‘Scrap metal hoards’ of the Later Urnfield Period in the Carpathian Basin: a case study on a hoard from Dezmir, Romania

Oliver Dietrich [1], Laura Dietrich [2], and Botond Rezi [3]
o.dietrich@fu-berlin.de
1 Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt, Halle (Saale), DE
2 Österreichisches Archäologisches Institut, Vienna, AT; laura.dietrich@oeaw.ac.at
3 Muzeul Județean Mureș, Târgu Mureș, RO; reziboti@yahoo.com

ABSTRACT – *Large ‘scrap’ metal hoards have so far been seen as a characteristic of the older Urnfield Period in the eastern Carpathian Basin. Using the hoard from Dezmir, Romania, as a starting point, this paper describes a group of hoards with chronologically and spatially diverse components. These hoards were hidden during the younger Urnfield Period and represent smaller variants of the older, large ‘scrap’ hoards. Earlier research has used them to define a chronological horizon (‘Phase 3-Jupalnic-Turia-Ha A2’). Based on archaeological observations, spatial data and a correspondence analysis, we argue that they represent a specific hoarding practice instead, characteristic of Phase 4,* i.e. *the younger Urnfield Period.*

KEY WORDS – *Carpathian Basin; Bronze Age; hoards; chronology*

Depoji ‘kovinskih odpadkov’ iz pozne kulture žarnih grobišč v Karpatski kotlini: študija depoja iz Dezmirja v Romuniji

IZVLEČEK – *Doslej je veljalo, da so veliki depoji ‘kovinskih odpadkov’ značilnost starejše kulture žarnih grobišč v Karpatski kotlini. S pomočjo depoja v Dezmirju v Romuniji predstavljamo skupino kronološko in prostorsko različnih depojev. Depoji so bili skriti v mlajši kulturi žarnih grobišč in predstavljajo manjše različice starejših depojev ‘odpadkov’. Z njimi so v preteklih raziskavah opredelili kronološki horizont ‘faza 3-Jupalnic-Turia-Ha A2’. Na osnovi arheoloških opazovanj, prostorskih podatkov in korespondenčnih analiz trdimo, da predstavljajo depojsko prakso, značilno za 4. fazo, torej mlajše obdobje kulture žarnih grobišč.*

KLJUČNE BESEDE – *Karpatska kotlina; bronasta doba; depoji; kronologija*

The hoard

Dezmir (com. Apahida, jud. Cluj) is situated approx. 2km ESE of Cluj-Napoca at the edge of a valley formed by the Zăpodie, a small tributary of the Someşul Mic. The repertory of archaeological finds from the district of Cluj lists single finds of stone axes, an Eneolithic settlement, another one of the Coţofeni Culture, Scythian and Celtic graves as well as Roman buildings; for the Bronze Age, a single find of pottery and a settlement in a plot called ‘Tăuşor’ are mentioned (*Crişan* et al. *1992.183–186*). The latter saw some small-scale excavation in the early 1960s (*Popescu 1964.556–557, Nr. 44*). What is entirely missing in this repertory though is information on a hoard (Fig. 1) that was discovered at roughly the same time.

The hoard was first published by Mircea Rusu in the frame of the ‘Inventaria Archaeologica’ series

DOI: 10.4312/dp.49.17

(*Rusu 1977a*). There he mentions that the hoard was accidentally discovered on 29th August 1964, while deep ploughing a plot called 'Bocomaia' some 400m to the west of the Someş depression. A short time after the discovery, Rusu and Viorica Pintea conducted excavations at the findspot, leading to the discovery of several more bronze artefacts and 'Hallstatt pottery'.[1] About 50m to the west of the hoard, a pit house dating to the same period was found. Whether the hoard was originally placed within a pottery vessel remains unclear, as the publication does not indicate the exact findspot of the illustrated pottery fragments. Rusu further mentions that the hoard was discovered next to the wall of a Roman villa rustica, which could indicate that the original context was disturbed to some degree. The finds are kept today in the Muzeul Naţional de Istorie a Transilvaniei (MNIT) Cluj-Napoca.

Given the excavations at the findspot, it seems probable that all preserved items of the find were recovered. The hoard was hidden next to or in a (small?) lowland settlement, within a settlement cluster that also included larger sites in dominant positions. Dezmir-Tăuşor, excavated in 1963, is located on a promontory (*Popescu 1964.556–557, Nr. 44*). A closer examination of this Bronze Age microregional system of different settlement types and hoards is unfortunately not possible at the moment. The finds from Dezmir-Tăuşor have never been published, and the plot 'Bocomaia' cannot be exactly located based on the information provided by Rusu. The Someşul Mic flows to the north of Dezmir. Following Rusus's description ("*400m to the west of the Someş depression*"), this would mean that the findspot was located to the northwest of the village, as the neighbouring village Sânnicoară is located immediately to the northeast. However, within this area no plot of land called 'Bocomaia' could be identified.



Fig. 1. The hoard from Dezmir (photo B. Rezi).

The bronze finds

Thirty-six bronzes and one lead artefact could be documented at the MNIT Cluj-Napoca (Fig. 1).[2] All objects underwent conservation procedures and the ones made of bronze now have a brownish to olive-green surface with patches/remains of light blue patina.

1. Beaked socketed axe with a nearly symmetrical mouth and a loop placed slightly below the rim. Both broadsides are uneven, likely due to gas bubbles trapped in the mould during casting; one has a hole caused by a casting fault. Excess metal was left in the area of the loop and casting seams are visible on the lateral sides. Traces of hammering are visible on the blade; the cutting edge is blunt and has small notches. Registration number MNIT Cluj-Napoca P59.547. Length (l.) 12.5cm, depth of socket (d/s.) 8.7cm, width of blade (w/b.) 5.25cm, weight (w.) 322g (Fig. 2.1).

2. Beaked socketed axe with a loop. Traces of the casting jet are visible on the upper part of the loop. Casting seams are detectable on the upper part of the lateral sides, in the blade area they were levelled through hammering. The cutting edge is blunt and has large nicks. The surface has adhesions of earth. Registration number MNIT Cluj-Napoca P 59.548. L. 11.6cm, d/s. 8.3cm, w/b. 4.6cm, w. 256g (Fig. 2.2).

3. Socketed axe with a sharp-edged mouth, loop and curved body. Below the rim there are two horizontal parallel ribs; one broadside has a casting fault (a large hole), the other one has a hole below the rim. There is unremoved excess metal on the loop, traces of ground casting seams

1 In Romanian terminology, meaning Ha A-B.
2 The artefacts were documented by Botond Rezi.

are detectable on the upper part of the lateral sides, while below they have been removed through hammering and use-wear. The cutting edge has notches and the corners have broken away. The surface is uneven due to gas bubbles trapped in the mould during casting. Registration number MNIT Cluj-Napoca P 59.549. L. 9.4cm, d/s. 5.2cm, w/b. 4.4cm, w. 116g (Fig. 2.3).

4. Beaked socketed axe with a loop and curved body; the trapezoid blade is separated from the body by a low ridge. The raw cast has not been overhauled, the two halves of the moulds have accidentally moved slightly in the vertical direction during casting. One broadside is uneven due to gas bubbles trapped in the mould and has a casting defect (an irregular hole). The casting jet was removed, the casting seams are clearly visible. Registration number MNIT Cluj-Napoca P 59.550. L. 13.2cm, d/s. 7.5cm, w/b. 4.8cm, w. 261g (Fig. 2.4).

5. Beaked socketed axe with a curved body, the loop mostly broken off. The broadsides, particularly in the blade area, have numerous casting defects. The casting jet was carefully removed from the loop, the blade area was intensively hammered, leading to the formation of a ridge between blade and body. The cutting edge is sharp and has small notches. Registration number MNIT Cluj-Napoca P. 59.551. L. 12cm, d/s. 7.2cm, w/b. 4.5cm, w. 230g (Fig. 3.5).



Fig. 2. Socketed axes from Dezmir (photo B. Rezi).

6. Beaked socketed axe with a loop and curved body; a large portion of the socket area, including the beak, has broken off. The casting jet has been removed from the loop and the contact point hammered. The casting seams are visible on the upper two-thirds of the narrow sides; one broadside is uneven due to gas bubbles trapped in the mould. The cutting edge is uneven, with small notches. Registration number MNIT Cluj-Napoca P 59.552. L. 12.8cm, d/s. 8.5cm, w/b. 4.8cm, w. 262g (Fig. 3.6)

7. Beaked socketed axe with a loop and pronouncedly curved body. The contact point of the casting jet is visible on the top of the loop, the casting seams are visible on the upper two-thirds of the narrow sides; below they have been removed. A large part of the cutting edge is missing in the centre. Registration number MNIT Cluj-Napoca P 59.553. L. 13.3cm, d/s. 8.4cm, w/b. 6.1cm, w. 381g (Fig. 3.7)

8. Socketed axe with a thickened rim, without a loop. The parallel narrow sides broaden only in the lower quarter of the body into a narrow blade. On one broadside an ornament composed of four chevrons hanging from the rim is preserved, the other broadside has only faint traces of a similar orna-



Fig. 3. Socketed axes from Dezmir (photo B. Rezi).

ment. No casting seams are detectable on the narrow sides, the cutting edge is rounded and has several notches. The surface is rough. Registration number MNIT Cluj-Napoca P 59.554. L. 12.5cm, d/s. 8.3cm, w/b. 4.6cm, w. 321g (Fig. 3.8)

9. Socketed axe with a thickened facetted rim and loop, the body is slightly curved. Both broadsides have three parallel horizontal ribs, one curved rib and below that a Y-shaped ornament, with a flexed rib on each side. The two halves of the moulds accidentally moved slightly horizontally during casting; the casting seams are visible on the upper two-thirds of the narrow sides; below they have been removed. A ridge divides the socket and blade, the cutting edge is jolted and has a large section with old damage. Registration number MNIT Cluj-Napoca P 59.555. L. 14.8cm, d/s. 9cm, w/b. 5.6cm, w. 518g (Fig. 4.9).

10. Socketed axe, due to a casting defect a part of the socket, including the loop, is missing. The parallel narrow sides evolve into a trapezoid blade. Two horizontal parallel ribs are located below the mouth of the socket, followed by pseudo-wings and a ridge. Traces of the casting seams are visible on the upper two-thirds of the narrow sides; below they have been removed. The surface is smooth, the cutting edge is sharp with only small notches and dents. Registration number MNIT Cluj-Napoca L. 9.2cm, remaining d/s. 5.1cm, w/b. 4.5cm, w. 115g (Fig. 4.10).

11. Socketed axe with a thickened rim, the loop broken off, and the body slightly curved. A remainder of the casting jet is visible on the socket mouth above the remains of the loop. One broadside has a ridge between the socket area and blade. The casting seams are visible on the narrow sides, the cutting edge is blunt with notches, and one edge is missing. The surface is rough; the blade in particular has numerous defects from gas bubbles trapped during casting. Registration number MNIT Cluj-Napoca P 59.567. L. 9.5cm, d/s. 5.1cm, w./b. 3.7cm, w. 96g (Fig. 4.11).

12. Lower half of a socketed axe. The breaking edges and the broadsides show traces of hammer blows. Faint traces of a decoration comprising of a 'Y' flanked by two flexed ribs on each side (similar to

Nr. 9) are visible. Traces of the casting seams are detectable on the narrow sides; the cutting edge is asymmetrical. The surface is very uneven due to gas bubbles trapped during casting. Registration number MNIT Cluj-Napoca P 59.565. L. 7.6cm, d/s. (preserved) 3.1cm, w/b. 4.95cm, w. 187g (Fig. 4.12).

13. Blade of a socketed axe, traces of hammer blows on the broadside at the break. During casting, the core was out of centre and the two halves of the mould shifted slightly horizontally. The narrow sides preserve the casting seams, the cutting edge is uneven. The surface is slightly uneven due to gas bubbles trapped during casting. Registration number MNIT Cluj-Napoca P 59.568. L. 6.4cm, d/s. (preserved) 2.5cm, w/b. 4.8cm, w. 148g (Fig. 4.13).

14. Fragment of an axe, lead. The shape and proportions indicate a socketed axe. However, as only the lower two-thirds are preserved and there is no indication of a socket, the object likely was massive. Traces of the casting seams are detectable on the narrow sides; the dark grey surface is uneven and shows white deposits. Registration number P 59.569. L. 8.4cm, body diameter 4x1.4cm, w/b. 5cm, w. 358g (Fig. 4.14).

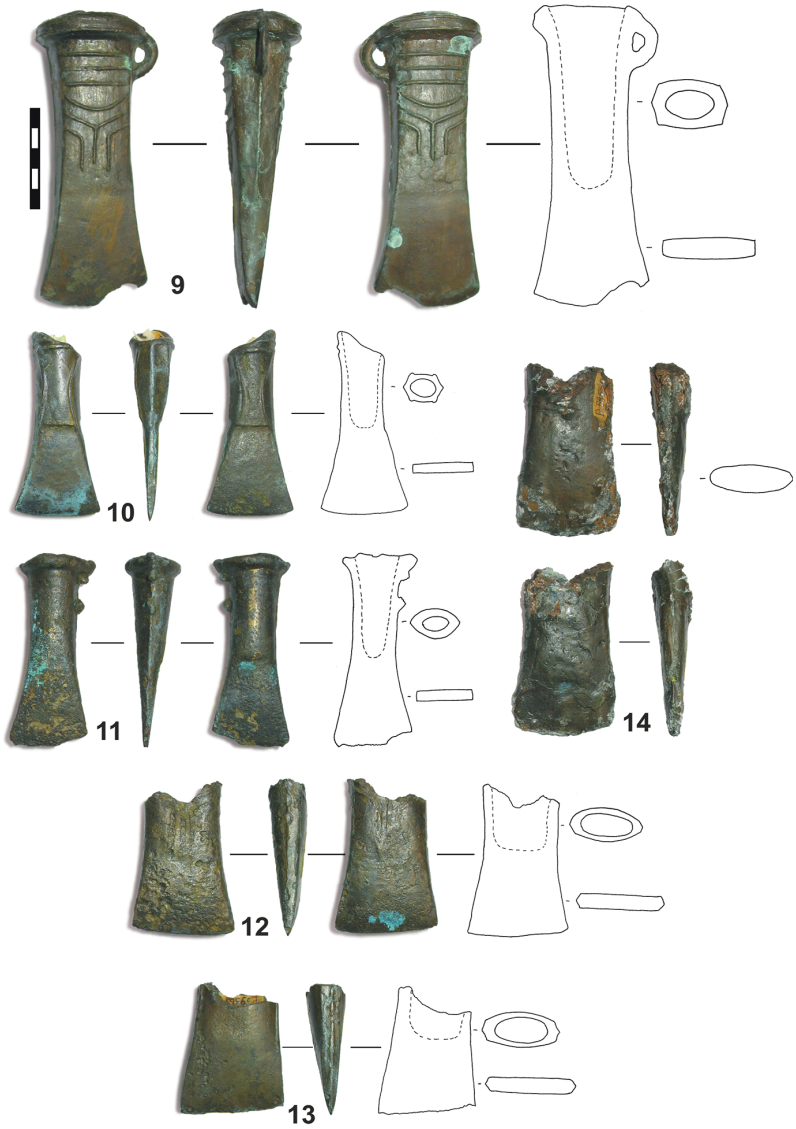


Fig. 4. Socketed axes from Dezmir (photo B. Rezi).

15. Fragment of a knob sickle ("Knopfsichel"). The hafting area and a large portion of the sharply curved blade are preserved. The base of the hafting area is slightly bent inwards and features a conical knob with a round cross section. Two oblique ribs followed by an antithetic rib pair are only faintly visible. The thickened rim of the blade is followed by a rib. The cutting edge has deep notches and nicks. Registration number P 59.556. L. 10.9cm, width 2.8cm (Fig. 5.15).

16. Fragment of a hook sickle ("Hakensichel") with a thickened rim. A casting defect (hole) did not prevent use, as the damage on the cutting edge shows. Registration number P 59.557 (MNIT), 59.558 (Rusu). L.7.4cm, width 2.4cm (Fig. 5.16).

17. Knob sickle, the point is missing. The base of the hafting area is slightly bent inwards and features a conical knob with a round cross section. The thickened rim of the blade is followed by two ribs. The cutting edge is heavily notched. Registration number P 59.560 (MNIT) 59.563 (Rusu). L. 14.1cm, width 2.2cm (Fig. 5.17).

18. Blade of a knob sickle with heavily thickened rim, which is followed by two ribs. The casting jet is still preserved, the cutting edge has several large notches. Registration number P 59.558 (MNIT), 59.557 (Rusu). L.12.6cm, width 2.5cm (Fig. 5.18).

19–20. Two fitting blade fragments of a hook sickle with a thickened rim. Registration number P 59.559.

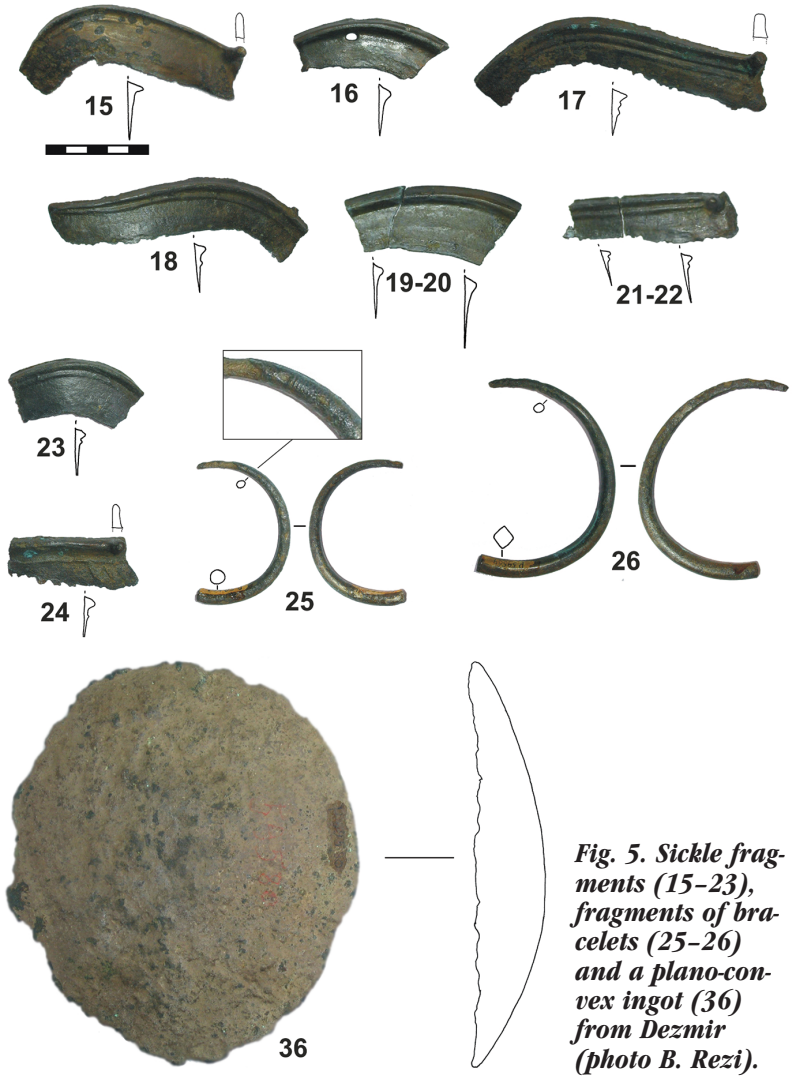


Fig. 5. Sickle fragments (15–23), fragments of bracelets (25–26) and a plano-convex ingot (36) from Dezmir (photo B. Rezi).

L. 5.5cm, width 3.4cm. Registration number P 59. 562b. L. 3.2cm, width 3.8cm (Fig. 5.19–20).

21–22. Two fitting fragments of a knob sickle. The base of the hafting area is rounded and features a conical knob. The rib runs along the edge, followed by a smaller, parallel one. The preserved part of the blade is straight, traces of several hammer blows are visible on the cutting edge. Registration number P 59.561, P 59.562a. L. 6.2cm, width 2.5cm. L. 3.3cm, width 2.1cm (Fig. 5.21–22).

23. Fragment of a knob sickle, the curved middle part is preserved. Registration number P 59.562c. L. 6.5cm, width 2.4cm (Fig. 5.23).

24. Hafting area of a knob sickle with an inwards bent base and small knob. Below the thickened rim runs a small rib; at the base, three parallel inclined ribs are added. The cutting edge shows several and quite regular notches. Registration number P 59.562 (MNIT), P. 59.560 (Rusu). L. 6.3cm, width 2.2cm (Fig. 5.24).

25. Fragment (approximately half) of a bracelet with a round cross section and pointed ends. Towards the end the surface is damaged and shows traces of ornamentation with regularly disposed vertical lines. Registration number P 59.563. Max. diameter 7cm, w. 29g (Fig. 5.25).

26. Fragment (approximately half) of a bracelet with rhomboid cross section and pointed ends. Towards the end the surface is damaged. Registration number P 59.564. Max. diameter 9.7cm, w. 58g (Fig. 5.26).

27. Irregular fragment of a plano-convex ingot (PCI),[3] bronze. Registration number P 59.570. L. 2.7cm, thickness 1.6cm, w. 106g (Fig. 6.27).

28. Fragment of a flat/flat PCI, bronze. Registration number P 59.571. L. 4.7cm, width 2.8cm, w. 447g (Fig. 6.28).

29. Irregular flat/flat PCI. Registration number P 59.573. L. 7.1cm, thickness 0.9cm, w. 130g (Fig. 6.29).

30. Irregular fragment of a flat/flat PCI, bronze. Registration number P 59.574. L. 5.8cm, thickness 3.3cm, w. 813g (Fig. 7.30).

31. Fragment of a presumably sub-rectangular, flat/convex PCI with a very large cavity. Registration number P 59.575. L. 6.4cm, width 2.8cm, w. 348g (Fig. 7.31).

32. Fragment of a likely drop-shaped convex/convex PCI, bronze. Registration number P 59.576. L. 5.8cm, width 3.9cm, w. 628g (Fig. 7.32).

3 The description of the PCIs follows the terminology proposed by Modl (*2019.380–381, Figs. 6–7*).

33. Complete round flat/convex PCI. Determined as copper after the colour of the metal. Registration number P. 59.577 (MNIT) 59.580 (Rusu). Diameter 8.9cm, thickness 2.5cm, w. 3950g (Fig. 6.33).

34. Fragment of a concave/convex PCI, bronze. Registration number P 59.578. L. 5.3cm, thickness 5.9cm, w. 866g (Fig. 7.34).

35. Fragment of a presumably irregular convex/convex PCI with a very large cavity, determined as copper after the colour of the metal. Rusu published a concave cross section drawing, the re-documentation shows clearly that the object is hollow and roughly half of it is preserved. Registration number P 59.579. L. 10.7cm, thickness 5.8cm, w. 1008g (Fig. 7.35).

36. Complete slightly ovoid flat/convex ingot. Registration number P 59.580 (MNIT), P 59.577 (Rusu). Diameter 19.6cm, thickness 3.4cm, w. 740g (Fig. 5.36).

37. Bronze ingot, bar/rod-shaped with a triangular cross section. Excess bronze on both narrow sides hints at casting in an open mould. Registration number P 59.572. L. 11.6cm, cross section 2.6x1.5cm, w. 133g (Fig. 6.37).

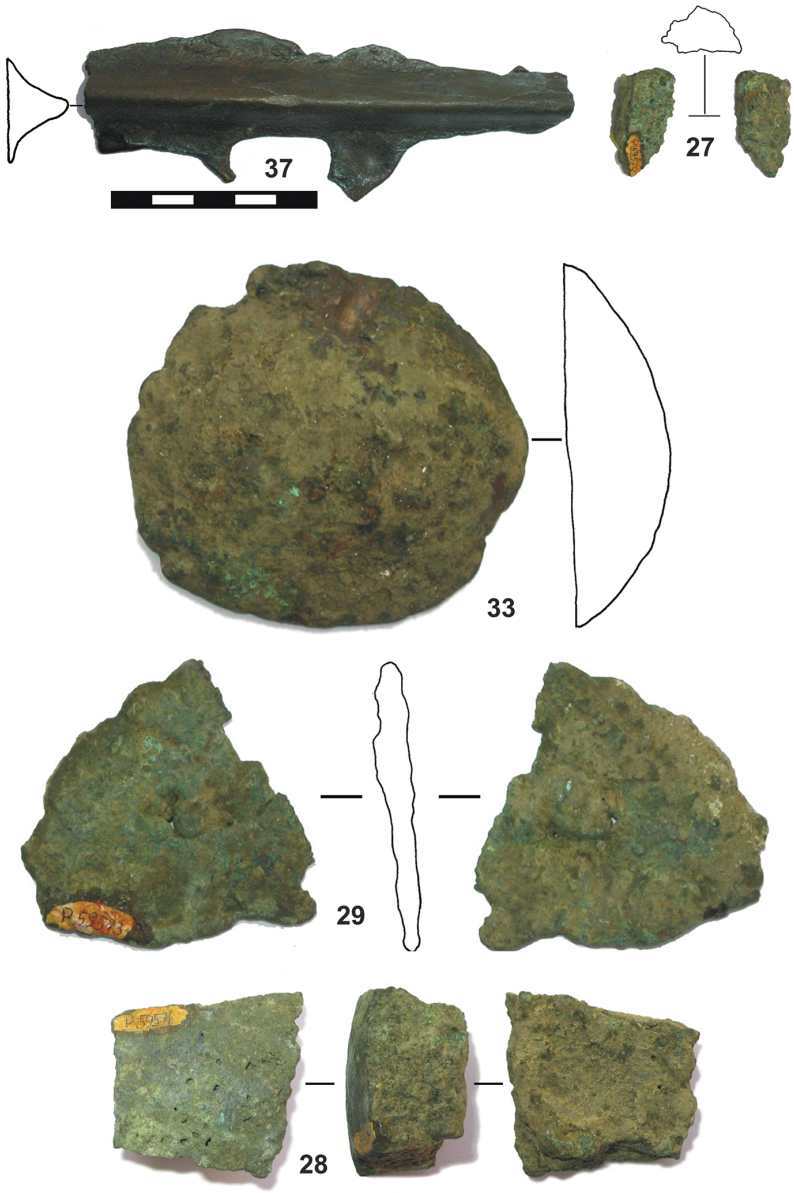


Fig. 6. Plano-convex ingots (27–28, 33), an irregular piece of bronze (29), and a rod-shaped ingot (37) from Dezmir (photo B. Rezi).

A total of 14 socketed axes, 10 sickle fragments, two fragments of bracelets, 10 plano-convex ingots and one bar-shaped ingot can be recorded for the hoard from Dezmir. These numbers differ slightly from earlier publications. Rusu published 14 socketed axes, nine sickle fragments (seven illustrated), two bracelets, one bar-shaped and ten plano-convex ingots (*Rusu 1977a*).[4] Mircea Petrescu-Dîmboviţa (*1977.122–123*) lists, without explanation, 14 socketed axes, nine sickle fragments, two bracelets, a 'casting residue' ("*un rest de turnat/Gussrest*": the

4 The find was first discussed in Rusu's (*1972.553–554, Nr. 84*) doctoral thesis, which remained unpublished. The illustrations are the same while some of the information differs. Rusu states that the findspot was a slight slope and that the plough would have reached a depth of 70–80cm. The find was discovered in a depth of 60cm and two pit houses were discovered at a distance of 50m from the findspot. The content of the hoard is also listed differently: "*6 celturi cu plisc, un celt masiv cu decor, un celt fără toartă şi decor, 2 celturi zvelte, decorate cu cîte două linii paralele reliefate, un celt zvelt cu aripioare false, 2 fragmente de celturi, dintre care unul cu decor; un fragment de celt din plumb; 10 fragmente de seceri dintre care 4 cu butoni şi 6 de tipuri neprecizate, 2 fragmente de brăţări nedecorate cu secţiunea rotundă sau ovală, o brăţară cu secţiunea plan-convexă, 14 turte de bronz şi mai multe fragmente de vase de lut hallstattiene.*" As the thesis clearly has the character of a manuscript, it seems likely that Rusu corrected this account for publication. However, some discrepancies remain, and are hard to explain as the published account states that Rusu personally knew the findspot.



Fig. 7. Fragments of plano-convex ingots from Dezmir (photo B. Rezi).

term is open to interpretation) and 13 ingots.[5] He illustrates five of the sickles already published by Rusu; the ingots and the 'casting residue' are not illustrated (*O.c.122–123, Pl. 288.11–17, 289.1–7*). In the German variant of his monograph, the number of ingots is corrected to ten, and all nine sickle fragments are illustrated (*Petrescu-Dîmboviţa 1978.137–138, Nr. 198, Pl. 217E, 218; sickles Pl. 218.15–23*).

The identification of the bar-shaped object nr. 37 as an ingot or a casting residue is a matter of interpretation, although we share Rusu's opinion and see it as a bar-shaped ingot. The discrepancies regarding the number of sickles are harder to explain. In Rusu's first publication of the hoard, several captions for sickles and bracelets on page R65b got mixed up. Rusu states that four fragments of one sickle (inventory numbers 59.561–59.562 a,b,c) were part of the hoard, but only one fragment (P. 59.561) is illustrated. Research on the originals showed that only the fragments P 59561 (Nr. 21) and P 59562a (Nr. 22) are from the same sickle, while P 59562c (Nr. 23) is at least not a directly fitting piece, and P59562b (Nr. 20) fits with P 59559 (Nr. 19). In his 1978 monograph, Petrescu-Dîmboviţa illustrated nine sickle fragments. Research at the MNIT Cluj-Napoca produced one more fragment, making a total of 10 fragments from at least seven, possibly eight sickles (if Nr. 23 is not from the same artefact as Nr. 21–22).

There is also a contradiction in the total number of hoarded objects. In 1977, Rusu mentioned a total of 43 artefacts with a weight of 13.114kg and published 34 bronzes with illustrations. A simple explanation in the sense of transposed digits is doubtful, as he further lists the mentioned sickle fragments without illustrations. Additionally, there is an unexplained gap in the inventory numbers between Nr. 59.564 and 59.571. Of course, this is not proof that there are missing objects. The 37 objects listed above are all that are stored at the MNIT. If the sickle fragments are assembled, the total number of artefacts would be 34.

On the level of particular objects, the renewed analyses of the artefacts reveals a few differences compared to the published record. The socketed axe Nr. 8 has to date been described as plain (*Rusu 1977a.*

5 Why Petrescu-Dîmboviţa mentions 13 ingots remains unclear. However, in his doctoral thesis Rusu mentions 14 ingots, illustrating 10. If Petrescu-Dîmboviţa used that source (which he does not cite) or other information from Rusu, the number could be explained by subtracting the 'casting rest' from the number of ingots.

Pl. R65a.8; Petrescu-Dîmboviţa 1977.Pl. 288/16). However, it has traces of chevron-shaped ornaments on one broadside. Socketed axe Nr. 2 has a clear ridge between the blade and socket area in the published drawings (*Rusu 1977a.Pl. R 65a.2; Petrescu-Dîmboviţa 1977.Pl. 288.12*), which does not exist on the original object. The bracelet Nr. 25 has been published as undecorated (*Rusu 1977a.R65b.12; Petrescu-Dîmboviţa 1998.62, Nr. 487, Pl. 48.487*), but there are indeed traces of ornaments. The plano-convex ingot Nr. 35 has been drawn and described as 'massive' (*cf. Rusu 1977a.Pl. R65c.34; Petrescu-Dîmboviţa 1978.Pl. 218/36*), although it is clearly hollow.

In summary, most of the artefacts are fragmentary or damaged. The socketed axes have a striking number of casting defects. However, as notches, breakages and deformations of the cutting edges show, all of them have been used except for the unfinished cast Nr. 4. The degree of use (ABN), a measure for the intensity of the use of socketed axes (*Dietrich 2021a.155–156, 162–164, Fig. 7/14*), points in the same direction. Five degrees of use can be determined using the ratio between blade and socket length between ABN 0 (raw casts) and ABN 4, meaning an artefact whose cutting edge has been moved nearly up to the socket by continuous use, rendering the axe unusable.[6] Applying this scheme to the axes from Dezmir, it becomes clear that most of them could still have been used.[7] This is different for the sickles, which are heavily damaged or in fragments. Several fragments have heavily damaged cutting edges, and for Nr. 24 in particular the uniformity of the notches could hint at intentional damaging. In addition to two complete ingots, the hoard contains eight fragments. Using the terminology established by Bianka Nessel (*2014.404–405*) for ingot segments, they are mostly amorphous, some nearly square. All can be characterized as small segments of large plano-convex ingots, none of the fragments fit together. Of particular interest are the two hollow fragments Nr. 31 and 35. Following Daniel Modl (*2019.381*), these cavities are too big to be caused by gas distention during casting of the ingots. One plano-convex ingot from the hoard of Miljana, opć. Klanjec, Croatia (*Dörfler* et al. *1969.69–72, Pl. I.1-2*) has a lead core instead of the cavity. Modl assumes that this could also have been the case for the quite rare 'hollow' plano-convex ingots (the same idea already in *Hansen 1994.231*). The reason for these poly-metallic ingots remains unclear. However, this practice could be interpreted as an attempted fraud within the trade for raw bronze, or as a way to manufacture less valuable votive items (*Hansen 1994.230–231*). In any case the fraud would have been easily detectable when the ingots were partitioned.

The fragment of a lead axe

The socketed axe made of lead (Nr. 14, Fig. 4.14), preserved fragmentarily, cannot have been intended for use, judging from the soft material and the missing socket. While lead is known from several finds in the Carpathian Basin (*Boroffka* et al. *2016*), the lead axe is unique so far. The only distant comparison is a socketed axe from the first hoard from Várvölgy, Zala/Veszprém megye, Hungary, with a lead content of 60.53% (*Müller 2006.15, Fig. 7*). The axe from Dezmir has been described as an axe-shaped ingot (*Boroffka* et al. *2016.409*). The shapes of ingots in the Carpathian area are quite standardized, though (*Modl 2019; Nessel 2019.185–204*), and axes are not among them.

Lead socketed axes are however known in larger numbers from Western Europe, and their find contexts offer another possible interpretation. A bronze casting mould from Cambridge-New Street contained a fragment of a lead socketed axe (*Lawson 1979. 178; Needham, Hook 1988.274, App. 2.1*); another find is known from Southall-Brickfield (*Gowland 1901.368, Nr. 2; Britton 1960.Pl. GB51.1a-b*). A casting mould from a hoard discovered on the Isle of Harty, Kent, had lead adhesions (*Evans 1881. 441–442*), and Needham and Hook have published a total of seven finds of lead in casting moulds, including the above mentioned axes (*Needham, Hook 1988.App. 2*). There are further instances of lead axes appearing without associated casting moulds (see list in *Dietrich 2011*), but this association was the basis for their interpretation.

Ronald F. Tylecote (*1962.125–128*) saw the lead axes as cores that took the role of wax cores in a procedure similar to lost wax casting. Ernst Foltz (*1980*) has argued against the feasibility of this tech-

6 Degree of use ("*Grad der Abnutzung*", ABN). 0-raw cast, unused. 1-light: Blade socket ratio only slightly reduced; blade is more than 1/3 of the whole axe. 2-medium: the blade is reduced to nearly 1/3 of the whole axe. 3-heavy: the blade is reduced to 1/4 or less of the whole axe. 4-extremely heavy: the blade is reduced up to the socket area. The axe is unusable.

7 As far as determinable: Nr. 1: ABN 3; Nr. 2: ABN 2; Nr. 3: ABN 1; Nr. 4: ABN 0; Nr. 5 ABN 2; Nr. 6: ABN 2–3; Nr. 7: ABN 1; Nr. 8: ABN 2; Nr. 9: ABN 1; Nr. 10: ABN 1; Nr. 11: ABN 1.

nological process, pointing out that lead lumps would remain in the mould when the molten bronze was poured in. Additionally, socketed axes were not produced by lost wax casting, as the casting seams on all axes known from Eastern and Western Europe demonstrate. Although they accept these arguments, Needham and Hook still do not completely exclude the possibility of lead cores (*Needham, Hook 1988. 265–268*).

An alternative interpretation has been proposed though, starting from numerous lead artefacts of the first millennium AD (for a summary see *Bergen 2005.26–37*): a multiphase technological process to produce clay or sand casting moulds from lead models (*Drescher 1978.97–98; Foltz 1980*). Klaus Goldmann (*1981*) has argued that casting in sand moulds may have been the most important technique of Bronze Age casters, as there are only very few stone or bronze moulds preserved. Although this seems debatable, there is good evidence for the use of bronze models in mould production for southeastern Europe (*Dietrich 2011*). Therefore, a similar role seems possible for the lead axe from Dezmir.

The pottery

As (preserved/recovered) ceramic vessels associated with hoards are relatively scarce in the Carpathian Basin, a closer look at the fragments published by Rusu[8] is of interest (*Rusu 1977a.Pl. R65d, Nr. 35–46*). The following 12 fragments were published (the numbers correspond with Fig. 8):

1. Rim sherd, undiagnostic;
2. Rim sherd of a coarse, bellied vessel with flaring rim, decorated with a (damaged?) knob;
3. Rim sherd of a fluted shallow bowl with fluted rim. The sherd is positioned incorrectly in Rusu's drawing, suggesting a large vessel;
4. Body sherd with handle, decorated with a ridge with finger imprints;
5. Body sherd, undecorated, likely part of a large vessel with cylindrical neck;
6. Undiagnostic bottom sherd;
7. Rim fragment of a globular fluted bowl with slightly incurved rim ("Einzugsschale": *Pankau 2004. 62, Typentafel IV, kalottenförmige Schalen Variante 3*);
8. Globular body of a large bowl, the flaring neck is lost, undecorated;
9. Fragment of a broad handle ("Bandhenkel");
10. Fragment of a fluted bowl (?);
11. Undiagnostic bottom sherd;
12. Neck and globular body of a vessel with conical neck ("Kegelhalsgefäß"). The neck has horizontal, parallel fluting, the body arcuate fluting ("*konzentrisch übereinandergelegte Halbkreise, die sich an spitz nach oben gerichteten Umbruchstellen zu einer Bogenreihe schließen*": *Pankau 2004.71, Pl. 5.A2a*).

Three of the twelve pottery fragments are diagnostic for typo-chronological questions (Nr. 3, 7 and 12). The remaining nine are too heavily fragmented (Nr. 1, 4, 6, 9, 10, 11) or are part of types wide-

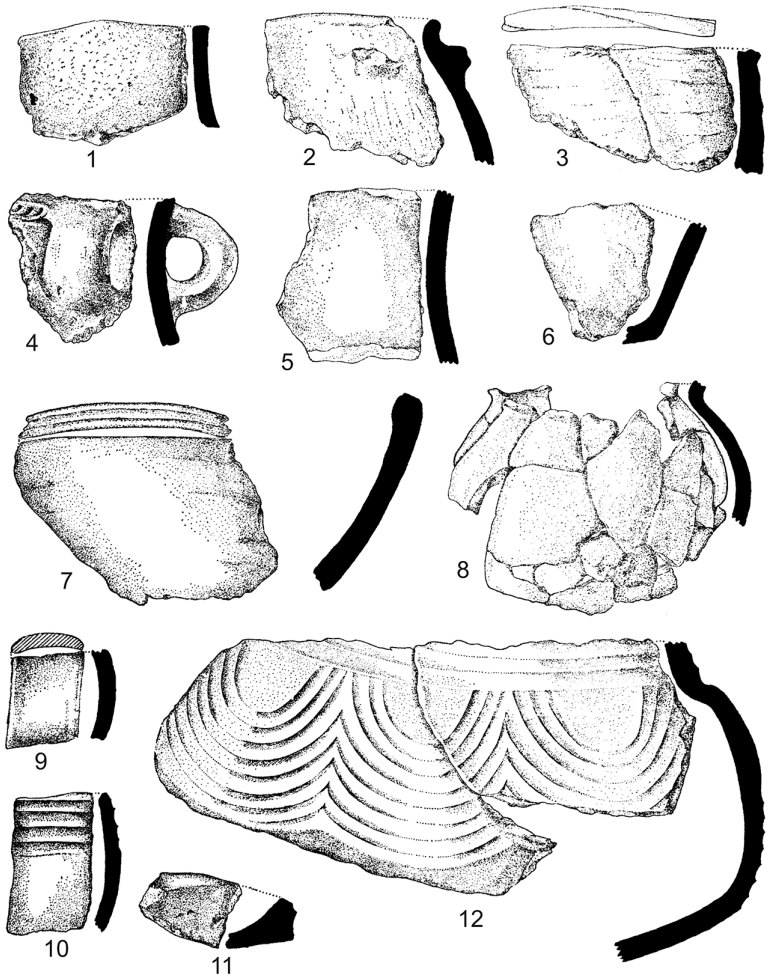


Fig. 8. Pottery found with or near the hoard after Rusu (1977a).

8 The pottery was not available for study at the MNIT Cluj-Napoca at the moment the bronzes were documented.

ly distributed in time and space (Nr. 2, 5, 8). The vessel with a conical neck Nr. 12 has analogies in the so-called Mediaş-Reci Group of the Gáva Culture, for example in the settlements of Mediaş-Cetate, jud. Sibiu (Layers I and II: *Zaharia 1965.Fig. 9.2, 6, Fig. 10.1, 6; Pankau 2004.Pls. 2.1, 12.6, 15.2*) and Reci, jud. Covasna (*Zaharia 1965.Fig. 11.10, 12*). There are further analogies from the so-called Grăniceşti Group of the Gáva Culture, for example from Grăniceşti, jud. Suceava (*László 1994.Fig. 25. 1–4, Fig. 26, Pl. II.3A and Pl. XII.16*, with 'closed' bows). Layer II of the multi-stratified settlement of Teleac, jud. Alba, has more developed variants of the same type (*Vasiliev* et al. *1991.Fig. 32.1, 9, Fig. 41/ 3, 5*). The vessels Nr. 3 and particularly Nr. 7 also have good comparisons in Teleac (Layers II and III; *Vasiliev* et al. *1991.Figs. 31.4, 34.3,6,10,13, 35.6,8,11*).

The dates for Layers I and II at Mediaş and Reci lie between Ha B1-B3 (*Zaharia 1965.102; Vasiliev* et al. *1991.128*) A. László has proposed a start date for Grăniceşti already in Ha A (*László 1994.93–94*); layer II of Teleac was dated to Ha B2-C, layer III to Ha D by Vasiliev (*Vasiliev* et al. *1991.118–129*; but see also the modifications by *Ciugudean 2012*). In short, the best chronological indicator for the pottery is provided by vessel Nr. 12, which has good analogies in Mediaş and dates broadly to Ha B. The importance of this chronological hint for the hoard is lessened by the fact that Rusu did not clearly state which fragments were found directly associated with the hoard, or in the house at a distance of about 50m.

A framework for the spatial-chronological analysis of the hoard from Dezmir

Rusu placed the hoard of Dezmir at the border of the hoarding horizons Jupalnic-Turia (Ha A2) and Moigrad-Tăuteu (Ha B1), while Petrescu-Dîmboviţa dated the find clearly into the Jupalnic-Turia horizon (*Rusu 1977a, Pl. R65d.7; Petrescu-Dîmboviţa 1977. 122–123*). Meanwhile, doubts have been raised about the existence of an equivalent of the central European phase Ha A2 within the Carpathian Basin (*Hansen 1996; Tarbay 2015; Dietrich 2021a*). Additionally, general methodological issues regarding the fine dating of hoard finds have been highlighted. Many hoards represent collections of metalwork accumulated over a longer period of time (*e.g., Vachta 2016; Hansen 2019*), and thus the depth of time represented by the artefacts can be extensive. There are, for instance, Middle Bronze Age shaft hole axes from hoards like Dipşa (*Ciugudean* et al. *2006.37. 22, Nr. 185, Pl. XXXVIII.2, XLVII.2*), Guşteriţa II (*Reissenberger 1872.14–15, Pl. II.11*[9]) and Şpălnaca II (*Petrescu-Dîmboviţa 1978.Pl. 140B.3*[10]), hoards that have conventionally been dated to Ha A1 (hoard horizon Cincu-Suseni). Şpălnaca II has additionally produced Middle Bronze Age flanged axes (*Petrescu-Dîmboviţa 1978.Pl. 140B.1–2*). Moreover, hoards like Guşteriţa II, Şpălnaca II, or Uioara de Sus include artefacts dating to the younger Urnfield Period, *i.e.* to a time after their conventional dating (*Dietrich 2021b*).

Svend Hansen (*2019*) has recently argued that these new insights into the formation processes of hoards should lead to a rethinking of the 'closed find' as a core concept of archaeology. These long-term collections of metalwork are closed finds, but they are not useful for the construction of chronologies, as they may span several hundred years. Hansen used the hoard from Moosbruckschrofen/Piller as a case study, whose artefacts were collected over roughly 300 years. For Romania, Soroceanu *et al.* (*2017*) have described this phenomenon for the first time for the hoard from Band. Whether the long-term accumulation of hoards reflects holy places continually used for depositions or sanctuaries where accumulated votive offerings were buried after being on display for some time, remains open at the moment and would be a topic for a proper study. With regard to the present paper, the chronological implications are of importance.

The only chronological system developed for hoard finds of the Carpathian Basin that takes their chronological fuzziness into account (although not identifying the formation processes as its reason) was developed by Wilhelm A. v. Brunn (*1968*). He differentiated four combination groups of bronze artefacts, which he equated with the phases defined by Herman Müller-Karpe (*1959; v. Brunn 1968.29*) for central Europe: Phase 1 – Bz D – Uriu-Domăneşti; Phase 2 – Ha A1 – Kisapáti-Lengyeltóti; Phase 3 – Ha A2 – Jaszkarajenö-Uszavölgy; Phase 4 – Ha B1 – Rohod-Szentes. However, v. Brunn explicitly stressed the problems of defining clear phases (*v. Brunn 1968.29*). Combinations of types from different pha-

9 Two axe fragments belong to the hoard, but not the one illustrated by Petrescu-Dîmboviţa (*1978.Pl. 106/68*), which has been identified as a single find from the same location already by Alexandru Vulpe (*1970.45, Nr. 148*).

10 Vulpe (*1970.65, Nr. 284*) interprets the artefact as a fragment of a hammer axe.

ses were common, and many finds were not clearly attributable to one phase. Only the contents of the earliest and latest phases were mutually exclusive, which led him to his well-known scheme of an older and younger group of types ("*ältere und jüngere Typengesellschaft*"). He particularly pointed out that the third phase (Jaszkarajenö-Uszavölgy) was detectable only by the gradual appearance of new types and the slow disappearance of older ones, *i.e.* a mixture of older and younger artefacts in closed finds (*v. Brunn 1968.46*). The hoard of Dezmir should be analysed within this theoretical framework, first establishing the chronological position of each of its components.

Chronological analysis

The fragments Nr. 19–20 and 16 belong to hook sickles judging from their strong lateral ribs and plain blades, but cannot be determined typologically beyond this point. Hook sickles are characteristic of the older Urnfield Period/ältere Typengesellschaft, they are rare in younger hoards (*Petrescu-Dîmboviţa 1978.69–70*). Most of the sickles from Dezmir are knob sickles. The well-preserved Nrs. 15 and 17 were classified as belonging to his type Panticeu by Petrescu-Dîmboviţa, which is mostly characteristic of the same older phase (*Petrescu-Dîmboviţa 1978. 14, Nr. 59–60, 24*). Fragment Nr. 18 was listed under the type Cenadu Mare-Şpălnaca I, which is dated to Jupalnic-Turia und Moigrad-Tăuteu (*Petrescu-Dîmboviţa 1978.24.18, Nr. 169*). The remaining fragments are too small for classification. Bracelets with pointed ends like Nr. 25 appear throughout the later Bronze Age (*Petrescu-Dîmboviţa 1998.71*). For bracelets with pointed ends and a rhomboid section (Nr. 26), one Bz D grave context from Cruceni, jud. Timiş, Romania, has been published (*Petrescu-Dîmboviţa 1998.124, Nr. 1374*). Plano-convex ingots have been discussed repeatedly in recent decades, but so far no chronological relevance of certain types has been detected (*Mozsolics 1984; Czajlik 1996; Nessel 2014; 2019.185–204, 272–274; Modl 2019*). The chronological position of Dezmir is thus largely dependent on the socketed axes.

The Romanian socketed axes have been analysed and published recently (*Dietrich 2021a*), and brief remarks on the types present at Dezmir may suffice here. Two large groups of socketed axes are present in the hoard: beaked axes and axes decorated with ribs. The beaked axe Nr. 1, with a nearly symmetrical mouth and rounded cross section of the body, represents a type characteristic of Phase 4 in northwestern Romania and eastern Hungary (*Dietrich 2021a.290, Nr. 0399, 291–292; type A11*). Nr. 2, a socketed axe with a short, vertical beak and nearly straight rim belongs to a chronologically indifferent variant, which is attested in the older and younger Urnfield period over a large area within the Carpathian Basin (*Dietrich 2021a.277, Nr. 0356, 282; variant A8h*). The long and slender axe Nr. 4 with a rounded cross section and a long vertical beak is one of the most common variants of Phase 4 in Romania, where 57 finds concentrate along the middle Mureş and the Someş-region; further finds are known from Slovakia, northeastern Hungary, and from the Transcarpathian regions of Ukraine (*Dietrich 2021a. 264, Nr. 0279, 280, variant A8a*). Axe Nr. 5, a rather squat and massive axe with a short, steep beak and a rounded cross section, belongs again to a variant mostly characteristic of Phase 4 (*Dietrich 2021a.249, Nr. 0211, 254; variant A6e*). Socketed axes like Nr. 7, with curved mouths, short beaks and rounded cross sections, are mainly known from Phase 4 contexts but also appear earlier (*Dietrich 2021a.233, Nr. 0130, 236, variant A5b*). A round cross section, a feature determined as being in general characteristic of beaked socketed axes of the younger Urnfield period (*Petrescu-Dîmboviţa 1944–1948*) is the only indication for the age of fragment Nr. 6 (*Dietrich 2021a, 297, Nr. 0453*).

The remaining socketed axes belong to variants with rib decoration. Axe Nr. 3, with a massive, curved body and broadening blade area has two horizontal ribs running below the mouth area. There are a few axes of this variant from contexts of the older Urnfield period, while most finds belong in Phase 4 (*Dietrich 2021a.672, Nr. 2731, 682–683; variant D5w*). On the other hand, long and slender axes without loops decorated with chevrons like Nr. 8 are mostly known from Phase 2 contexts (*Dietrich 2021a.542, Nr. 1927, 548–549; variant D1g*). The long and slender trapezoid axe Nr. 9 has a Y-shaped ornament below horizontal ribs; the rounded upper part of the Y is repeated above it by a bow – this variant is almost always associated with Phase 4 hoards (*Dietrich 2021a.596, Nr. 2264, 614; variant D3m*). The massive, curved axe Nr. 10, which is further characterized by an abruptly and significantly broadening blade and an hourglass-shaped decoration, belongs to a variant of the so-called Passau Type (*Blajer 2018*), dated securely in Phase 4 (*Dietrich 2021a.666, Nr. 2688, 681; variant D5m*). The same is true for the undecorated slender and trapezoidal axe Nr. 11 (*Dietrich 2021a.604, Nr. 2323, 618; variant D3y*). Fragment Nr. 14 has a Y-

shaped motif, which substantiates a Phase 4-date (*Dietrich 2021.606, Nr. 2343*). Finally, fragments 13–14 cannot be classified (*Dietrich 2021a.688, Nr. 2796–2797*).

Summing up the dating of all hoard components (Fig. 9), the general impression is of a chronologically diverse assemblage. Some types are clearly or partly characteristic of the older Urnfield Period, while others have a tendency towards or a clear date in the younger Urnfield Period. The youngest artefacts define the moment the hoard was hidden, Phase 4. There is no reason to date the hoard of Dezmir to Phase 3 – Ha A2 – Jupalnic-Turia.

Spatial analysis

The hoard is not only chronologically, but also geographically diverse. Knob sickles of the Panticeu type concentrate between the middle Mureş and the Someş region, in the upper Tisza area and again in Central Germany (*Petrescu-Dîmboviţa 1978.Pl. 291A*).[11] The Cenadu Mare type of knob sickles concentrates in the Upper Tisza region and the Someş area (*Petrescu-Dîmboviţa 1978.Pl. 291B*). As there still is no general overview on knob sickles except for central Germany (*Sommerfeld 1994*), these observations are not much more than tendencies though. Again, the socketed axes can provide a clearer image.

Between the types and variants present in the hoard, beaked axes of variant A8a (Fig. 10) and the axes with chevron motifs of variant D1g (Fig. 11) are the most frequent types in the Carpathian Basin and adjacent areas. Variant A8a has a very dense distribution in the Upper Tisza region, and a less dense one to the east of the Apuseni mountains in the Someş region. Socketed axes of variant D1g on the other hand concentrate in Transdanubia and in the Drava-Sava region; the eastern Carpathian Basin represents the periphery of their distribution, where larger numbers of these axes appear only in exceptionally large hoards like Uioara de Sus or Guşteriţa II (*Dietrich 2021b*). They are, indeed, foreign to this region. These two geographical areas – the Upper Tisza region on one hand and Transdanubia/the Drava-Sava region on the other – represent the main geographical components within the hoard of Dezmir. The remaining types/variants of beaked axes in the hoard follow the same trend, with the notable exception of variant A5b, which is clearly indigenous to the Someş area and the Crişana, with few finds further to the west (Fig. 12). Between the axes with plastic ribs, variant D5w is characteristic of the eastern Carpathian Basin, variant D5m concentrates in the Someş region and the Crişana (Fig. 13), while variant D3y is found throughout the Carpathian Basin north of the Mureş River and variant D3m again is mostly known from the Drava-Sava region, with a few finds reaching the Crişana and even the middle Mureş (Fig. 13).

The best approach to better determine the interaction zone the hoard from Dezmir is part of is map-

	Phase 1	Phase 2	Phase 3?	Phase 4	Phase 5
Rings with pointy ends and trapezoid square section					
Hook sickles					
Knob sickles type Panticeu (Petrescu-Dîmboviţa 1978)					
Socketed axes variant A8h					
Socketed axes variant A6e					
Knob sickles type Cenadu Mare-Şpălnaca I (Petrescu-Dîmboviţa 1978)					
Socketed axes variant A5b					
Socketed axes variant D1g					
Socketed axes variant D5w					
Socketed axes variant A8a					
Socketed axes type A11					
Socketed axes variant D3m					
Socketed axes variant D3y					
Socketed axes variant D5m					

Fig. 9. Chronological overview of the components of the hoard from Dezmir (white: absent; light grey: sporadic appearance; dark grey: main time of use).

11 Petrescu-Dîmboviţa's map partly reflects the degree to which the archaeological material in certain regions had been analysed and published at the time he finished his monograph. The high concentration of Central German finds is partly due to an in-depth study published on the sickle hoards of this area (*v. Brunn 1958*).

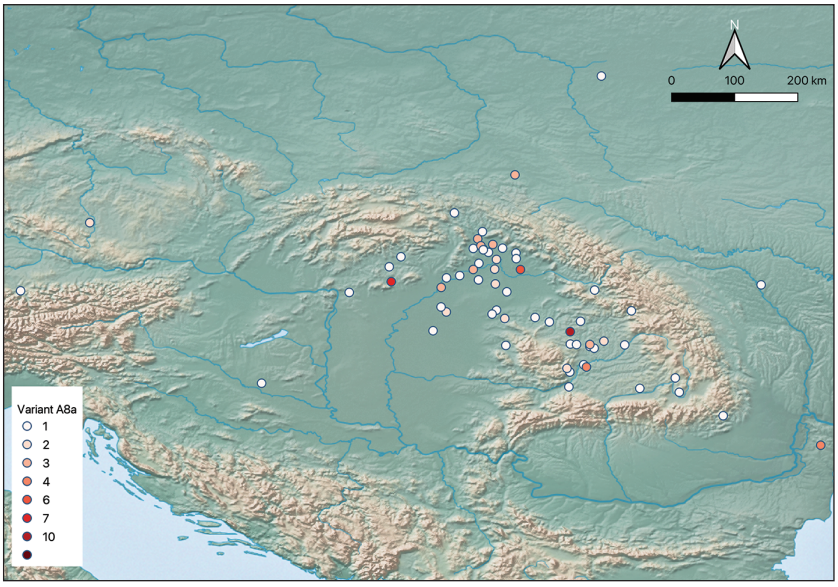


***Fig. 10. Distribution of socketed axes of variant A8a by quantity. Map: Natural Earth Data (Public Domain: https://www.naturalearthdata.com/); QGIS 3.16. Data from* Dietrich 2021a.**

ping hoards with a similar combination of socketed axe types (Fig. 14). It comes as no surprise that hoards which have three or more types of socketed axes in common with Dezmir concentrate in the Someş region. The closest match is a hoard discovered at Dârja, a few kilometres to the north of Dezmir (*Rusu 1977b*). Another concentration of hoards with similar assemblages of socketed axes is located in the Upper Tisza region. In Transdanubia or in the Drava-Sava area, however, similar combinations are nearly completely missing.

Discussion: Dezmir and the 'scrap hoards' of the younger Urnfield Period

Based on the analysis carried out above, it is possible to determine the characteristics of the hoard from Dezmir as follows:

1. A high frequency of damaged artefacts or fragments;
2. Different metals (bronze, copper, lead);
3. Raw material/ingots;
4. Chronologically diverse artefacts, the youngest, however, belong in Phase 4 after v. Brunn;
5. A relatively large catchment area from which the artefacts derive.

These characteristics are highly reminiscent of the large 'scrap metal hoards', which usually represent long-term collections but have a major accumulation phase in the older Urnfield Period (*Dietrich 2014; 2021b*). For Dezmir, a date in a horizon Jupalnic-Turia or Phase 3 after v. Brunn does not hold, as shown above. This raises the question as to whether the mixture of older and younger artefacts is a general characteristic of the hoards once used to define this chronological phase. What was once believed to be a chronological grouping could in reality be a certain hoarding pattern. To test this hypothesis, all hoards once attributed to the Phases Jupalnic-Turia/Moigrad-Tăuteu were tested by a correspondence analysis (CA).

Hoards are multivariate datasets, differentiated by the presence or absence of chronologically relevant types ("Leittypen"). The appearance, main time of use, and slow disappearance of these types should follow a unimodal model for hoards dating to a short, clearly determined period. The CA has been used successfully for similarly structured datasets in archaeology (*Müller, Zimmermann 1997; Müller-Scheeßel 2008; Siegmund 2015; Greenacre 2017*).

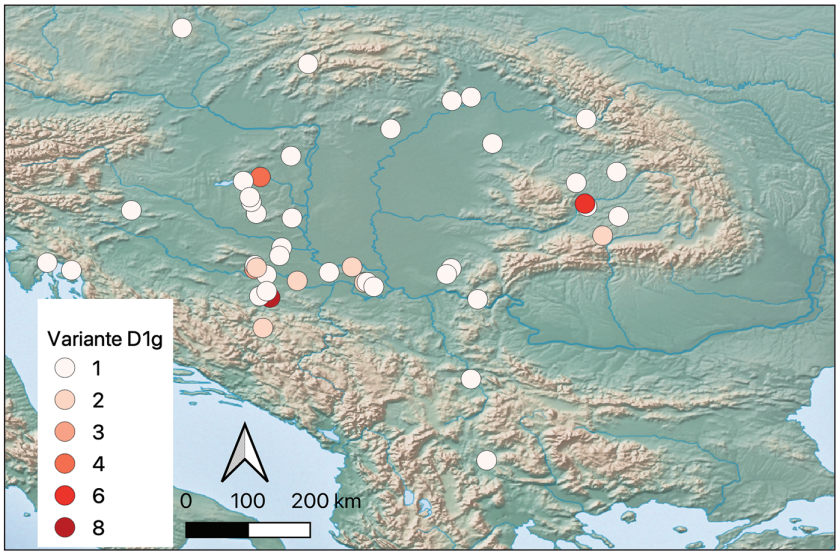


***Fig. 11. Distribution of socketed axes of variant D1g by quantity. Map: Natural Earth Data (Public Domain: https://www.naturalearthdata.com/); QGIS 3.16. Data from* Dietrich 2021a.**

A CA calculates the similarity of multivariate datasets based on a contingency table that lists the presence/absence or abundancy of attributes (in this case the types of artefacts in the hoards). First, scores are calculated for the columns and rows of the table, whose similarity is then checked by chi-squared distances. Then, the inertia of the columns and rows is calculated (*i.e.* their deviation from the mean values of the columns/rows). This results in the overall inertia of the analysis. If the inertia is very low, the data are too similar for a statistically valid result.

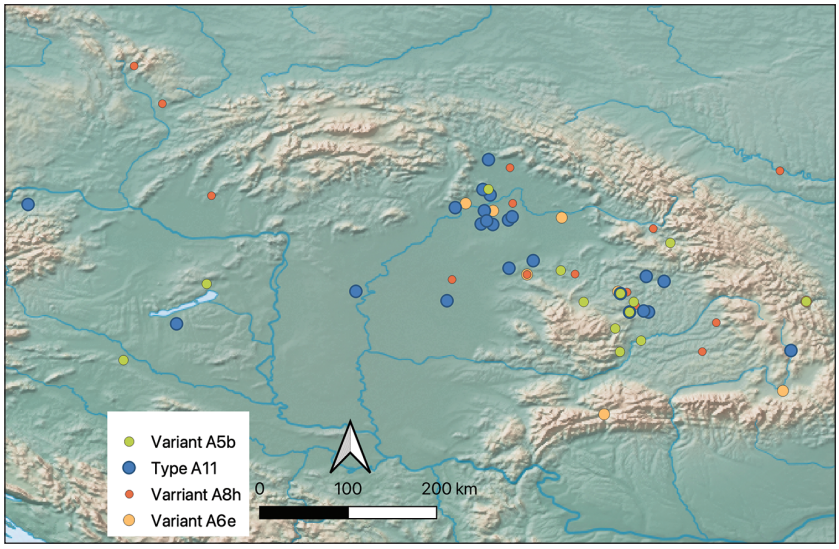


***Fig. 12. Distribution of socketed axes of variants A5b, A6e, A8h and type A11. Map: Natural Earth Data (Public Domain: https://www.naturaleart hdata.com/); QGIS 3.16. Data from* Dietrich 2021a.**

The results of a CA are multidimensional. Thus, there are several solutions for every CA, which in the reduced visualization of the results take the form of different axes. The first one (axis 1) is the dominant result. The other solutions are independent of the first axis, and all represent a ratio of the inertia. This ratio is expressed through the eigenvalue of each axis and through its percentage of the total inertia. In archaeology, the first three solutions are usually checked for statistical meaning. An ideal solution would have a high eigenvalue and the datapoints would be distributed in a parabolic or u-shaped plot in the diagram. Deviations from this distribution hint at problems within the dataset, *e.g.*, types used for a long time distorting the solution.

All hoards defined by Petrescu-Dîmboviţa (*1978*) as characteristic of the phases Jupalnic-Turia and Moigrad-Tăuteu were used for the CA, with some additions of more recent finds (Fig. 15). The list was reduced to secure find contexts with at least two relevant types ("Leittypen") that appear in at least two hoards. The types were chosen based on the list provided by v. Brunn (*1968.Fig. 1–4, Tab. 1*), with some additions regarding the socketed axes based on Dietrich (*2021a*).[12] The software package PAST 5.0 (*Hammer* et al. *2005*) was used for the analyses. If the resulting axes 1 and 2 are mapped in a coordinate plane, the distribution takes on the form of a parabola, although the area to the left of the y-axis has fewer finds and types (Fig. 16). The axes represent 11.6 and 10.1% of the total inertia, respectively. The hoards to the left of the Y-axis are characterized by types 12 ('Transylvanian' socketed axes), 20 (richly decorated belts), 43 (hook sickles), and 45 (saw blades). A combination of all these types causes the single outlier, the hoard of Zimandu Nou. They are also the key to an explanation of this result. All are characteristic for the older Urnfield Period. The result of the CA therefore reflects chronology – some of the finds have older artefacts in their composition, and therefore move away from the main cluster of finds. Dezmir is within the group of chronologically diverse finds, as are most of the hoards proposed earlier as characteristic of Phase 3-Jupalnic-Turia-Ha A2. This becomes clearer if the finds are arranged in a combinatory table according to their position in the CA (Fig. 16). The table lists their main components: tools, weapons, ornaments, raw material, bronze vessels, wagon parts, and horse gear. The general tendency is that the chronologically diverse finds are also heterogenous in their com-

12 The following types characteristic to Phases 2–4 are present in the hoards and were chosen for analysis (numbering after v. Brunn (*1968*), with additions): 12 socketed axes of the 'Transylvanian' type; 16 early winged axes with wings in the upper part of the axe; 20 richly decorated belts; 30 socketed axes with flexed rib decoration; tongue sickles, variant 2; 32 massive winged axes, the wings are located in the upper part and there is no ridge between blade and body; 33 socketed axes of the 'Passau Type'; 34 socketed axes decorated with vertical curved bundles of ribs; 35 socketed axes decorated with chevrons and a pronounced ridge between blade and body; 36: bracelets/legrings decorated with hatched chevrons; 37 tongue sickles of type 3; passementerie fibulas with small spirals at the bow and large terminal ones; 43 hook sickles; 44 flange hilted swords of the Reutlingen type; 45 saw blades; 49 beaked socketed axes with round diameter and steep beak; 51 kettles of type B1; 53 cups of the Kirkendrup type.

position, while the finds clearly datable to Phase 4 have fewer components and are generally smaller.

Result

A close analysis of the hoard from Dezmir and comparable finds reveals good evidence against the formerly proposed chronological hoarding horizon 'Phase 3-Jupalnic-Turia-Ha A2'. In the Eastern Carpathian Basin, this group comprises of hoards with chronologically diverse artefacts hidden in Phase 4. Their structure, here described and analysed using Dezmir as a case study, is highly reminiscent of the large so-called scrap metal hoards like Uioara de Sus, which were accumulated mostly during the older Urnfield Period. These hoards comprise a large number of chronologically diverse, often damaged or fragmented artefacts and a high percentage of raw material, while some of the objects are foreign to the region they were deposited in (*Dietrich 2014; 2021b*). Contrary to earlier beliefs, this hoarding scheme does not disappear in the younger Urnfield Period, but survives in a quantitatively reduced form. The hoard from Dezmir is a characteristic example of this group of hoards.

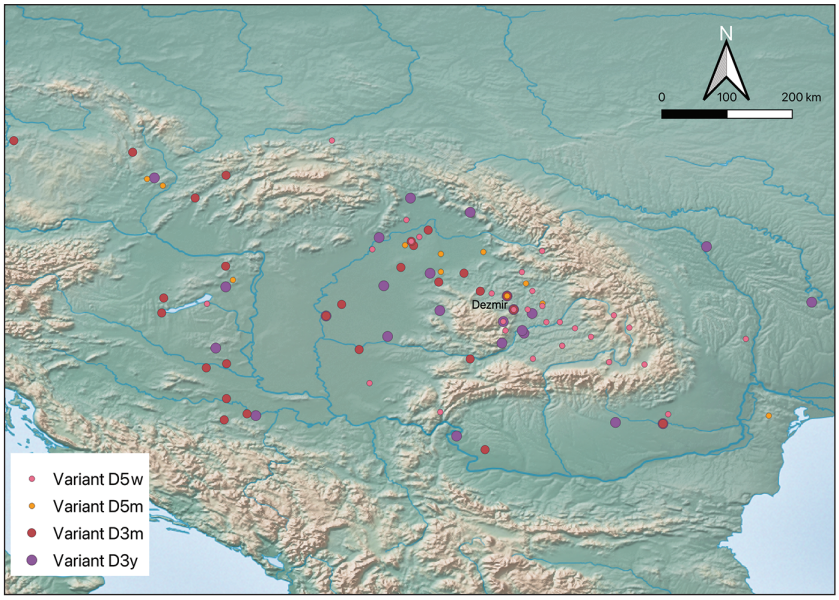


***Fig. 13. Distribution of socketed axes of variants D3m, D3y, D5m, D5w. Map: Natural Earth Data (Public Domain: https://www.naturalearthdata.com/); QGIS 3.16. Data from* Dietrich 2021a.**

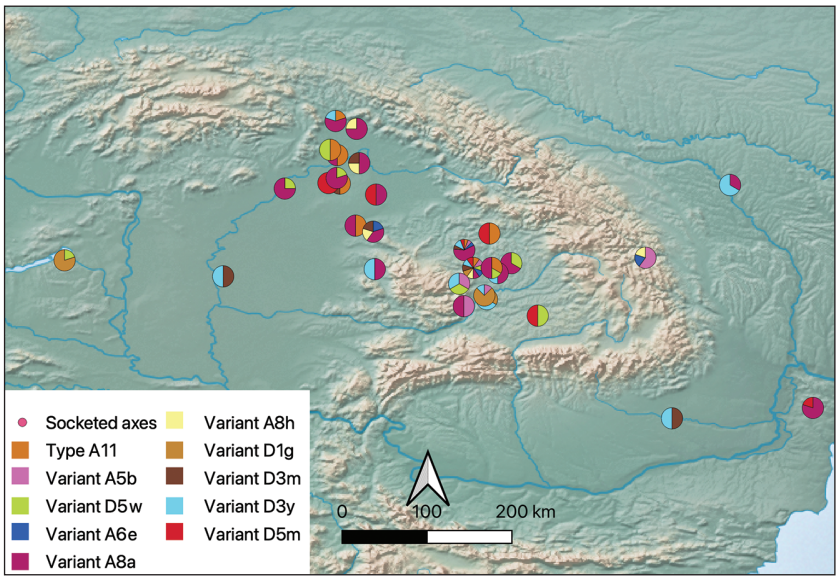


***Fig. 14. Distribution of hoards with socketed axe combinations similar to Dezmir. Map: Natural Earth Data (Public Domain: https://www.naturalearthdata.com/); QGIS 3.16. Data from* Dietrich 2021a.**

ACKNOWLEDGEMENTS

We want to thank Dr. Tudor Soroceanu, Berlin, for the idea to work on the hoard of Dezmir, as well as numerous suggestions along the way. We are also grateful to the MNIT Cluj-Napoca for the permission to re-document the hoard. Work at the Museum was carried out by Botond Rezi.

Hoard	*Number of objects*	tools	weapons	ornament	ingots	vessel	wagon	horse
Zimandu Nou	16	x		x	x			
Cetea	24+	x	x	x	x	x		
Vărd	34	x		x	x			
Dridu	341	x	x	x	x	x		x
Zagon II	32?	x	x	x				
Nou Săsesc	23+?	x		x	x			
Cluj-Napoca III	12	x	x	x				
Dezmir	34	x		x	x			
Brăduţ	48+	x		x	x	x		
Moigrad I	32	x	x	x		x		
Variaş	7	x	x					
Budeşti-Fânaţe	10	x	x	x	x			
Visuia	54	x		x	x	x		
Dârja	40	x	x		x			
Târgu Secuiesc I	6	x						
Fizeşu Gherlii I	13	x		x			x	
Brad	4	x	x	x				
Cenad	23+	x	?	?	x			
Sâg	39	x	x	x		x		
Săcuieni	29+	x	x	x				
Sărvăzel	12	x	x		x			
Blăjenii de Jos	9	x						
Şpălnaca I	136+	x	x	x	x	x		
Cluj-Napoca II	11+	x	x					
Ciceu Corabia	43+	x	x	x				x
Sâmbăta Nouă I	33	x			x			
Seleuşu	36	x	x	x	x			
Şoarş	36+	x	x					
Văleni	2+	x						
Tăuteu	47	x	x	x	x			

Hoard	*Number of objects*	tools	weapons	ornament	ingots	vessel	wagon	horse
Căpuşu de Câmpie	40+	x	x	x	x			
Suatu	31	x	x	x				
Pir	35	x	x	x				
Corneşti	114	x	x	x	x	x		
Câţcău	5	x	x					
Jupalnic	22	x	x					
Ghirişu Român	31	x	x	x				
Sălard	56?	x		x	x		x	
Josani	48	x			x			
Giorocuta	6	x		x				
Porumbenii Mari	7?	x	x					
Henig	3	x		x				
Sărăţeni	4+?	x						
Boldeşti	9?	x						
Zagon I	45?	x	x	x		x		
Pănade	8+	x		x	x			
Hida	25	x	x					
Ţelna	9?	x						
Dacia	10	x	x					
Plăieşti	7?	x						
Bancu I	29	x	x					
Şieu II	14	x	x					
Arad	51	x	x	x	x			
Mileni	16	x	x					
Glod	11	x	x					
Groşii Ţibleşului	13+	x						
Oradea-Umgebung	2+	x						
Cămin	12+	x	x					
Zlatna II	11?	x	x					
Bârlad	5	x		x				

Fig. 15. Result of the correspondence analysis of hoards of the 'Jupalnic-Turia' an 'Moigrad-Tăuteu' phases (PAST 5.0).

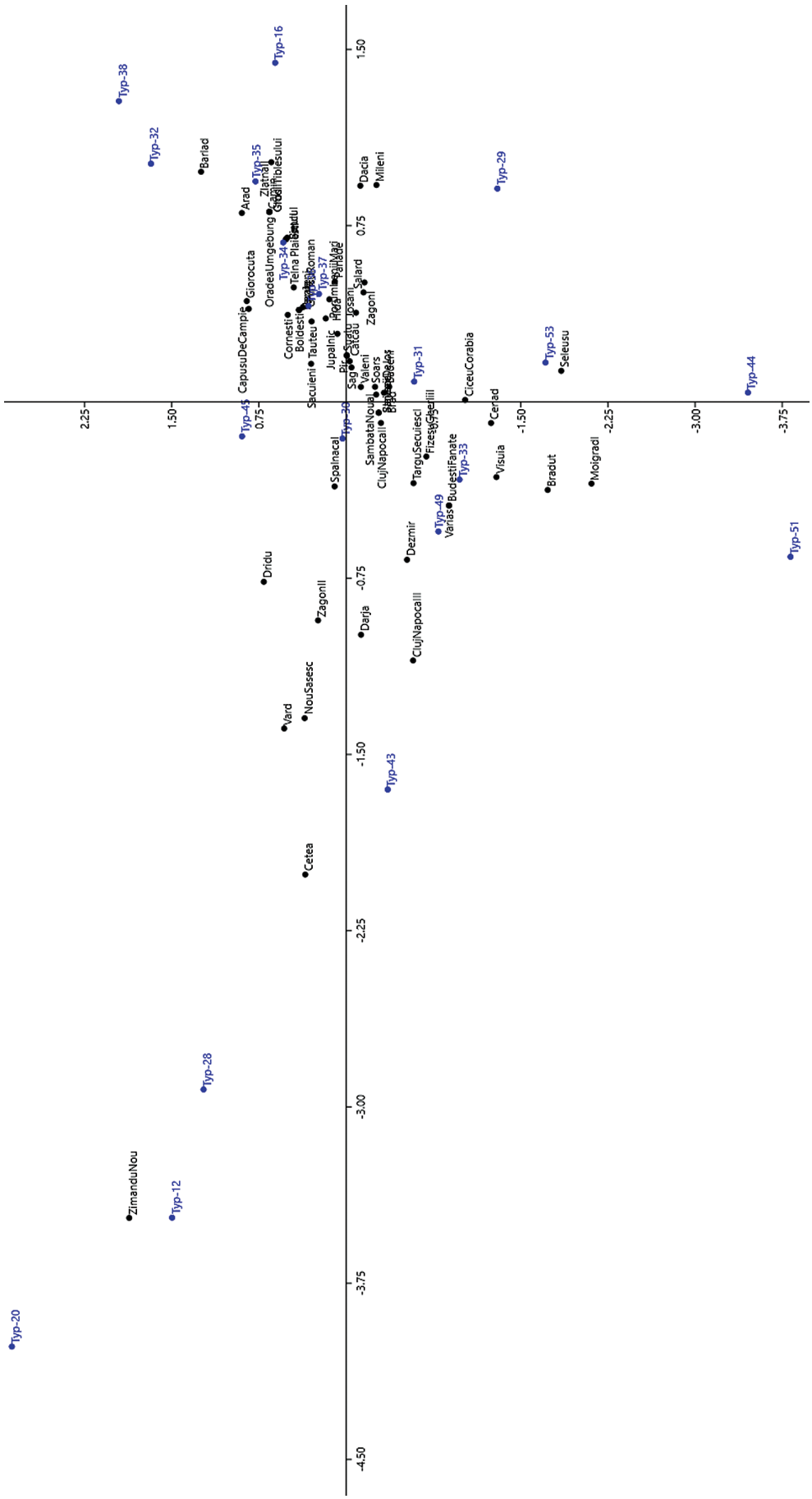


Fig. 16. Combination table of hoards of the 'Jupalnic-Turia' an 'Moigrad-Tăuteu' phases in the order established by the correspondence analysis, highlighting the main components of the finds.

References

Bergen C. 2005. *Technologische und kulturhistorische Studien zu Bleifunden im 1. Jahrtausend*. Universitätsforschungen zur Prähistorischen Archäologie 125. Verlag Dr. Rudolf Habelt GmbH. Bonn.

Blajer W. 2018. Some remarks on socketed axes of the Passau type. *Recherches Archéologiques Nouvelle Serie 10: 7–19*. https://doi.org/10.33547/rechacrac.ns10.01

Boroffka N., Nessel B., Prange M., Ciugudean H., and Takács M. 2016. Neues Licht auf alte Fragen – Einige besondere Metallobjekte aus dem Depotfund von Aiud, Kreis Alba, Rumänien. In M. Bartelheim, B. Horejs, and R. Krauss (eds.), *Von Baden bis Troia. Resourcennutzung, Metallurgie und Wissenstransfer. Eine Jubiläumsschrift für Ernst Pernicka*. Oriental and European Archaeology 3. Verlag Marie Leidorf GmbH. Leidorf: Rahden/Westf.: 339– 421.

Britton D. 1960. Great Britain. *Inventaria Archaeologia 8: 48–54*.

von Brunn W. A. 1958. Der Schatz von Frankleben und die mitteldeutschen Sichelfunde. *Prähistorische Zeitschrift 36: 1–70*. https://doi.org/10.1515/prhz.1958.36.1.1

1968. *Mitteldeutsche Hortfunde der jüngeren Bronzezeit*. Römisch-Germanische Forschungen 29. Walter de Gruyter. Berlin.

Ciugudean H., Luca S. A., and Georgescu A. 2006. *Depozitul de bronzuri de la Dipşa*. Bibliotheca Brukenthal V. Altip. Alba Iulia.

Ciugudean H. 2012. The chronology of the Gáva culture in Transylvania. In W. Blajer (ed.), *Peregrinationes Archaeologicae in Asia et Europa Joanni Chochorowski Dedicatae*. Instytut Archeologii Uniwersytetu Jagiellońskiego Wydawnictwo. Profil-Archeo. Kraków: 229–243.

Crişan I. H., Bărbulescu M., Chirilă E., Vasiliev V., and Winkler I. 1992. *Repertoriul arheologic al judeţului Cluj*. Bibliotheca Musei Napocensis 5. Institutul de Istorie şi Arheologie Cluj-Napoca. Cluj-Napoca.

Czajlik Z. 1996. Ein spätbronzezeitliches Halbfertigprodukt: Der Gußkuchen. Eine Untersuchung anhand von Funden aus Westungarn. *Archaeologia Austriaca 80: 165–180*.

Dietrich O. 2011. Zentralisierte Produktionsstrukturen? Überlegungen zur räumlichen Beziehung von bronzezeitlichen Gussformen und Fertigprodukten in Südosteuropa am Beispiel der rumänischen Tüllenbeile. *Marisia XXXI: 77–91*.

2014. Learning from 'scrap' about Late Bronze Age hoarding practices. A biographical approach to individual acts of dedication in large metal hoards. *European Journal of Archaeology 17(3): 468–486*. https://doi.org/10.1179/1461957114Y.0000000061

2021a. *Bronzezeitliche Tüllenbeile aus Rumänien. Studien zu Chronologie, Chorologie und Hortung*. PhD thesis. Dissertationen FU. Refubium Freie Universität Berlin. Berlin. http://dx.doi.org/10.17169/refubium-30761

2021b. in press. Aiud – Guşteriţa II – Şpălnaca II – Uioara de Sus. Gedanken zu den Formationsprozessen und der Interpretation von bronzezeitlichen Großhorten des südlichen Karpatenbeckens. *Dacia N. S. LXV*.

Dörfler G., Neuninger H., Pittioni R., and Siegl W. 1969. Zur Frage des Bleierz-Bergbaus während der jüngeren Urnenfelderkultur in den Ostalpen. *Archaeologia Austriaca 46: 68–98*.

Drescher H. 1978. Untersuchungen und Versuche zum Blei- und Zinnguß in Formen aus Stein, Lehm, Holz, Geweih und Metall. *Frühmittelalterliche Studien 12: 84–115*. https://doi.org/10.1515/9783110242119.84

Evans J. 1881. *Ancient bronze implements of Great Britain and Ireland*. Longmans, Green & Co. London.

Foltz E. 1980. Guss in verlorener Form mit Bleimodellen? *Archäologisches Korrespondenzblatt 10: 345–349*.

Goldmann K. 1981. Guss in verlorener Sandform – Das Hauptverfahren alteuropäischer Bronzegiesser? *Archäologisches Korrespondenzblatt 11: 109–116*.

Gowland W. 1901. The early Metallurgy of Silver and Lead. *Archaeologia 57(2): 359–422*. https://doi.org/10.1017/S0261340900014211

Greenacre M. 2017. *Correspondence analysis in practice*. Routledge. Boca Raton, London, New York.

Hammer Ø., Harper D. A. T., and Ryan P. D. 2001. PAST: Palaeontological Statistics Software Package for Education and data analysis. *Palaeontologia Electronica 4(1): 1–9*. https://palaeo-electronica.org/2001_1/past/past.pdf

Hansen S. 1994. *Studien zu den Metalldeponierungen während der älteren Urnenfelderzeit zwischen Rhônetal und Karpatenbecken*. Universitätsforschungen zur Prähistorischen Archäologie 5. Dr. Rudolf Habelt. Bonn 1994.

1996. Bemerkungen zur zeitlichen Stellung der Hortfunde des Typus Gyermely. *Archäologisches Korrespondenzblatt 26: 433–441*.

2019. Metalldeponierungen in Eurasien. Ein Phänomen der Langen Dauer, der Konjunkturen und der Ereignisse. In S. Hye, U. Töchterle (eds.), *UPIKU: TAUKE. Festschrift für Gerhard Tomedi zum 65. Geburtstag*. Universitätsforschungen zur Prähistorischen Archäologie 339. Dr. Rudolf Habelt GmbH. Bonn: 201–217.

László A. 1994. *Începuturile epocii fierului la est de Carpaţi. Culturile Gáva-Holihrady şi Corlăteni-Chişinău pe teritoriul Moldovei*. Bibliotheca Thracologica VI. Institutul Român de Tracologie. Bucharest.

Lawson A. J. 1979. A late bronze age hoard from West Caister, Norfolk. In C. Burgess, D. Coombs (eds.), *Bronze Age hoards. Some finds old and new*. BAR British Series 67. BAR Publishing. Oxford: 173–179.

Modl D. 2019. Recording plano-convex ingots (Gusskuchen) from Late Bronze Age Styria and Upper Austria – A short manual for the documentation of morphological and technological features from production and partition. In R. Turck, T. Stöllner, and G. Goldenberg (eds.), *Alpine Copper II – Alpenkupfer II. New results and perspectives on prehistoric copper production*. Der Anschnitt. Beiheft 42. Deutsches Bergbau-Museum Bochum. Bochum: 373–398.

Mozsolics A. 1984. Ein Beitrag zum Metallhandwerk der ungarischen Bronzezeit. *Berichte der Römisch-Germanischen Kommission 65: 19–72*.

Müller R. 2006. Investigation of a hill settlement from the Late Bronze Age at Várvölgy, Nagyláz-hegy (2003–2006). *Régészeti Kutatások Magyarországon 2006: 5–26*. https://archeodatabase.hnm.hu/hu/download/2607/file/e85e506d-015d-41fd-a775-fc4a2d32d7c9?type=pdf

Müller J., Zimmermann A. (eds.) 1997. *Archäologie und Korrespondenzanalyse. Beispiele, Fragen, Perspektiven*. Internationale Archäologie 23. Verlag Marie Leidorf. Espelkamp.

Müller-Karpe H. 1959. *Beiträge zur Chronologie der Urnenfelderzeit nördlich und südlich der Alpen*. Römisch-Germanische Forschungen 22. Walter de Gruyter. Berlin.

Müller-Scheeßel N. 2008. Korrespondenzanalyse und verwandte Verfahren. In M. K. H. Eggert (ed.), *Prähistorische Archäologie: Konzepte und Methoden*. Narr Francke Attempto Verlag. Tübingen, Basel: 219–239.

Needham S. P., Hook D. R. 1988. Lead and lead alloys in the Bronze Age. In E. A. Slater, J. O. Tate (eds.), *Science and Archaeology. Symposium Glasgow 1987*. BAR British Series 195. BAR Publishing. Oxford: 259–274.

Nessel B. 2014. Bronze Age portioning of raw metal – concepts, patterns and meaning of casting cakes. *Apulum 51: 401–416*.

2019. *Der bronzezeitliche Metallhandwerker im Spiegel der archäologischen Quellen*. Universitätsforschungen zur Prähistorischen Archäologie 344. Dr. Rudolf Habelt GmbH. Bonn.

Pankau C. 2004. *Die älterhallstattzeitliche Keramik aus Mediaş/Siebenbürgen*. Universitätsforschungen zur Prähistorischen Archäologie 109. Dr. Rudolf Habelt GmbH. Bonn.

Petrescu-Dîmboviţa M. 1944–1948. Depozitul de bronzuri de la Bîrsana (Maramureş). *Anuarul Institutului de Studii Clasice 5: 264–281*.

1977. *Depozitele de bronzuri din România*. Editura Academiei Bucharest.

1978. *Die Sicheln in Rumänien mit Corpus der jung- und spätbronzezeitlichen Horte Rumäniens*. Prähistorische Bronzefunde XVIII, 1. C. H. Beck Verlagsbuchhandlung. München.

1988. *Der Arm- und Beinschmuck in Rumänien*. Prähistorische Bronzefunde X, 4. Steiner. Stuttgart.

Popescu D. 1964. Săpăturile arheologice din Republica Populară Romînă în anul 1963. *Studii şi Cercetări de Istorie Veche 15(4): 551–580*.

Reissenberger L. 1872. Der neueste archäologische Fund bei Hammersdorf. *Archiv des Vereins für Siebenbürgische Landeskunde 10: 8–37*.

Rusu M. 1972. *Metalurgia bronzului din Transilvania la începutul Hallstattului*. Unpublished PhD thesis. Universitatea "Al. I. Cuza". Iaşi.

1977a. Dezmir, Kr. Cluj, Rumänien. *Inventaria Archaeologica Rumänien 10: R 65a-d*.

1977b. Dîrja, Kr. Cluj, Rumänien. *Inventaria Archaeologica Rumänien 10: R 66a-d*.

Siegmund F. 2015. *Gewußt wie: Praxisleitfaden Seriation und Korrespondenzanalyse in der Archäologie*. Eigenverlag. Norderstedt.

Sommerfeld C. 1994. *Gerätegeld Sichel. Studien zur monetären Struktur bronzezeitlicher Horte im nördlichen Mitteleuropa*. Vorgeschichtliche Forschungen 19. Walter de Gruyter. Berlin, New York.

Soroceanu T., Rezi B., and Németh R. E. 2017. *Der Bronzedepotfund von Bandul de Câmpie, jud. Mureş*. Universitätsforschungen zur Prähistorischen Archäologie 307. Dr. Rudolf Habelt GmbH. Bonn.

Tarbay J. G. 2015. The reanalysis of the eponymous hoard from Gyermely-Szomor and the Ha A2 period in the territory of Hungary. In R. E. Németh, B. Rezi (eds.), *Bronze Age Chronology in the Carpathian Basin*. Editura Mega. Târgu Mureş: 311–371.

Tylecote R. F. 1962. *Metallurgy in archaeology. A prehistory of metallurgy in the British Isles*. Taylor & Francis. London.

Vachta T. 2016. Thesaurierungsprozesse bronzezeitlicher Hortfunde anhand ihrer Kompositionselemente. In S. Hansen, D. Neumann, and T. Vachta (eds.), *Raum, Gabe und Erinnerung: Weihgaben und Heiligtümer in prähistorischen und antiken Gesellschaften*. Edition Topoi. Berlin: 93–117.

Vasiliev V., Aldea I. A., and Ciugudean H. 1991. *Civilisaţia dacică timpurie în aria intracarpatică a României. Contribuţii arheologice: Aşezarea fortificată de la Teleac*. Editura Dacia. Cluj-Napoca.

Vulpe A. 1970. *Die Äxte und Beile in Rumänien I*. Prähistorische Bronzefunde IX, 2. C. H. Beck'sche Verlagsbuchhandlung. München.

Zaharia E. 1965. Remarques sur le Hallstatt ancien de Transylvanie. Fouilles et trouvailles de Mediaş 1958. *Dacia N.S. IX: 83–104*.