 59 × 38 mm, 466 g.
Surface: Polished; traces of pecking visible only locally. Rough surfaces of the originally flaked preform preserved at the blade and butt (probably not due to secondary damage). Grinding traces visible: fine parallel striations, mostly transverse.
Shaft hole: Asymmetrical X-shaped perforation; the drilling direction is unclear, perhaps from below (a ledge at the upper outlet of the hole), later drilled/modified from above; Ø 20 mm from above, 20 mm from below, 18 mm in the centre. Drilling traces nearly completely smoothed out, very fine in places.
Raw material: Metabasite (?).
Analytical methods used: OS, MS, XRD.
Repository: Litoměřice M, inv. no. T22 (Třebenice collection).
References: Buchvaldek 1967: 163, Karte 24:10; Zápotocký 1964: 301, fig. 16:1.

26. Trmice, Ústí nad Labem District (Fig. 5:1)

Find circumstances: Grave no. 14 discovered during rescue excavation related to the D8 highway in 1987. The only artefact found was the hammer-axes; the burial contained the remains of a man (*adultus*, 20–40 years old) lying on his right side, along with dislocated bones of another individual.

Dimensions and weight: 141 × 50 × 34 mm, 384 g.

Surface: Polished; no traces of prior pecking observed. Parts of the original surface of the preform preserved, only faintly ground. Grinding traces visible: fine parallel striations, mostly transverse.

Shaft hole: Symmetrical perforation, probably drilled from above; Ø 18 mm from above, 18 mm from below. Very rough drilling traces, not smoothed.

Raw material: Proterozoic metatuffite (?)

Analytical methods used: OS, MS, XRD.

Repository: Ústí nad Labem M, inv. no. 13034.

References: Cvrková *et al*., 1991: 14, fig. 10; Pavelková 1991: 41.

27. Trnová u Polep, Litoměřice District (Fig. 6:2)

Find circumstances: Discovered during the establishment of a hop field near the village in 1894; originally from the collection of R. von Weinzierl.

Dimensions and weight: 140 × 38 at sh. hole (max. width 39) × 35 mm, 366 g.

Surface: Smoothed, with only occasional traces of possible pecking or the original surface of the blank. Grinding marks visible: fine parallel striations, predominantly transverse.

Shaft hole: Slight V-shaped perforation, drilled from the top; Ø 20 mm at the top, 17 mm at the bottom; coarse drilling traces visible, but partially smoothed.

Raw material: Jizera Mountains-type (Jizerské hory) metabasite (probably).

Analytical methods used: OS, MS, XRD.

Repository: Teplice M, inv. no. W1326 (acq. no. 155/80).

References: Buchvaldek 1967: 163, Karte 24:13 (as atypical AAH); Budinský 1985: 73.

28. Turnov, Semily District (Fig. 6:3)

Find circumstances: Isolated find from the village's cadastral area, in the Durychov locality, near house no. 522.

Dimensions and weight: 156 × 47 × 29 mm, 352 g.

Surface: Indeterminateeither strongly weathered, corroded, or chopped and pecked.

Shaft hole: Slightly V-shaped, drilled from the top; Ø 20 mm at the top, 19 mm at the bottom; perforation corroded, occasionally with traces of coarser drilling

marks. Unlike the surface, some smoothed patches visible in the perforation, suggesting partially ground drilling traces.
Raw material: Tertiary volcanic (trachytic) rock.
Analytical methods used: OS, MS.
Repository: Turnov M, inv. no. A3818.
References: Buchvaldek 1967: 163, Karte 24:18; Kalferst and Prostředník 1993: 28, tab. IV:2; Prostředník and Šída 2004: 314, 348, fig. 21:2.

29. Vchynice, district Litoměřice (Fig. 5:4)
Find circumstances: Isolated find from the village's cadastral area, originally from the collection of R. von Weinzierl.
Dimensions and weight: approx. 75 × unknown × 29 mm, 180 g.
Surface: smoothed, slightly corroded, polishing traces unobservable due to corrosion.
Shaft hole: preserved only slightly, most likely symmetrical or V-shaped; Ø cannot be measured; drilling traces probably smoothed and unobservable.
Raw material: Tertiary porphyritic basaltoid.
Analytical methods used: OS, MS, DE.
Repository: Teplice M, inv. no. K5182.
References: Buchvaldek 1967: 163, Karte 24:11; Budinský 1985: 97.

30. Velebudice, district Most (Fig. 6:4)
Find circumstances: Isolated find from the Scheithauer field, gift from 1894.
Dimensions and weight: 136 × 62 × 39 mm, 448 g.
Surface: carefully smoothed, slightly corroded in places, traces of possible previous pitting not observed or completely smoothed out. Occasional traces of grinding, barely visible, mostly transverse.
Shaft hole: bore slightly X-shaped; Ø 22 mm top, 22 mm bottom, 21 mm middle; drilling traces almost perfectly smoothed, visible grinding traces in the bore axis (fine scratches).
Raw material: Serpentinite.
Analytical methods used: OS, MS, XRD.
Repository: Most M, inv. no. 187 (acc. nos. 5302 and 2339/90).
References: Buchvaldek 1967: 163, Karte 24:28 (as atypical AAH); Dobeš and Buchvaldek 1993: 221, fig. 28.

31. Zákolany, district Kladno (Fig. 5:6)
Find circumstances: Budeč hillfort, isolated find acquired before 1925.
Dimensions and weight: 129 × 56 × 36 mm, 414 g.

Surface: imperfectly smoothed traces of pitting, i.e., rougher surface (probably not corrosion). Occasional transverse grinding traces. Edge secondarily (recently) ground into a narrow hammer shape.
Shaft hole: V-shaped bore, drilled from above; Ø 23 mm top, 21 mm bottom; coarse drilling traces visible, partially smoothed.
Raw material: diabase / dolerite.
Analytical methods used: OS, MS.
Repository: NM Praha, inv. no. 10051.
References: Buchvaldek *et al.*, 1997: 156, fig. 50.

32. Žalov, district Praha-západ (Fig. 2:2)
Find circumstances: Levý Hradec hillfort, no further details.
Dimensions and weight: approx. 56 × approx. 42 × 35 mm, 128 g.
Surface: carefully smoothed, no traces of possible previous pitting observed. Traces of grinding visible: fine parallel scratches, mostly transversely oriented.
Shaft hole: symmetrical bore, drilling direction unknown; Ø approx. 16 mm; coarse drilling traces, only partially smoothed.
Raw material: serpentinite.
Analytical methods used: OS, MS, DE.
Repository: NM Praha, inv. no. 16720.
References: Buchvaldek 1967: 163, Karte 24:26 (as Levý Hradec, classified as atypical AAH); Buchvaldek *et al.*, 1997: 169, fig. 68.

II. UNANALYSED A-TYPE HAMMER-AXES

33. Bílina, Teplice District
Find circumstances: Blade section of an A-type battle axe without further details.
Dimensions and weight: *c.* 95 × 45 × 30 mm.
Surface: Smoothed; two parallel grooves along the axis of the artefact on the upper face.
Repository: Teplice M, inv. no. K2686 (not located).
References: Buchvaldek 1967: 163, Karte 24:2 (plus personal archive of M. Buchvaldek).

34. Hořovičky, Rakovník District
Find circumstances: Unknown.
References: Buchvaldek 1967: 163, Karte 24:7 (as atypical AAH).

35. Káraný – surroundings, Prague-East District (Fig. 7:2)
Find circumstances: From the River Jizera.
Dimensions and weight: L. 149 × 50 × 30 mm, 447 g.
Surface: Original surface not preserved; the object was most likely secondarily water-worn due to its origin (the protruding lamina on the butt end of the axe can be considered evidence of secondary abrasion). Any grinding marks not observed or preserved.
Shaft hole: Faint V-shaped bore, drilled from the top; Ø 18 mm (top), 17 mm (bottom); coarse drilling marks visible, partially smoothed.
Repository: Department of Archaeology, Faculty of Arts, Charles University, without inventory number.
References: Buchvaldek 1967: 163, Karte 24:16, pl. XIX:3.

36. Kounice, Nymburk District
Find circumstances: Unknown.
References: Buchvaldek 1967: 163, Karte 24:23 (as atypical AAH).

37. Městec Králové – surroundings, Nymburk District
Find circumstances: Unknown.
References: Buchvaldek 1967: 163, Karte 24:20 (as atypical AAH).

38. Most, Most District (Fig. 8:1)
Find circumstances: Inhumation grave discovered during the excavation of factory foundations in 1864. According to descriptions, in addition to the hammer-axe, the grave contained an item of silicite (not preserved) and pottery (not preserved).
Dimensions and weight: approx. 99 (originally 120) × 53 × 38 mm, 355 g.
Surface: Polished (in the 20th century the item was secondarily exposed to fire); an indistinct ridge on the upper side.
Shaft hole: V-shaped bore; Ø 21 mm from above, 20 mm from below; very coarse drilling marks.
Repository: Municipal Office in Petrohrad, inv. no. 148.
References: Dobeš and Buchvaldek 1993: 212, fig. 17.

39. Opálka, Klatovy District (Fig. 8:2)
Find circumstances: Isolated find from field plot no. 82/2, discovered by V. Soušek in 1934.
Dimensions and weight: approx. 95 × ca 50 × 30 mm, 236 g.
Surface: Ground.

Fig. 7. A-type hammer-axes from Bohemia. 1 – Obříství, Nr. 16; 2 – Káraný – surroudings, Nr. 35; 3 – Čáslav, Nr. 2; 4 – Polerady, Nr. 19. Photo: I. Hrušková.

Shaft hole: According to description, drilled from both sides, approx. Ø 16 mm.
Raw material: According to B. Šreinová, very fine-grained metatuffite, "probably from a local or nearby source".
Repository: Klatovy Museum, inv. no. 5.
References: Metlička *et al.*, 2007: 110, fig. 4:2.

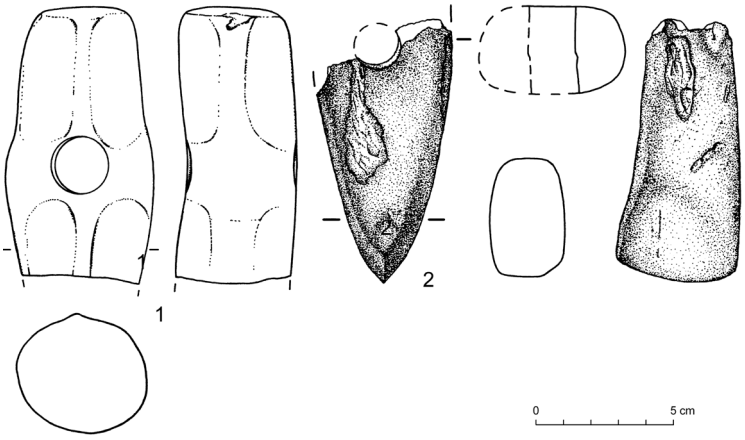

Fig. 8. A-type hammer-axes from Bohemia (not located). 1 – Most, Nr. 38; 2 – Opálka, Nr. 39. After Dobeš, Buchvaldek 1993; Metlička *et al.*, 2007.

40. Pecka (near Nová Paka), Jičín District
Find circumstances: Unknown.
References: Buchvaldek 1967: 163, Karte 24:19.

41. Týnec nad Labem, Kolín District
Find circumstances: Unknown.
References: Buchvaldek 1967: 163, Karte 24:22 (as atypical AAH).

FIND CONTEXTS AND DISTRIBUTION OF A-TYPE HAMMER-AXES IN BOHEMIA

At present, around 40 examples of the discussed type of hammer-axes are recorded in Bohemia; our study includes 41 specimens. For various reasons, however, the presented assemblage, as is often the case, cannot be regarded as complete. Some of the recorded pieces have not been revised (i.e., found but not re-examined; see the second group in the catalogue), so we remain reliant on their listing by M. Buchvaldek, which is probably reliable (Buchvaldek 1967: 163, Abb. 24). The inclusion of some typologically problematic pieces (especially so-called hybrid forms, see below) also presents difficulties. On the other hand, additional pieces may be concealed in museum collections. Compared with geographically neighbouring areas – for example,

Moravia (fewer than 10 pieces, excluding the examples from Jevišovice and Peška 2021: 514, fig. 1) or Bavaria (around 25 pieces; Buchvaldek 1998: 26, fig. 14:5) – the Bohemian assemblage is relatively large.

As in other regions, this is a group of artefacts with varying combinations of features that define the ideal type. We have attempted to divide them into *three morphological and evidential categories*. The first two categories broadly follow the earlier distinction between shapes that adhere to the ideal form – that is, the "true" A-type hammer-axes – and less formally shaped pieces lacking, in particular, the curved lateral axis and dropped blade edge, that is, the "degenerate" forms (essentially following Brandt 1967: 43–49, Pl. 6). The third, heterogeneous category consists of specimens displaying features of other types, such as faceted hammer-axes (Sýrovice, item 24), simple variants of hammer-axes of the Ślęża type (see e.g., Šebela 1999: 73, Pl. 134:5), or A-type derivatives from Silesia and Lesser Poland (Włodarczak 2006: 33, table XXII:B). Given their looser connection with the ideal A-type, this category also includes other problematic pieces for simplicity, namely typologically inconspicuous fragments and artefacts of unknown form listed in M. Buchvaldek's 1967 inventory (see above).

Based on find contexts, the hammer-axes can be divided into artefacts originating from (inhumation) graves (6 to 7 specimens) and isolated finds, the latter clearly predominating (accounting for about 85% of the total; see Fig. 1). In graves, A-type hammer-axes are accompanied at most by a flint blade, as is typical throughout the European Corded Ware oecumene. A notable exception is formed by two cases: the find from Most (Catalogue item no. 38) and a male inhumation grave from Obříství (Catalogue item no. 16). No pottery has survived from the former, but the latter yielded a typologically archaic beaker, a silicite blade and, importantly, a pair of antler belt clasps. According to the radiocarbon date, the grave falls around the 29th century BC, making it an important element not only for dating A-type hammer-axes but also for the belt clasps.

Isolated finds are generally interpreted as the last remains of ploughed-out graves (Buchvaldek 1997: 44). In many cases this was undoubtedly so, but other possibilities must also be considered. The votive aspects may be recalled by practices associated with roughly contemporary copper hammer-axes of the Eschollbrücken type, which are found exclusively in bogs and similar contexts, never in graves (Maran 2008; see Malmer 1962: 666–671 for the votive function of stone artefacts). Certain find circumstances of Czech A-type hammer-axes allow for this interpretation (Items 6 and 35 in the Catalogue). In terms of provenance, isolated finds without more precise information are especially problematic, as they may have served as so-called thunderstones, meaning that their original deposition need not correspond to what is stated in museum documentation. Certainly, in the Czech lands too, trade in these artefacts

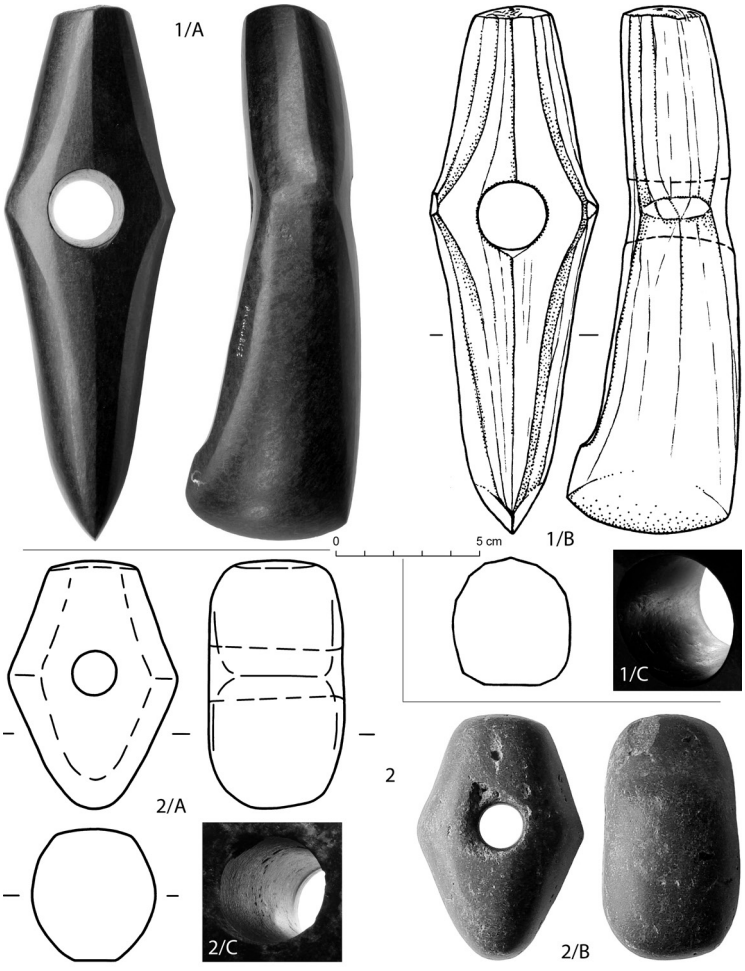

Fig. 9. Examples of other types of hammer-axes of the Corded Ware Culture from Bohemia. 1 – Faceted hammer-axe (Pardubice); 2 – Battle axe of Bohemian type (Kozárovice). Photo: I. Hrušková. Drawing: L. Raslová.

based on belief in their protective powers was still flourishing at the beginning of the 20th century (see e.g., Sklenář 1999: 23–65). The occurrence of A-type hammer-axes in the context of other archaeological cultures (Jevišovice, layer B, Medunová-Benešová 1972: 144–154, Pl. 91–93) or mixed groups (Lüscherz; Winiger 1993) at the same

time suggests their potential connection with local Late Neolithic/Eneolithic groups (e.g., the Cham Culture in western Bohemia). It cannot be ruled out either that they may relate to actual settlement by Corded Ware communities (see for example the hill-top settlement Wattendorf-Motzenstein in Upper Franconia; Seregély 2008).

In light of the above, the distribution pattern of A-type hammer-axes in Bohemia must be considered carefully. Compared with the settlement oecumene of the Corded Ware Culture, which is itself constructed on the basis of grave finds, two anomalies can be observed (Fig. 1). Firstly, there is a marked concentration of finds in north-western Bohemia, which could at first sight be interpreted as the initial penetration of a migrating Corded Ware population from the neighbouring Middle Elbe–Saale region. However, the distribution of contemporary ceramic forms of the A-horizon does not fully support this picture (Dobeš *et al.*, 2021: 492–496, fig. 2). This may thus reflect the current state of research, differing chronological dynamics in the use of A-type hammer-axes in central and north-western Bohemia, or other reasons. Secondly, differences can be observed when comparing the distribution of A-type hammer-axes with their typological (and broadly chronological) successors, i.e., faceted hammer-axes and Bohemian-type hammer-axes (Fig. 1 versus Buchvaldek 1986a: fig. 56). A-type hammer-axes tend to concentrate on the periphery of the Corded Ware settlement oecumene and beyond it, particularly in contrast to the distribution of the local Bohemian-type hammer-axe, which occurs predominantly at its centre. Given the above-mentioned interpretative issues surrounding isolated finds of stone hammer-axes, this could be an indication reflecting the initial stages of necessary contact between incoming and local populations, when Corded Ware communities moved within or settled rather on the fringes of areas continuously inhabited since the Early Neolithic (cf., Buchvaldek 1964: 4).

RAW MATERIALS OF THE BOHEMIAN A-TYPE HAMMER-AXES

In this chapter, we assess a collection of 32 ground tools from the perspective of the raw materials used. These are specimens that were available for more detailed non-destructive analysis. The petrographic classification of the artefacts often allowed identification only to a broader lithological group, without the possibility of determining a more precise provenance. This limitation is due to the fact that the analysis was restricted to non-destructive research methods. The primary tool for identifying specific raw materials was optical stereomicroscopy, complemented by measurements of magnetic susceptibility and density, and in selected cases also X-ray diffraction (approximately half of the analysed artefacts). The list of methods applied to individual artefacts is provided in the catalogue.

The most common raw material identified in the Bohemian assemblage is *metabasite* (8 specimens, representing 25% of the collection). In six cases, this was specifically determined to be *Jizera Mountains-type (Jizerské hory) metabasite*. In two instances, a more precise provenance could not be established, but their attribution to the Jizera Mountains sources is probable. These artefacts are found mainly in eastern Bohemia (Čáslav, Přední Lhota and Jičíněves) and also along or near the Elbe River (Roudnice nad Labem, Obříství near Mělník, Trnová and Třebenice near Litoměřice). The only site beyond this area is Sýrovice in the Louny district. Given the dimensions of the hammer-axes, it appears unlikely that they were produced by reworking older Neolithic shoe-last adzes or axes. It must therefore be assumed that the Jizera Mountains sources were known and exploited during the Corded Ware period as well.

In second place are *basaltic rocks* (basaltoids) of Tertiary age (7 specimens, representing 22% of the assemblage). Their precise classification (basalt, basanite, tephrite, phonolite, nephelinite and others) is not possible without preparing thin sections and determining the chemical composition, i.e., by means of destructive analyses. These young volcanic rocks form not only the Central Bohemian Uplands and the Doupov Mountains, but also numerous morphologically prominent features within, for example, the Bohemian Cretaceous Basin (Kunětická hora near Pardubice, Bezděz, Luž, Čeřovka, Zebín and Veliš near Jičín /Pacák 1957/, Čertova zeď hill near Český Dub, the summit of Mužský near Mnichovo Hradiště, Hazmburk and others). These dominant landscape features may have attracted attention. A number of Corded Ware hammer-axe finds lie in the vicinity of potential sources (Bílina, the Elbe near Děčín, Most, Vchynice near Litoměřice, Chocnějovice near Mnichovo Hradiště), and in the case of other finds, occurrences of basaltoid neovolcanics can always be found relatively nearby.

The third most numerous group comprises rocks identified as *amphibole diorite or porphyritic microdiorite* (6 specimens, representing 19% of the assemblage). These are predominantly dyke rocks, and the occurrences of artefacts made from them are concentrated in Central Bohemia. In the case of the Bohemian Corded Ware hammer-axes, their provenance is very likely linked to dyke rocks associated with the Central Bohemian Pluton.

In fourth place are *serpentinites* (4 specimens, representing 13% of the assemblage). Three of these finds come from the Podkrušnohoří region, specifically from the Chomutov-Teplice Basin. Nearby natural occurrences of high-quality serpentinites are found at Zöblitz, Kuhschnappel and Hohenstein-Ernstthal on the Saxon side of the Ore Mountains, while more distant serpentinite sources lie near Mnichov within the Mariánské Lázně metabasite complex.

Other rocks – *Proterozoic greywacke* (2 specimens, 7%) and probably *Proterozoic/Palaeozoic diabase* (2 specimens, 7%) – are only marginally represented. The origin

Fig. 10. Jevišovice, Znojmo District. A-type hammer-axes (1–8) and a clay model of a hammer-axe, probably of the same type (9). After Medunová-Benešová 1972, redrawn and supplemented by M. Dobeš.

of these rocks can be assumed to lie within the Proterozoic formations of the Barrandian area, i.e., within the region of Central and Western Bohemia.

Other rock types were each recorded in a single specimen. These include *amphibolite* (Lovosice), *biotite gneiss* (Most) and probably *Proterozoic metatuff* (Trmice near Ústí nad Labem). Their provenance can theoretically be inferred from the nearest occurrences of such rocks (for example, for Most, the slopes of the Ore Mountains).

As part of our study, the assemblage of A-type hammer-axes and their preforms from layer B at Jevišovice (Fig. 10) was also re-evaluated petrographically. In terms of raw material, this assemblage differs from the Bohemian finds – as, indeed, does the entire assemblage of Moravian A-type hammer-axes of the Corded Ware Culture compared with those from Bohemia (Přichystal and Šebela 1992; Přichystal 1999). The raw material of the available artefacts was newly analysed microscopically (non-destructively). Within the assemblage, a hypabyssal igneous rock related to the lamprophyre or lamproite group clearly predominates. The nearest occurrences of comparable rocks lie some 18–20 km to the west in a straight line. It is therefore highly probable that the Jevišovice workshop processed local raw material.

BASIC TECHNOLOGICAL OBSERVATIONS ON BOHEMIAN A-TYPE HAMMER-AXES

Comments on the manufacturing technology of A-type hammer-axes are relatively rare in the literature (an exception is Malmer 1962: 607–610, figs 107–109). The works cited above are primarily focused on describing the shape—that is, detailed typological characterisation and its spatial and chronological context. A detailed comparison with non-Bohemian A-type hammer-axes from Corded Ware contexts is therefore currently impossible due to the lack of relevant observations.

A basic idea of the manufacturing sequence of A-type hammer-axes can paradoxically be gained from assemblages at the fringes of the Corded Ware settlement oecumene, namely at the Lüscherz group settlements in western Switzerland (Winiger 1993: 68–78, figs 39–41) and layer B at Jevišovice in Moravia, belonging to the eponymous archaeological culture (Medunová-Benešová 1972: 144–147, 172, Pls 91–93; Peška 2021: 514, fig. 3). The artefacts from the latter site have received detailed attention, including new evaluation of the raw material used for their production (see above) and the revision and supplementation of the relevant drawings (Fig. 10).

Due to the absence of related remains at the settlements (Lüscherz, Jevišovice), it is not possible to determine how the raw material was initially processed at this stage of the production chain. This stage was very likely conditioned by the mechanical properties of the material (for example, in the case of Jizera Mountains-type metabasite, cutting of fractured slabs is documented for the Neolithic; Stolz 2016). Subsequent working involved pecking, by which the rough shape of the preform was prepared for drilling. Traces of pecking are mostly visible even on polished finished products, though often the process remained at this stage only (see, for example, the hammer-axe from the grave at Roztyly, Catalogue item 22). Except for two cases

(Fig. 10:4 and 8), all the studied artefacts from Jevišovice have a rough surface, although these are often clearly unfinished or defective pieces. On some specimens, it is difficult to distinguish whether this represents a roughly worked surface or the result of later corrosion of originally polished material. The latter interpretation is supported by protruding laminae of harder rock components (observed, for example, on Catalogue items 19 and 35, see Fig. 7:2 and 4). Fine traces of surface polishing are almost always oriented perpendicular to the longitudinal axis of the artefact.

For drilling, two possible approaches can be distinguished: "false drilling" and "true drilling" using a solid or hollow drill. The "false drilling" technique – i.e., creating the perforation by pecking through – is different from "true drilling" (Goldhammer *et al*., 2012: 127). In the past, solid and hollow drilling were the subject of debate regarding their respective chronological status (Malmer 1962; Zápotocký 1992). However, in his extensive study of hammer-axes of the Funnel Beaker Culture, M. Zápotocký (1992: 144–148) pointed out that both technologies were used simultaneously for all major hammer-axe types, but to varying degrees depending on geographical distribution. It appears that solid drilling is more characteristic of the northern distribution area of the Funnel Beaker Culture, whereas hollow drilling is more typical of the southern area. This may relate to the preceding tradition of the Stroke-Ornamented Ware Culture (5100/5000–4500/4400 BC), for whose later phase hammer-axes drilled with a hollow drill are typical (Pavlů and Zápotocká 2013: 78–81). Simplified, drilling with a hollow drill can be associated with the Danubian tradition, while drilling with a solid drill reflects the northern tradition – although both techniques overlap.

Looking at unfinished boreholes on hammer-axes from Jevišovice and Lüscherz, it is clear that a hollow drill was used from one side, combined with a cup-shaped countersink from the opposite side to maintain axial stability of the preform during the drilling process. However, the use of a hollow drill is not documented for the earliest hammer-axes of the northern Single Grave Culture and Boat Axe Culture, where the borehole profile suggests drilling with a solid drill from both sides (Malmer 1962: 607–610, 618, Fig. 107; Beran 1990: 34). This situation would thus correspond with regional differences in the preceding period. For the Bohemian specimens, the same method is typical as for the Jevišovice artefacts – drilling with a hollow drill from one side; in no case was a marked central widening of the borehole found that would indicate the use of a solid drill (cf., Figs 12–14 and Malmer 1962: Abb. 107). The hollow drill is also indicated by the borehole profile, which is symmetrical or slightly conically narrowing from one side (V-profile). The traces of drilling are mostly very coarse, occasionally carelessly smoothed, and only rarely carefully finished.

Where the drilling direction could be determined, it was almost exclusively from the upper side of the hammer-axe, just as with pieces from the two cited settlements

(Winiger 1993: Abb. 40:4–5, 10; Medunová-Benešová 1972: Pl. 93:7, 11; here Fig. 10:1–2, 7). A similar drilling direction can be observed on isolated finds of preforms of Bohemian hammer-axes with formal features corresponding to the earlier Corded Ware phase (Fig. 11). Here, it is worth recalling an early observation by M. Buchvaldek, who pointed out significant differences in the method of drilling and the final finishing of the shaft hole. Whereas A-type hammer-axes were drilled from the top and the borehole was left unsmoothed, faceted hammer-axes are characterised by a borehole drilled from both sides (X-profile borehole) which is, however, very carefully polished. Bohemian-type hammer-axes, that is, the local and chronologically youngest type, were again drilled from one side (V-profile borehole), but unlike the first group, from the bottom. However, the drilling traces are not as coarse as on the A-type hammer-axes but much finer and more regular (compare Figs 12–14 with Fig. 9). For the boreholes of faceted hammer-axes, an alternative interpretation is that they may not have been drilled from both sides but from one side and subsequently carefully polished from both ends to create the characteristic X-profile.

In addition to the stone pieces, clay hammer-axes or hammer-axe models – probably toys or cult objects – should also be mentioned. An interesting example with a central rib and a stylised representation of pecking (?) comes from Jevišovice (Fig. 10:9), but similar finds are also documented in Lüscherz (Winiger 1993: 77, fig. 35:5) and in multiple examples from Wattendorf-Motzenstein (Seregély 2008: 62–63, Pl. 6:1–2, 26:3 and others). They probably formed a standard and functionally important part of Corded Ware inventories (and of contemporary and earlier cultures: Zápotocký and Zápotocká 2008: 194–195, fig. 80:1–2).

Some of the analysed hammer-axes show signs of slight asymmetry compared to others. This is most evident at the blade, which was probably resharpened secondarily. This asymmetry is most pronounced on the hammer-axes from Roudnice (Fig. 2:4) and Podlesice (Fig. 4:2). Both are isolated finds, so their repair could have taken place outside the contemporary Corded Ware context. Otherwise, this would indicate their longer use within the Corded Ware Culture. The fact that only a few cases of repair were documented may conversely suggest that the hammer-axes were not used for activities that would have caused significant damage. The secondary use of a fragment of a hammer-axe as a smoothing tool can be observed on one specimen from Jevišovice (see arrow in Fig. 10:4).

DISCUSSION

In this study, we have for the first time comprehensively assessed the Bohemian assemblage of hammer-axes of the Corded Ware Culture in terms of the raw materials

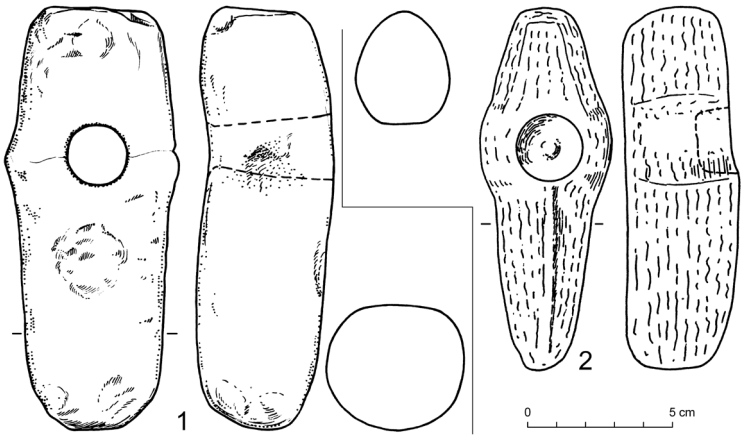

Fig. 11. Presumed preforms of A-type hammer-axes from Bohemia. 1 – Zákolany; 2 – Prague–Libeň. Drawing: L. Raslová (1), see Buchvaldek *et al*., 1997; no. 2 after Buchvaldek *et al*., 1991.

used, focusing on the locally earliest phase of this culture, the so-called A-horizon. In Bohemia, the raw material composition of these artefacts in the Late Neolithic (Eneolithic/Chalcolithic) is of particular significance, as this region contains an important source of raw material for the production of polished tools, the Jizera Mountains-type metabasite. This resource was exploited as early as the Linear Pottery Culture (LBK; 5500/5400–5100/5000 BC) and represents the principal source of this raw material during the LBK period for the whole of Central Europe (Burgert *et al*., 2024). This source is located outside the traditional prehistoric oecumene, and knowledge of it – or rather, the continuity or discontinuity in its exploitation – may indirectly indicate the continuity or discontinuity of settlement and distribution networks.

From the perspective of raw material use, we consider it a fundamental finding that Jizera Mountains-type metabasite accounts for the highest proportion of the hammer-axes analysed, making up a quarter of the artefacts. Another important observation is that the other identified raw materials also most likely originate within the region of Bohemia.

As noted above, the Corded Ware Culture is understood within Czech prehistoric research as an intrusive element whose origins can be traced archaeogenetically to the area of present-day western Ukraine, or further east. According to DNA analyses of material from Czech Corded Ware cemeteries, this origin (steppe ancestry) is detectable in up to 100% of men and 80% of women (Papac *et al*., 2021). It seems that the remaining 20% of the original population, which we infer from the archaeogenetic record, played an important role in maintaining knowledge of the Jizera Mountains metabasite sources.

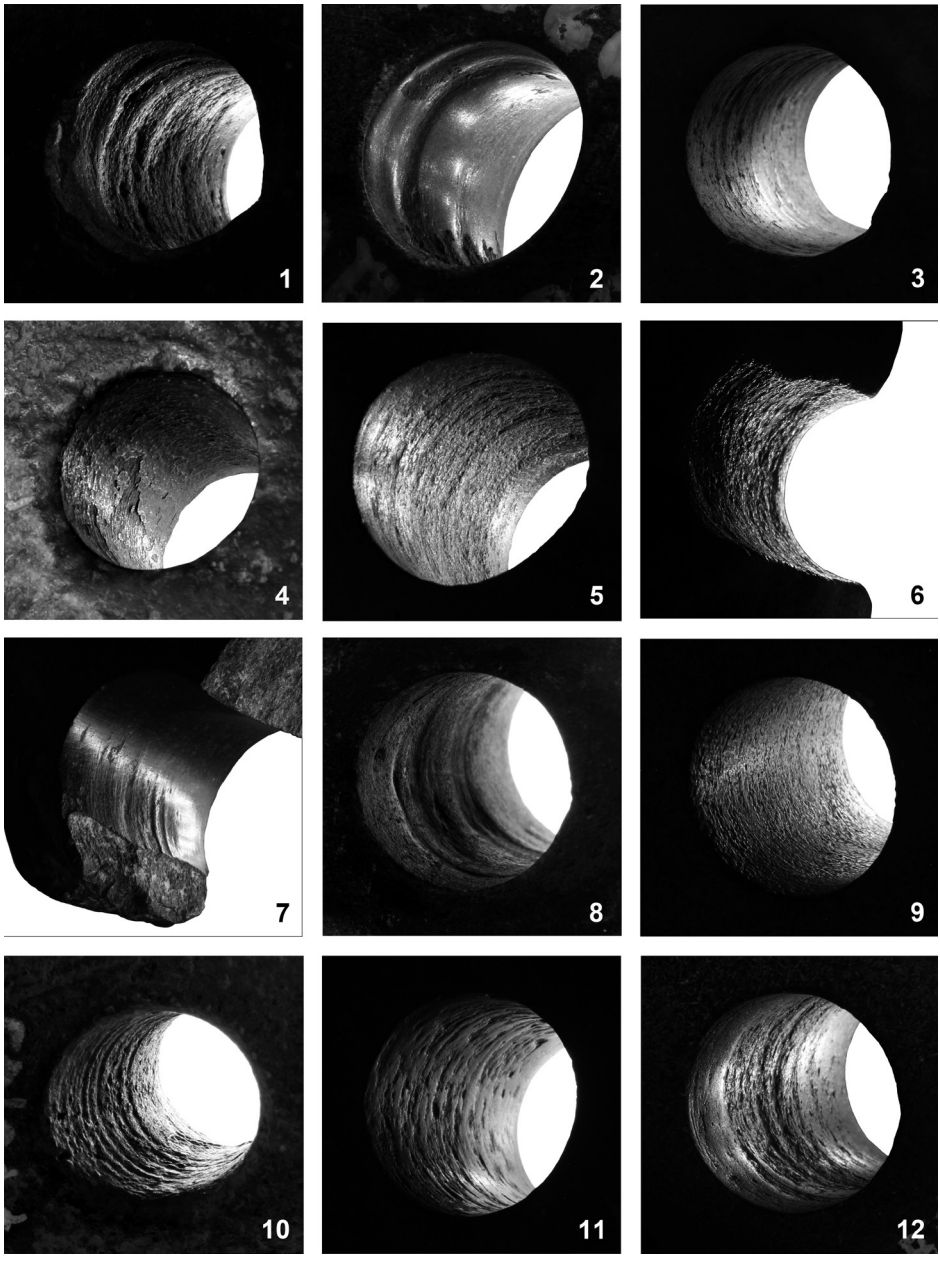

Fig. 12. Detail of the boreholes of A-type hammer-axes of the Corded Ware Culture from Bohemia. The numbering of the images corresponds to the numbering of sites in the catalogue. Photo: I. Hrušková.

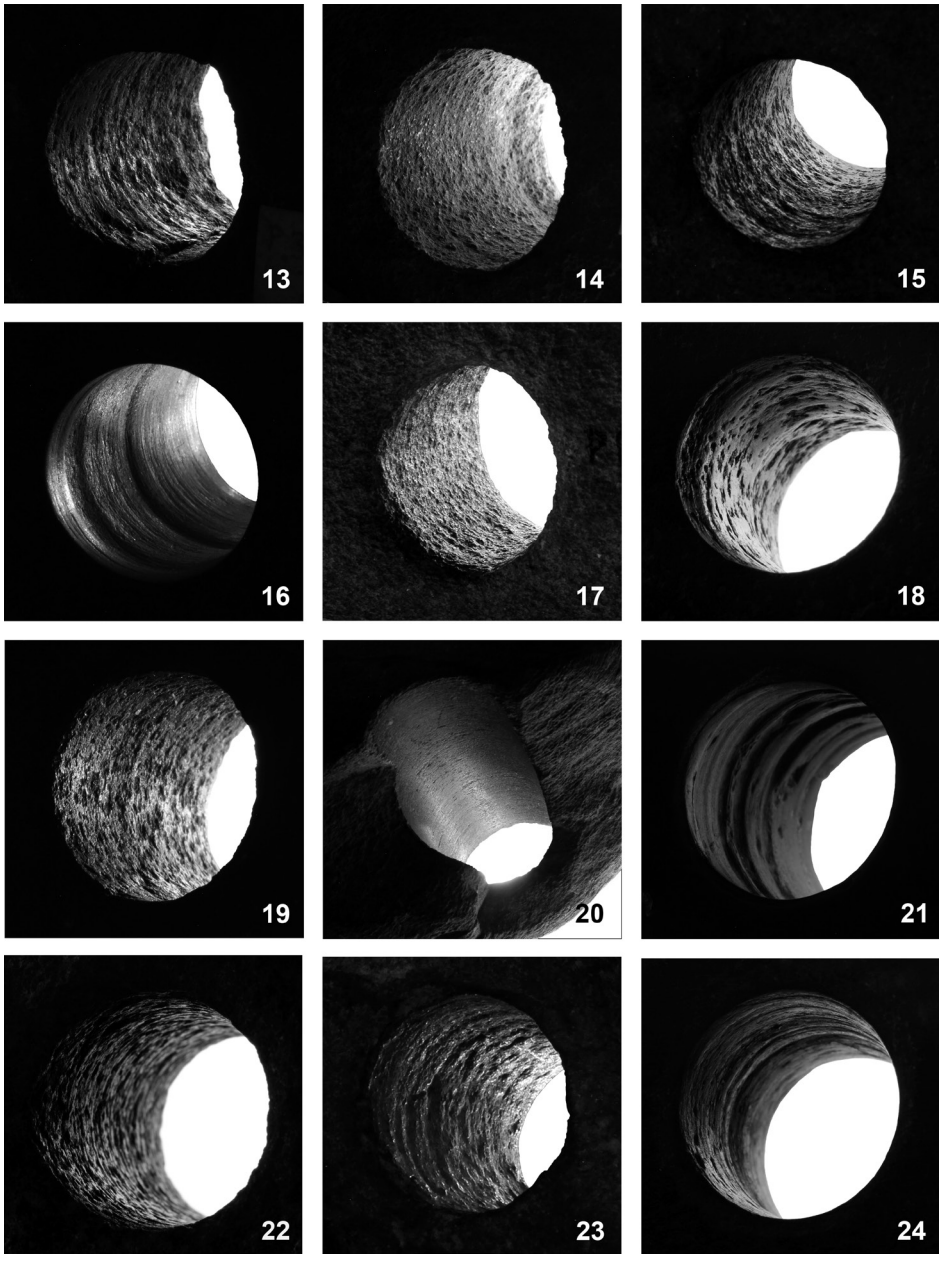

Fig. 13. Detail of the boreholes of A-type hammer-axes of the Corded Ware Culture from Bohemia. The numbering of the images corresponds to the numbering of sites in the catalogue. Photo: I. Hrušková.

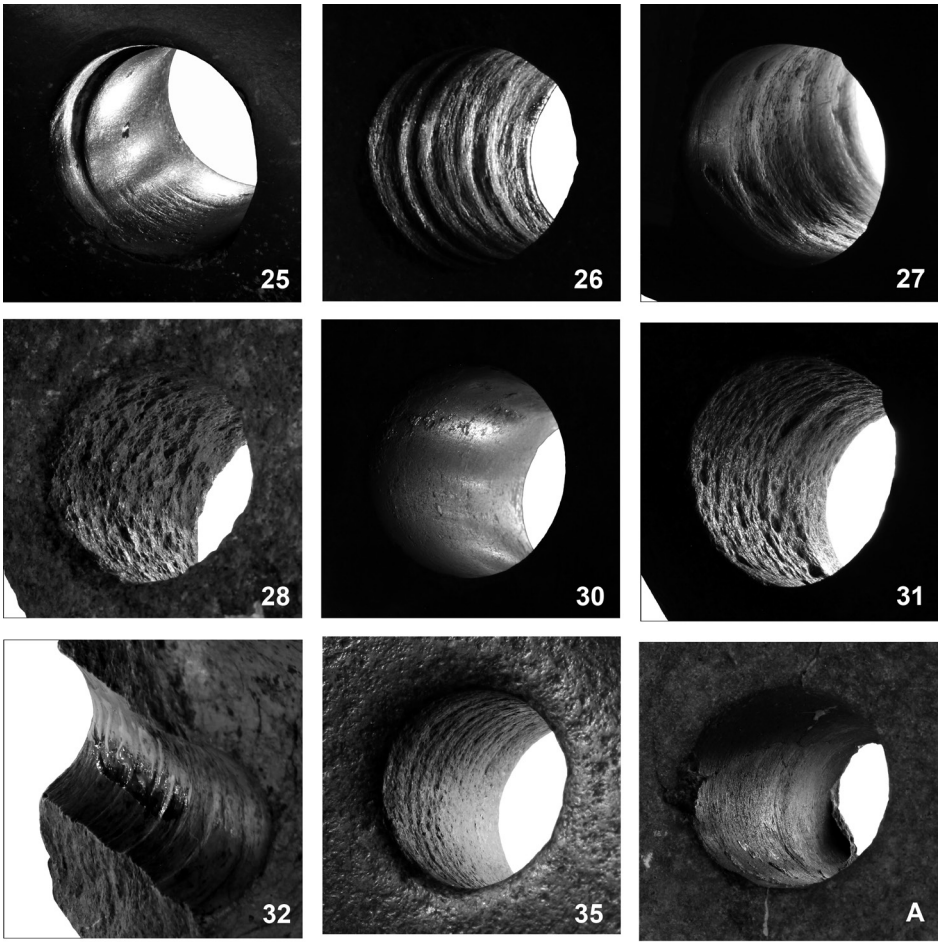

Fig. 14. Detail of the boreholes of A-type hammer-axes of the Corded Ware Culture from Bohemia. The numbering of the images corresponds to the numbering of sites in the catalogue. The final image (A) shows the borehole of a presumed preform from the Zákolany site (Fig. 11:1). Photo: I. Hrušková.

Another important step for future research is the identification and quantification of this raw material in the period following the decline of the Stroke-Ornamented Pottery Culture, when it is still represented in Bohemian assemblages by 85–90% (Burgert *et al.*, 2023). This concerns in particular the Funnel Beaker Culture and subsequent cultures of the Baden circle. Finally, the ground tools of the Early Bronze Age – specifically the Únětice Culture – remains virtually unexplored from this perspective.

An important aspect is the manufacturing technology of the hammer-axes themselves, specifically the method used to drill their shaft holes. As described above, the Bohemian A-type hammer-axes are characterised by a borehole drilled from the top using a hollow drill, which clearly differs from the boreholes of the two typologically later hammer-axe types of the Corded Ware Culture. This indicates distinct manufacturing traditions linked to specific groups of artefacts, which in turn may reflect different groups of producers. In the context of existing ancient DNA analyses, it is noteworthy that the Bohemian Corded Ware (and not only there) is characterised by a sequence of different male kinship lines (Y-chromosome DNA haplogroups), which supports the idea that the migration of Corded Ware populations was a process consisting of several waves during the first half of the 3rd millennium BC (see Papac *et al.*, 2021; cf., Włodarczak 2021). The seemingly simple study of drilling techniques and their comparison in chronological and geographical terms could therefore contribute to the discussion of the population and cultural dynamics of this period.

CONCLUSION

The analysis of the earliest hammer-axes of the Corded Ware Culture from Bohemia has revealed several important findings. Of the total of 41 recorded pieces that meet the parameters of the so-called A-type hammer-axes, 32 were available for detailed study. Of these, 25% were made from Jizera Mountains-type metabasite, 22% from Tertiary basaltic rocks (basaltoids), and 19% from amphibole diorite or porphyritic microdiorite. Other raw materials are represented by only four or fewer pieces: serpentinites (13%), Proterozoic greywacke and Proterozoic/Palaeozoic diabase (both 7%), as well as single finds of amphibolite, biotite gneiss, and Proterozoic metatuff.

The origins of these raw materials can be sought within the Bohemian Massif, although more precise localisation of the sources is mostly not possible. The exception is the most commonly used material, the Jizera Mountains-type metabasite. This raw material comes from quarrying areas around Jistebsko or Velké Hamry in north-eastern Bohemia and represents the principal source for the production of ground tools in the Linear Pottery Culture in Central Europe (Burgert *et al.*, 2024). In Bohemia, this material continued to be predominantly exploited during the Stroke-Ornamented Ware Culture. For the subsequent period (the Funnel Beaker Culture) no data are yet available. However, as this study has demonstrated, the continuity of metabasite exploitation in the Jizera Mountains extends into the Corded Ware Culture.

From the perspective of manufacturing technology, we have demonstrated that the Bohemian A-type hammer-axes of the Corded Ware Culture were consistently

drilled from the upper side using a hollow drill. This clearly distinguishes this group from other typological categories within the Corded Ware Culture (faceted hammer-axes and Bohemian-type hammer-axes). Although the raw materials used are of regional origin, no workshop sites from this period have so far been identified in Bohemia.

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REFERENCES

Alexandrov, S. 2021. Fourth/third millennium BC barrow graves in North-East Bulgaria (120 years of investigations). In V. Heyd, G. Kulcsár and B. Preda-Bălănică (eds), *Yamnaja interactions. Proceedings of the International Workshop held in Helsinki, 25–26 April 2019*, 271–314. Budapest. Archaeolingua 44.

Allentoft, M. E., Sikora, M., Sjögren, K.-G., Rasmussen, S., Rasmussen, M., Stenderup, J. *et al*. 2015. Population genomics of Bronze Age Eurasia. *Nature* 522/7555: 167–172. DOI: 10.1038/nature14507.

Anonymus, 1941. Neue Funde aus dem Sudetengau bis zum 31. XII. 1940. *Sudeta Neue Folge* 1 (1939/40): 104–117.

Beran, J. 1990. *Funde der Einzelgrabkultur im Bezirk Magdeburg*. Halle (Saale). Neolithische Studien IV. Wissenschaftliche Beiträge der Martin-Luther-Universität Halle-Wittenberg 1990/6 (L 21).

Borkovskyj, I. 1933. Problémy středoevropské šňůrové kultury. *Památky archaeologické* 39: 3–14.

Borkovskyj, I. 1934. Origin of the culture with Corded Ware in Central Europe. In *Proceedings of the First International Congress of Prehistoric and Protohistoric Sciences, London, August 1–6, 1932*, 211–213. London.

Brami, M. 2021. The mythology of Maria Gimbutas. In V. Heyd, G. Kulcsár and B. Preda-Bălănică (eds), *Yamnaja interactions. Proceedings of the International Workshop held in Helsinki, 25–26 April 2019*, 125–136. Budapest.

Brandt, K. H. 1967. *Studien über steinerne Äxte und Beile der jüngeren Steinzeit und der Stein-Kupferzeit Nordwestdeutschlands*. Hildesheim.

Buchvaldek, M. 1957. Starší šňůrová keramika v Čechách. *Archeologické rozhledy* 9: 362–401.

Buchvaldek, M. 1964. A-sekeromlat ze Lbosína, okr. Benešov u Prahy. *Sborník vlastivědných prací z Podblanicka* 5: 107–110.

Buchvaldek, M. 1967. *Die Schnurkeramik in Böhmen*. *Acta Universitatis Carolinae*. Praha. Philosophica et historica monographia 19.

Buchvaldek, M. 1971. Bemerkungen zur neuen Schnurkeramikforschung. *Památky archeologické* 62: 551–563.

Buchvaldek, M. 1986a. *Kultura se šňůrovou keramikou ve střední Evropě I. Skupiny mezi Harcem a Bílými Karpaty*. Praha. Praehistorica 12.

Buchvaldek, M. 1986b. Zum gemeineuropäischen Horizont der Schnurkeramik. *Prähistorische Zeitschrift* 61: 129–151.

Buchvaldek, M. 1992. Šňůrová keramika na Plzeňsku. *Sborník Západočeského muzea v Plzni, řada Historie* 8: 17–20.

Buchvaldek, M. 1997. Bemerkungen zum A-Horizont in Mitteleuropa. In P. Siemen (ed.), *Early Corded Ware Culture. The A-horizon – Fiction or Fact? International Symposium in Jutland 2nd–7th May 1994*, 43–51. Esbjerg.

Buchvaldek, M. 1998. Kultura se šňůrovou keramikou ve střední Evropě II. Skupiny mezi horním Rýnem, Mohanem a středním Dunajem. *Praehistorica* 23*:* 17–60.

Buchvaldek, M. 2002. Poznámky k A-sekeromlatům v Čechách, na Moravě a v Bavorsku. In P. Čech and Z. Smrž (eds), *Sborník Drahomíru Kouteckému. Příspěvky k pravěku a rané době dějinné v severozápadních Čechách* 9, 61–65. Most.

Buchvaldek, M., Havel, J. and Kovářík, J. 1991. Katalog šňůrové keramiky v Čechách VI. *Praehistorica* 17: 151–205.

Buchvaldek, M., Moucha, V., Popelka, M. and Vojtěchovská, I. 1997. Katalogy šňůrové keramiky v Čechách XI–XIV. Kladensko, Slánsko, Kralupsko a Praha-západ. *Praehistorica* 22: 113–255.

Buchvaldek, M. and Velímský, T. 1987. Katalog šňůrové keramiky v Čechách II. Povodí Lomského potoka. *Praehistorica* 13: 63–121.

Budinský, P. 1985. Archeologické nálezy z Litoměřicka a z neznámých nalezišť ve sbírce teplického muzea. *Archeologický výzkum v severních Čechách*. Teplice.

Burgert, P., Přichystal, A. and Gadas, P. 2023. Raw materials for Neolithic ground tools from the extraction fields at Bílý Kámen Hill, Central Bohemia. *Archeologické rozhledy* 75: 253–277. https://doi.org/10.35686/AR.2023.18

Burgert, P., Šída, P., Trampota, F., Kachlík, V. and Přichystal, A. 2024. Prehistoric quarrying in the Jizerské hory mountains. *Archeologia Polski* 69: 43–68. https://doi.org/10.23858/APol69.2024.003

Cvrková, M., Koutecký, D. and Brus, Z. 1991. Pohřebiště se šňůrovou keramikou v Ústí n. L. – Trmicích a Stadicích. Doplněk ke Katalogu šňůrové keramiky v Čechách III. *Praehistorica* 17: 9–38.

Dani, J. and Kulcsár, G. 2021. Yamnaya interactions in the Carpathian Basin. In V. Heyd, G. Kulcsár and B. Preda-Bălănică (eds), *Yamnaja interactions. Proceedings of the International Workshop held in Helsinki, 25–26 April 2019*, 329–359. Budapest. Archaeolingua 44.

Dobeš, M. 1993. Katalog šňůrové keramiky v Čechách VII. Chomutovsko. *Praehistorica* 20: 175–196.

Dobeš, M. 1997. Katalog šňůrové keramiky v Čechách X. Podbořansko. *Praehistorica* 22: 75–112.

Dobeš, M. and Buchvaldek, M. 1993. Katalog šňůrové keramiky v Čechách VIII. Mostecko. *Praehistorica* 20: 197–258.

Dobeš, M., Pecinovská, M. and Ernée, M. 2021. On the earliest Corded Ware in Bohemia. In V. Heyd, G. Kulcsár and B. Preda-Bălănică (eds), *Yamnaya interactions. Proceedings of the International Workshop held in Helsinki, 25–26 April 2019*, 487–511. Budapest. The Yamnaya Impact in Prehistoric Europe 2.

Dobeš, M., Pecinovská, M., Papac, L. and Ernée, M. 2023. Corded Ware graves from Obříství, Czech Republic. In A. Lahelma, M. Lavento, K. Mannermaa, M. Ahola, E. Holmqvist and K. Nordqvist (eds), *Moving northward. Professor Volker Heyd's Festschrift as he turns 60*, 97–114. Helsinki. Monographs of the Archaeological Society of Finland 11.

Filip, J. 1947. *Dějinné počátky Českého ráje*. Praha.

Furholt, M. 2014. Upending a "Totality": Re-evaluating Corded Ware Variability in Late Neolithic Europe. *Proceedings of the Prehistoric Society* 80: 67–86.

Glob, P. V. 1945. *Studier over den jyske Enkeltgravskultur*. København. Aarbøger for nordisk Oldkyndighed og Historie 1944.

Goldhammer, J., Hartz, S. and Paulsen, H. 2012. Picken, Schleifen, Bohren – Beispiele mesolithischer und frühneolithischer Felsgesteinbearbeitungstechniken im Norden. In A. Stobbe and U. Tegtmeier (eds), *Verzweigungen. Eine Würdigung für A.J. Kalis und J. Meurers-Balke*, 125–137. Bonn. Frankfurter Archäologische Schriften 18.

Gogăltan, F. 2021. Transylvania. Within or outside of the Yamnaya World? In V. Heyd, G. Kulcsár and B. Preda-Bălănică (eds), *Yamnaja interactions. Proceedings of the International Workshop held in Helsinki, 25–26 April 2019*, 243–270. Budapest. Archaeolingua 44.

Götze, A. 1891. *Die Gefässformen und Ornamente der neolithischen schnurverzierten Keramik im Flussgebiete der Saale: Inaugural-Dissertation der Philosophischen Fakultät zu Jena zur Erlangung der Doktorwürde*. Jena.

Haak, W., Lazaridis, I., Patterson, N., Rohland, N., Mallick, S., Llamas, B. *et al*. 2015. Massive migration from the steppe is a source for Indo-European languages in Europe. *Nature* 522/7555: 207–211. DOI: 10.1038/nature14317

Hafner, A. and Suter, P. J. 2003. *Das Neolithikum in der Schweiz*. www.jungsteinSITE.de, accessed November 27, 2003.

Hell, M. 1943. Zwei Tonmodel für Schaftlochäxte aus Kupfer vom Rainberg in Salzburg und der Beginn der alpinen Kupfergewinnung. *Wiener Prähistorische Zeitschrift* 30: 55–66.

Heyd, V. 2016. Das Zeitalter der Ideologien: Migration, Interaktion, und Expansion im prähistorischen Europa des 4. und 3. Jahrtausends v. Chr. In M. Furholt, R. Großmann and M. Szmyt (eds), *Transitional Landscapes? The 3rd Millennium BC in Europe. Proceedings of the International Workshop "Socio-Environmental Dynamics over the last 12,000 Years. The Creation of Landscapes III (15–18 April 2013)" in Kiel*, 53–84. Bonn. Universitätsforschungen zur prähistorischen Archäologie 292.

Heyd, V., Kulcsár, G. and Preda-Bălănică, B. (eds). 2021. *Yamnaja interactions. Proceedings of the International Workshop held in Helsinki, 25–26 April 2019*. Budapest.

Holodňák, P. and Holodňáková, R. 2002. Superpozice hrobu KŠK s hroby kultury únětické z pískovny v Roztylech, okr. Chomutov – eneolitická mohyla s dodatečnými pohřby starší doby bronzové. In P. Čech and Z. Smrž (eds), *Sborník Drahomíru Kouteckému. Příspěvky k pravěku a rané době dějinné v severozápadních Čechách* 9, 135–140. Most.

Hübner, E. 2005. *Jungneolithische Gräber auf der Jütischen Halbinsel. Typologische und chronologische Studien zur Einzelgrabkultur*. København. Nordiske Fortidsminder Serie B 24:1.

Kalferst, J. and Prostředník, J. 1993. Nálezy kultury se šňůrovou keramikou ve východních Čechách. *Pojizerský sborník* 1: 16–47.

Kerig, T. 2010. Ein Statuenmenhir mit Darstellung einer Axt vom Eschollbrückener Typ? Zu einem enigmatischen Steindenkmal aus Gelnhausen-Meerholz (Mainz-Kinzig-Kreis). *Prähistorische Zeitschrift* 85: 59–78.

Klimscha, F. 2016. Axes and Allies: Long-range Contacts in Northern Central Europe during the 4th and 3rd Millennia BC as exemplified by Stone and Metal Artefacts. In M. Furholt, R. Großmann and M. Szmyt (eds), *Transitional Landscapes? The 3rd Millennium BC in Europe. Proceedings of the International Workshop "Socio-Environmental Dynamics over the last 12,000 Years. The Creation of Landscapes III (15.–18. April 2013)" in Kiel*, 85–100. Bonn. Universitätsforschungen zur prähistorischen Archäologie 292.

Krzak, Z. 1961. *Materiały do znajomości kultury złockiej*. Wrocław–Warszawa–Kraków.

Kurzyk, K. 2011. Pozostałości kurhanu starosznurowego w Żyglądzie, gm. Papowo Biskupie, stanowisko 26 (ziemia chełmińska). In H. Kowalewska-Marszałek and P. Włodarczak (eds), *Kurhany i obrządek pogrzebowy w IV–II tysiącleciu p.n.e.*, 459–466. Kraków–Warszawa.

Malmer, M. P. 1962. *Jungneolithische Studien*. Lund: C.W.K. Gleerup. Acta Archaeologica Lundensia, Series in 8°, Nr. 2.

Maran, J. 2008. Zur Zeitstellung und Deutung der Kupferäxte vom Typ Eschollbrücken. In F. Falkenstein, S. Schade-Lindig and A. Zeeb-Lanz (eds), *Kumpf, Kalotte, Pfeilschaftglätter. Zwei Leben für die Archäologie. Gedenkschrift für Annemarie Häußer und Helmut Spatz*, 173–188. Rahden/Westf. Internationale Archäologie – Studia honoraria 27.

Medunová-Benešová, A. 1972. *Jevišovice – Starý Zámek. Schicht B – Katalog der Funde*. Brno. Fontes Archaeologiae Moravicae, tomus VI.

Metlička, M., Řezáč, M. and Turek, J. 2007. Nálezy z období závěru eneolitu v jihozápadních Čechách. *Archeologické výzkumy v jižních Čechách* 20: 109–116.

Neustupný, E. 2013. The Corded Ware Culture. In E. Neustupný (ed.), *The prehistory of Bohemia 3. The Eneolithic*, 40–62. Praha.

Pacák, O. 1957. Čedičové vyvřeliny na území speciální mapy l. Jičín č. 3855. *Sborník Ústředního ústavu geologického* XXIV(2): 69–134.

Papac, L., Ernée, M., Dobeš, M., Langová, M., Rohrlach, A. B., Aron, F. *et al*. 2021. Dynamic changes in genomic and social structures in third millennium BCE central Europe. *Science Advances* 7/35 (25 Aug 2021): 1–17. DOI: 10.1126/sciadv.abi6941

Pavelková, J. 1991. Kostrové pozůstatky hrobů se šňůrovou keramikou ve Stadicích a Trmicích. *Praehistorica* 17: 39–42.

Pavlů, I. and Zápotocká, M. 2013. *The Prehistory of Bohemia 2. The Neolithic*. Praha.

Peška, J. 2013. *Morava na konci eneolitu*. Olomouc.

Peška, J. 2021. The early Corded Ware horizon in the Czech Republic – part Moravia. In V. Heyd, G. Kulcsár and B. Preda-Bălănică (eds), *Yamnaja interactions. Proceedings of the International Workshop held in Helsinki, 25–26 April 2019*, 513–541. Budapest.

Přichystal, A. 1999. The petrographic investigation of stone artefacts of the Corded Ware culture in Moravia and the adjacent part of Silesia. In L. Šebela, *The Corded Ware culture in Moravia and in the adjacent part of Silesia (catalogue)*, 213–223. Brno. Fontes archaeologiae Moravicae.

Přichystal, A. and Šebela, L. 1992. Lithic raw materials used by the people with Corded Ware in Moravia and the adjoining part of Upper Silesia. *Scripta Facultatis Scientiarum Naturalium Universitatis Masarykianae – Geology* 22: 29–39.

Prostředník, J. and Šída, P. 2004. Lužická skupina kultury se šňůrovou keramikou v Pojizeří. In M. Lutovský (ed.), *Otázky neolitu a eneolitu 2003. Sborník referátů z 22. pracovního setkání badatelů zaměřených na výzkum neolitu a eneolitu. Český Brod – Kounice 23.–26. září 2003*, 307–354. Praha.

Schultrich, S. 2022. Spätneolithische Streitäxte Nordwestdeutschlands und ihr pan-europäischer Kontext. *Die Kunde Neue Folge* 73: 41–90.

Šebela, L. 1993. Sekeromlat typu A z Jičíněvsi, okr. Jičín. *Přehled výzkumů* 36 (1991): 126–127.

Šebela, L. 1999. *The Corded Ware culture in Moravia and in the adjacent part of Silesia (catalogue)*. Brno.

Seregély, T. 2008. *Endneolithische Siedlungsstrukturen in Oberfranken I. Wattendorf-Motzenstein: eine schnurkeramische Siedlung auf der Nördlichen Frankenalb. Studien zum dritten vorchristlichen Jahrtausend in Nordostbayern*. Bonn. Universitätsforschungen zur prähistorischen Archäologie 154.

Sklenář, K. 1999. *Hromové klíny a hrnce trpaslíků. Z pokladnice české folklórní archeologie*. Praha.

Strahm, Ch. 1971. *Die Gliederung der schnurkeramischen Kultur in der Schweiz*. Bern.

Stocký, A. 1929. *La Bohême préhistorique I. L'âge de pierre*. Praha.

Stolz, D. 2016. Doklady řezání na sídlišti kultury s lineární keramikou v Žebráku, okr. Beroun. *Archeologie ve středních Čechách* 20: 103–110.

Struve, K. W. 1955. *Die Einzelgrabkultur in Schleswig-Holstein und ihre kontinentalen Beziehungen*. Neumünster.

Sulimirski, T. 1933. Die schnurkeramischen Kulturen und das indoeuropäische Problem. In O. Hałecki (ed.), *La Pologne au VII[e] Congrès International des Sciences Historiques, Varsovie 1933*. Vol. 1, 287–308. Warsaw.

von Weinzierl, R. R. 1894. Neolithische Gräber einer Nekropole aus verschiedenen Epochen bei Lobositz. *Mittheilungen der anthropologischen Gesellschaft in Wien* 24: 144–152.

Winiger, J. 1993. Dendrodatierte Schnurkeramik der Schweiz. *Praehistorica* 20: 9–118.

Włodarczak, P. 2006. *Kultura ceramiki sznurowej na Wyżynie Małopolskiej*. Kraków.

Włodarczak, P. 2019. Grób 15 z Wilczyc na tle środkowoeuropejskim: odmienność i reguła w rytuale pogrzebowym małopolskiej kultury ceramiki sznurowej. In P. Włodarczak (ed.), *Wilczyce, stanowisko 10. Norma i precedens w rytuale pogrzebowym małopolskiej kultury ceramiki sznurowej*, 169–209. Kraków – Niepołomice – Pękowice.

Włodarczak, P. 2021. Eastern impulses in cultural and demographic change during the end of the south-eastern Polish Eneolithic. In V. Heyd, G. Kulcsár and B. Preda-Bălănică (eds), *Yamnaya interactions. Proceedings of the International Workshop held in Helsinki, 25–26 April 2019*, 435–461. Budapest. The Yamnaya Impact in Prehistoric Europe 2.

Zápotocký, M. 1964. Mladoeneolitické a starobronzové nálezy z Třebenicka a okolí ve sbírkách Paříkova muzea v Třebenicích. *Sborník Severočeského muzea, řada historická* 4: 289–329.

Zápotocký, M. 1992. *Streitäxte des mitteleuropäischen Äneolithikums*. Weinheim: VCH, Acta Humaniora. Quellen und Forschungen zur prähistorischen und provinzialrömischen Archäologie Band 6.

Zápotocký, M. 2002. Eneolitická broušená industrie a osídlení v regionu Čáslav – Kutná Hora. In I. Pavlů (ed.), *Bylany, Varia* 2, 159–228. Praha.

Zápotocký, M. and Zápotocká, M. 2008. *Kutná Hora - Denemark. Hradiště řivnáčské kultury (ca 3000–2800 př. Kr.)*. Praha.