# ACTA TERRAE SEPTEMCASTRENSIS

## XIII, 2014

**"LUCIAN BLAGA" UNIVERSITY OF SIBIU**
**FACULTY OF SOCIAL SCIENCES**
**INSTITUTE FOR THE STUDY AND PROMOTION OF THE TRANSYLVANIAN PATRIMONY IN EUROPEAN CONTEXT**

# ACTA TERRAE

# SEPTEMCASTRENSIS

# XIII

Editor: Sabin Adrian LUCA

**Sibiu, 2014**

***ISSN 1583-1817***

**Contact adress: „Lucian Blaga" University of Sibiu, Faculty of History and Patrimony, *Institute for the Study and Promotion of the Transylvanian Patrimony in European context,* B-dul Victoriei Nr. 5-7, 550024 Sibiu, România; tel. / fax. 0269 / 214468; 0745 / 366606; e-mail: sabinadrian.luca@ulbsibiu.ro, ins.arheologie@ulbsibiu.ro; web: http://arheologie.ulbsibiu.ro.**

## Content

**Anamaria TUDORIE,** SOME CONSIDERATIONS REGARDING THE ORNAMENTATION OF STARČEVO-CRIȘ POTTERY FROM CRISTIAN I (SIBIU COUNTY)…….. 7

**Georgeta EL SUSI**, A SURVEY ON FAUNAL REMAINS FROM CRISTIAN I (SIBIU COUNTY) ..... 23

**Gheorghe LAZAROVICI, Sabin Adrian LUCA, Gheorghe NATEA, Cosmin SUCIU, Mihai CĂSTĂIAN,** TURDAȘ, C SECTOR, RECONSTRUCTION OF FEATURE OR ST 29 BASED ON ETHNO-ARCHEOLOGICAL STUDIES …. 73

**Victor SAVA**, EARLY COPPER ARTIFACTS IN THE AREA OF THE LOWER MUREŞ AND CRIŞUL ALB VALLEYS…….…….……...….113

**Raymond Whitlow Valerii Kavruk Buzea Dan-Lucian Björn Briewig,** GEOGRAPHIC INFORMATION SYSTEMS (GIS) METHODS FOR LANDSCAPE RESEARCH AT PĂULENI-CIUC "DAMBUL CETĂŢII" (JUD. HARGHITA).....149

,

**Gabriel SICOE,** EINIGE MITHRAS-RELIEFS AUS DEM NATIONALEN BRUKENTHAL MUSEUM IM LICHTE NEUER IKONOGRAPHISCHEN ERKENNTNISSE .....169

# EARLY COPPER ARTIFACTS IN THE AREA OF THE LOWER MUREŞ AND CRIŞUL ALB VALLEYS

**Victor Sava**
Arad Museum
sava_vic@yahoo.com

***Abstract:*** *Just like the majority of the micro-zones in the Carpathian Basin, the Lower Mureş Valley and the Crişul Alb Valley follow the pattern of onset and development of the first metal objects. The first artifacts made of copper have been identified, in the area under study, at the peak of the Tisa-type manifestations. The number of such discoveries increases constantly until the arrival of Bodrogkeresztúr pottery and of the "Scheibenhenkel" pottery. The chronological horizon specific to the Cernavodă III-Boleráz pottery is characterized by the complete disappearance of artifacts made of metal. One can easily note, nevertheless, that with the end of the Coţofeni manifestations, metallurgy grew momentum again. The present study represents a general overview of the first artifacts made of copper in the Lower Mureş area and that of Crişul Alb.*
***Keywords:*** *Lower Mureş, Crişul Alb, copper, Neolithic, Eneolithic*
***Rezumat:*** *La fel ca în majoritatea microzonelor din bazinul carpatic, văile Mureşului Inferior şi Crişului alb urmăresc tiparul de apariţie şi dezvoltare a primelor obiecte din metal. Primele obiecte din cupru au fost identificate, în aria noastră de studiu la apogeul de dezvoltare a manifestărilor de tip Tisa, Numărul descoperirilor de acest fel a crescut constant, până la apariţia ceramicii Bodrogkeresztúr şi "Scheibenhenkel". Orizontul cronologic specific pentru ceramica Cernavodă III-Boleráz e caracterizat prin dispariţia totală a obiectelor de metal. Se poate lesne observa totuşi că, la sfârşitul culturii Coţofeni, metalurgia a crescut din nou. Studiul de faţă reprezintă o privire de ansamblu asupra primelor artefacte din cupru în bazinul Mureşului Inferior şi cel al Crişului Alb.*
***Cuvinte cheie:*** *Mureşul inferior, Crişul Alb, cupru, Neolitic, eneolitic*

## Introduction

The use of metal represents one of the significant technological innovations in human society. The success of this material largely depended on two of its properties: the fact that it could be reused and the fact that it could be transformed (Hansen 2009, 140; Hansen 2011, 137). One must also mention the fact that the spread of artifacts made of metal, superior to those made of stone or perishable materials, has triggered major social changes in the prehistoric communities.

In the present study I will present and discuss the earliest artifacts made of copper discovered in the Lower Mureş and Crişul Alb area. Through the term of Lower Mureş I envisage the corridor of River Mureş between the place where it

enters the plain (in the area of the settlement of Lipova) and the spot where it flows into River Tisa, near the settlement of Szeged. Besides the artifacts discovered between the two above mentioned settlements, I have decided to include also those found on the mountainous corridor of the Mureş until the settlement of Deva, in order to provide as a complete and coherent picture of the discoveries on the Lower Mureş as possible. From a chronological perspective, the debate makes reference to the earliest copper artifacts discovered in Neolithic and Eneolithic contexts.

**The development of copper metallurgy**

Discoveries that attest the use of copper for jewelry items have been dated even since the middle of the eleventh millennium B.C. Beads made of malachite have been discovered in the cave in Shanidar (Iraq) (Solecki 1974; Gulmac 1991, 197; Solecki *et al*. 2004). The first proof for the processing of copper artifacts through annealing is known from the ninth millennium B.C. from Çayönü Tepesi (Turkey) (Madin *et al*. 1999; Özdoğan, Özdoğan 1999, 15). Small objects made of native copper (beads, awls, or pins) started to spread on sites such as those in Çayönü Tepesi (Cambel 1974, 361-377; Muhly 1989; Mohen 1990, 49-50; Maddin *et al.* 1991) and Aşikli Höyük (Esin 1999) during the eighth millennium B.C. During the seventh millennium B.C. one finds copper items on sites such as those in Maghzaliyeh (Irak) (Müller-Karpe 1991), Ali Kosh (Iran) (Smith 1969), and Tell Ramad (Syria) (Lanord, Contenson 1973).

With the start of the sixth and fifth millennia B.C., copper artifacts spread in the Balkan Peninsula and in the Carpathian Basin (Kalicz 1992, 12-13; for the present-day territory of Romania see the discussion of the copper items in Neolithic contexts in Comşa 1974; see in Borić 2009, footnote 1, an enumeration of sites dated to the early Neolithic in which copper items or primary materials have been discovered). Among the oldest items of the kind one can mention the needle discovered by N. Vlassa in Balomir (Vlassa 1967, 403, Fig. 6; Vlassa 1969, 513-519, Abb. 6; Horedt 1976, 174, 176, Abb. 1°). Other Starčevo-Criş sites where copper objects have been found are Lepenski Vir IIIa-IIIb (Jacanović, Šljivar 1998, 189; Antonović 2002, 33), Divostin (Gulmac 1991, 146; Antonović 2002, 33), or Zmajevac (Antonović 2002, 33; Jacanović, Šljivar 1998, 189). Other artifacts of this early chronological horizon, made of copper, have been identified in Iernut (Vlassa 1976, 119) and Cuina Turcului. Some researchers have contested the inclusion of the latter two discoveries in the Starčevo-Criş horizon (Luca *et al.* 2000, 38-39, 48).

More discoveries can be mentioned for the subsequent chronological stage, despite the fact that they did not increase significantly in numbers. Such artifacts can be mentioned from the settlement in Neszmély that belongs to the Zelis-type discoveries (Bognár-Kutzián 1963, 333-334, 485, 499, 536), but also in some of the tombs from Csongrád "Bokrospuszta" (Hegedus 1983, 30, footnote 62, Fig. 15) and Csanytelek "Újhalastó" (Hegedus 1983, 25, Fig. 8-9) (both sites belong to the transition phase from Szakálhát to Tisa). For the early Vinča on the territory of Romania, a hook came up in level Ia in the Vinča settlement, phase A in Gornea

(Lazarovici 1970, 477; Lazarovici 1977a, 54; Lazarovici 1979, 87; Mareş 2002, 236, pt. 1046-1047; Suciu 2009, 193), while, as indirect evidence of the use of copper, one can mention one bone with depositions of copper oxide. One loop and one bone with copper oxides discovered in Liubcova "Orniţa" belong to phase A (Comşa 1974, 77, pt. 13; Lazarovici 1979, 87; Suciu 2009, 193). In this context, one should mention one hook discovered in settlement B from Verbicioara (Mareş 2002, 334, pt. 1716; Suciu 2009, 193) and one awl from Limba "Vărăria" (Suciu 2009, 193); both items have been associated to Vinča, phase B2.

With the last stage of the Neolithic, the number of artifacts made of metal increases, while the types become more diverse. In this context one can mention the Lengyel I settlement in Mlynarce (Novotny 1958, 28; Bognár-Kutzián 1976, 70) and the rich cemetery in Zegővárkony (Dombay 1960, 76, 86, 88, 123, 125, 134, 136-138, Pl. V/2; XXXIV/18-19; XLI/10; XLII/6-8; LXIV/11-20; LXV/18-20; LXXI/9; LXXIII/2-4; LXXIV/6-9, 11, 13), from the same chronological stage. Another site worth mentioning is that in Polgár "Csőszhalom" (Raczky *et al*. 1996), where specialists have discovered an impressive number of beads. Inside a pit that was part of dwelling no. 9 they have identified 259 copper beads. The sites in Berettyóújfalu "Herpály" (Korek, Patay 1956, 42, Pl. IV/8; Kalicz, Raczky 1984, 128; Kalicz, Raczky 1987, 122) and Berettyószentmárton (Bognár-Kutzián 1963, 336-337) are also worth mentioning in this context.

There is conclusive evidence for the practice of copper metallurgy in the Balkan Peninsula on Vinča sites (a recent abstract of the topic can be found in Radivojević *et al*. 2010). To the present state of research, one can mention that the extraction of copper was performed in areas such as Ai Bunar (Bulgaria) (Černych 1978) or Rudna Glava (Serbia) (Jovanović 1971; Jovanović 1972; Jovanović 1982). On the basis of the discovery of five deposits of vessels in the mine in Rudna Glava, archaeologists were able to date the entire complex (Borić 2009, 194) to the Gradac phase of the Vinča Culture (Jovanović 1990, 33; Gulmac 1991, 293; Jovanović 1994, 2; Jovanović 2006, 221). Despite all these facts, the new radiometric researches indicate that the mine in Rudna Glava started to be used around 5400/5350 B.C.; in the Gradac phase one notes an intensification of activity, while around 4650 B.C. the mine ceased to be used (Borić 2009, 205-206, Tb. 2).

On the basis of M. M. Vasić's notes, D. Antonović demonstrated that the tell in Vinča contains elements that indicate the processing of copper in all levels (Antonović 2002; Antonović 2006). According to Vasić's journal, copper beads and pendants were discovered besides the numerous pieces of malachite (one of the theories, invalidated by recent discoveries, on the use of malachite in the framework of Vinča manifestations, was that postulated by Chapman 1981, who stated that the malachite was used in the decoration of the human body). Malachite was identified in all levels, even in complexes dug into the archaeological sterile (at a depth of 10.25 m). The Vinča-type manifestations also include sites with discoveries that have been connected to copper metallurgy. Among them one can mention Gornja Tuzla, where a mold fragment has been discovered; and Grivac, where a mold made

of sandstone has been brought to the light from the layer corresponding to the Vinča-Pločnik I (Vinča B2-C) horizon (Antonović 2002, 39).

One of the most interesting Vinča sites that can be connected to copper metallurgy is the one in Belovode. From a chronological perspective, this site started its existence in the first part of the Vinča manifestations (phase A-B2) (Jacanović, Šljivar 1998, 189; Šljivar 2006, 95-100; Šljivar *et al.* 2006, 251). Among the clearest proofs of metallurgy there is a mold fragment, made of clay, used in the casting of chisels, discovered in level Belovode D (Vinča B2). The same level has revealed a stone mallet used for braking down the ore, with very good analogies in Rudna Glava (Jovanović 1971, Pl. VI/3; Jovanović 1992, Fig. 1, 2). In the same site, in Belovode, levels B-D (Vinča A-B2) have revealed elements from certain installations for the reduction of copper ore (Šljivar *et al*. 2006, 252-254, Pl. II/3-5). From the perspective of absolute chronology, the occupation of the site in Belovode took place around 5350 B.C. and the end of Vinća habitation has been established around 4650 B.C. (Borić 2009, 209).

Four deposits of copper-made objects have been identified in Pločnik. The four depositions consist of 34 artifacts (four axes with socketing hole, 25 chisels, four bracelets, and one pin), weighing a total of 16.034 kg (Šljivar 2006, 100-103; Šljivar *et al.* 2006, 254-255). Besides these 34 objects, three more copper chisels were discovered during new researches (Šljivar 1996; Šljivar *et al.* 2006, 255). From a stratigraphic perspective, al the mentioned artifacts from Pločnik were discovered between the depth of 0.80 and 1.10 m, a layer that belongs to the Gradac phase (Vinča B2) (Šljivar 1996, 97; Šljivar *et al.* 2006, 257). Due to the new radiometric measurements, specialists were able to establish that Vinča habitation in Pločnik started during the 5290-5140 B.C. interval and that Vinča habitation ended sometime around 4650 B.C. (Borić 2009, 211). Unfortunately, both samples that date the level of the so-called deposits from Pločnik have been contaminated and their absolute chronology cannot be established.

The numerous discoveries of copper items that belong to the horizon with Tiszapolgár pottery (Bognár-Kutzián 1972; 138-145; 197-201; Diaconescu 2009, 162-179) support the statement that this stage can be characterized by a qualitative and quantitative jump forward in the field of copper metallurgy (Vulpe 1973, 220-221). Discoveries of copper objects also appear in the final Petrești phases in Noşlac (Vlassa 1967, 420-421, Fig. 14/1-2; Vlassa 1976, 138-139, Fig. 14/1-2), Caţa (Roska 1942, 116, Fig. 142), Ghirbom (Aldea 1979, 25-29), and Turdaş (Luca 2001, Fig. 3/4). Massive axes with socketing hole appeared and spread during this chronological stage and copper items are evenly distributed throughout the entire Carpathian Basin.

Despite the fact that numerous copper artifacts are known, there is little proof of how they were made. Traces of copper processing have been identified on sites such as Lucska (Bognár-Kutzián 1976, 74), where traces of melted metal were noted inside several pottery vessels. The funerary inventory of tomb no. 2 in Tiszapolgár "Drumul Hajdunánás" (Bognár-Kutzián 1972, 98, 164) consisted of a

crucible covered in a layer of copper oxide and two small fragments of copper. Another crucible was discovered in a tomb from Tibava (Andel 1958, Pl. 1/7; Bognár-Kutzián 1976, 74).

An even larger affluence of copper artifacts can be observed with the onset of Bodrogkeresztúr-type discoveries (Luca 1999, 56-57). Axes with socketing hole, such as those of the Jászladány or Mezőkeresztes type, started to spread during that period. As for the previous horizon, there is little proof of how metal artifacts were made. Among such evidence one can mention half-processed copper lumps, such as ingots. Such artifacts are part of the composition of the deposition in Szeged "Szillér" (Pulszky 1881, 1, Pl. 1/1; Pulszky 1884, 23, Pl. 2; Roska 1942a, 51-52; Patay 1943, Pl. 50/12; Patay 1984, Pl. 68/2A). Another example, along the same idea, is the discovery of a half-processed copper piece in a female tomb in Tiszapolgár "Basatanya" (Bognár-Kutzián 1963, 335, Pl. LXIII/15).

The Cernavodă III-Boleráz horizon represents the turning point in copper metallurgy; at this horizon, the number of discovered items drops drastically (Vulpe 1974, 245). A series of researchers, such as A. Vulpe (Vulpe 1973, 235), Z. M. Virág (Virág 2003, 132), I. Nestor (Nestor 1954, 98), B. Jovanović (Jovanović 1991, 98), J. Makkay (Makkay 1996, 42) attempted to provide certain explanations for this phenomenon. Contrary to the opinion of the above mentioned authors, P. D. Gulmac stated that the lack of metal discoveries during this horizon is due to the stage of the art and to the strategy of research (Gulmac 1991, 332-333. Hansen shares the same opinion: Hansen 2011, 137, 145).

Towards the end of the Baden and Coţofeni manifestations, the copper metallurgy was reinvigorated. Stage Coţofeni III experienced a spread and diversification of copper objects; one finds different types of daggers, tools, and jewelry items (Ciugudean 2002). To the same Coţofeni stage one can also attribute remains of some metallurgic workshops in Băile Herculane, Cuptoare "Piatra Ilişovei", and Moldova Veche (Ciugudean 2002, 101). In this context one must mention a case of radiocarbon dating (OxA-14676) in Rudna Glava, performed on a sample from shaft no. 10, that can be included in the 2910-2880 B.C. interval, that can be contemporaneous to the Kostolac and Coţofeni manifestations (Borić 2009, 198).

Some discoveries made in the Baden cultural environment bring data on the metallurgy of that period. The site of Novacka Cuprija, near the city of Smederevska Palanka, is known through the discovery of a small piece of copper-arsenic slag (Gulmac 1991, 327-328). Thirteen mold fragments have been discovered in Salos; the settlement belongs both to the classical and the late Baden phase (Gulmac 1991, 330-331). Another element that attests the practice of metallurgy was found in Okukalj, where a crucible was revealed near a hearth (Gulmac 1991, 331). Other crucibles have been identified on the sites in Lanycsok, Zok, and Slepcany (Gulmac 1991, 331). A crucible similar to the one in Lanycsok was recently discovered in the settlement in Balatonőszöd "Temetői dűlő" (Horváth T. 2008, 76-77, Fig. 12/1). Besides the mentioned crucible, a copper owl,

rectangular in section, can also be attributed to the Boleráz phase of this settlement; one must mention that this item from Balatonőszöd was found in a complex that belongs to the Boleráz phase.

**Repertory of copper artifacts in the Lower Mureş and Crişul Alb area**

In order to present the discoveries in a clear and concise manner I have chosen to design the repertory according to ten fields (the model of the present repertory was taken from Gogâltan 1999): 1. Settlement name; 2. Type of discovery; 3. Geographical location of the discovery; 4. The character of the discovery; 5. Description of the discovery; 6. History of research; 7. Place where the materials are kept; 8. Cultural belonging; 9. Bibliography; 10. Observations.

*Discoveries of the Tisa chronological horizon*

1. 1. **Čoka**, "Kremenyák", city of Čoka, county of Vojvodina, Serbia; 2. Tell; 3. Natural levee; 4. Systematic excavations, K. Gubitza, 1904; E. Orosz, 1906; F. Móra, 1907-1913; 5. Fourteen malachite beads and two hematite bars were identified during F. Móra's 1908 excavations. P. Gulmac mentions a bracelet fragment also discovered there; 6. T. Baranovački, 1863; 7. National Museum in Belgrad; Ferenc Móra Muzeum, Szeged, Inv. No. 224-250; 8. Tisa-type discovery; 9. Banner 1960, 18; Gulmac 1991, 264.

2. 1. **Hódmezővásárhely**, "Gorzsa", city of Hódmezővásárhely, county of Csongrád, Hungary; 2. Tell; settlement; necropolis; 3. The tell is located on a 4-5 m elevation; possibly an island; 4. Rescue excavations, E. Zalotay, 1953; Gy. Gazdapusztai, 1955-1956; Systematic excavation Gy. Gazdapusztai, 1957, 1963; F. Horváth, 1978-1996; 5. Gazdapusztai's excavation has revealed three copper bracelets, one discovered inside the settlement and two in tomb no. 2. Horváth's excavations complete the copper discoveries through the identification of some beads and bracelets, part of funerary inventories; 6. G. Tompa, 1952; 7. Ferenc Móra Muzeum Szeged; 8. Tisa-type discovery; Proto-Tiszapolgártype discovery?; 9. Gazdapusztai 1963, 47, pl. IV/1-3; Horváth 1987, fig. 38; 10. The exact number of copper items discovered through Horváth's excavation is not known.

3. 1. **Hódmezővásárhely**, "Kopáncs-Kökénydomb", city of Hódmezővásárhely, county of Csongrád, Hungary; 2. Tell; 3. Natural levee; 4. Stray find; 5. In the collection of the museum in Hódmezővásárhely, I. Bognár-Kutzián discovered a copper bracelet; 6. I. Bognár-Kutzián, 1963; 7. Tornyai János Museum, Hódmezővásárhely; 8. Tisa-type discovery; 9. Bognár-Kutzián 1963, 333, 336; Bognár-Kutzián 1976, 70.

*Discoveries of the Tiszapolgár chronological horizon*

1. 1. **Čoka**, "Kremenyák", city of Čoka, county of Vojvodina, Serbia; 2. Tell; settlement; 3. Natural levee; 4. Discovered during the 1910 systematic excavations, at a depth of 1.60 m; 5. Hammer-axe, type Čoka; L:17.6 cm; G: 340 g; 6. F. Móra, 1910; 7. Ferenc Móra Muzeum Szeged; 8. Tiszapolgár-type discovery; 9. Childe

1929, 75, pl. 38; Roska 1942a, 31, pl. 29; Banner 1960, 19, 34, pl. LVII/1; Bognár-Kutzián 1972, 140, fig. 26; Patay 1984, 8, 6, 100, no. 585; taf. 55/585.

2. 1. **Deszk**, "Kovács tanya", municipality of Deszk, county of Csongrád, Hungary; 2. Necropolis; 3. Low terrace; 4. Systematic excavation, F. Móra, 1930, 1931; 5. Deszk A. Tomb no. 4: a. loop (Bognár-Kutzián 1972, pl. XXXIII/7), b-c. two rings; Ø:1.7 × 2.1 cm (Bognár-Kutzián 1972, pl. XXXIII/8), d-v. 20 beads (Bognár-Kutzián 1972, pl. XXXIII/6). Tomb no. 8: a. one bead. Tomb no. 9: a. one ring; Ø:2.2 × 1.8 cm. Deszk B. Tomb no. 4: a. bracelets with overlapping and slightly rounded ends, with thick bard and circular section (Bognár-Kutzián 1972, pl. XXXIV/1), b. bracelet with open, sharp ends, thin bar, circular section (Bognár-Kutzián 1972, pl. XXXIV/3). Tomb no. 8: a. bracelet with overlapping ends, thick bar, circular section (Bognár-Kutzián 1972, pl. XXXIV/4), b. bracelet destroyed during recovery. Tomb no. 11: a. bracelet with overlapping ends, thick bar, round in section (Bognár-Kutzián 1972, pl. XXXIV/5); 6. F. Móra, 1930; 7. Ferenc Móra Muzeum Szeged; 8. Tiszapolgár-type discovery; 9. Bognár-Kutzián 1963, 420-421; Bognár-Kutzián 1972, 22-34, pt. 213, pl. XXXIII/6-9; XXXIV/1, 3-5.

3. 1. **Hódmezővásárhely**, "Népkert", city of Hódmezővásárhely, county of Csongrád, Hungary; 2. Necropolis; 3. Terrace; 4. Archaeological test trench, Gy. Gazdapusztai, 1963; rescue excavation K. Nagy, 1965; 5. Tomb no. 1: a-b. two beads, very oxidized (Bognár-Kutzián 1972, pl. XXXV/4). Tomb no. 2: a. bracelet with overlapping ends and bar lozenge-shaped in section; Ø: 6.6 × 5.8 cm, $Ø_{bar}$: 0.3/0.4 cm (Bognár-Kutzián 1972, pl. XXXV/5), b. bracelet with open ends and bar triangular in section; Ø: 7.7 × 6.5 cm, $Ø_{bar}$: 0.75 × 0.45 cm (Bognár-Kutzián 1972, pl. XXXV/3). Tomb no. 3: a. pluri-spiral bracelet, made of flat bar; Ø: 4.5 × 5.6 cm; $l_{band}$: 0.9 cm (Bognár-Kutzián 1972, pl. XXXV/2). Tomb no. 4: a. bracelet with overlapping ends, thick bar, rectangular in section; Ø: 5 × 5.7 cm (Bognár-Kutzián 1972, pl. XXXV/1); 6. Gy. Gazdapusztai, 1963; 7. -; 8. Tiszapolgár-type discovery; 9. Bognár-Kutzián 1972, 44-47, pt. 202, pl. XXXV/1-5.

4. 1. **Hódmezővásárhely**, "Szakálhát - Bakay tanya", city of Hódmezővásárhely, county of Csongrád, Hungary; 2. Isolated tomb; 3. Natural levee; 4. Systematic excavation, J. Banner, 1934, 1935; 5. The tomb contained two rings, that seem to have been placed on a necklace; Ø: 4.3 × 4.7 cm, respectively Ø: 4.6 × 4.6 cm, $Ø_{bar}$: 0.3 cm; 6. J. Banner, 1934; 7. -; 8. Tisa Tiszapolgár-type discovery; 9. Bognár-Kutzián 1972, 47-51, pt. 199.

5. 1. **Lipova**, city of Lipova, Arad County, Romania; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Hammer-axe, Pločnik-type; 6. E. Vulpe, 1930; 7. -; 8. Tiszapolgár-type discovery; 9. Roska 1942, 146, pt. 30; Roska 1942a, 40, pt. 100; Vulpe 1975, 20, pt. 16, pl. 2/16; Lazarovici 1975, 28, list 4, pt. 20; Mareş 2002, 258-59, pt. 1223, pl. 12/3; Diaconescu 2009, 182, pt. 3.

*Discoveries of the Bodrogkeresztúr and Disk-Handles chronological horizon*

Deposits

1. 1. **Szeged**, "Szillér", city of Szeged, county of Csongrád, Hungary; 2. Deposit; 3. Terrace; 4. Stray find; 5. a. chisel; L: 11.4 cm, l: 1.7 cm, g: 1.5 cm; G: 160 g (Pulszky 1881, 1, pl. 1/1b; Pulszky 1884, 23, pl. 1b; Roska 1942a, 51-52; Patay 1943, pl. 50/10; Patay 1984, 21, pt. 10, pl. 1/10), b. piercer (Pulszky 1881, 1, pl. 1/1; Pulszky 1884, 23, pl. 1b; Roska 1942a, 51-52; Patay 1943, pl. 50/9; Patay 1984, pl. 68/4A), c. Flat axe of the Szakálhat-type, Sălacea variant; L: 17.4 cm; l: 6.1 cm; g: 1.3 cm; G: 485 g (Pulszky 1881, 1, pl. 1/1; Pulszky 1884, 23, pl. 1; Roska 1942a, 51-52; Patay 1943, pl. 50/1; Patay 1984, 21, pt. 31, pl. 2/31), d. axe-adze of the Jászladány-type, Brad variant; L: 28.8 cm; G: 1310 g (Pulszky 1881, 1, pl. 1/3; Pulszky 1884, 23, pl. 3; Roska 1942a, 51-52; Patay 1943, pl. 50/2; Patay 1984, 79, pt. 424, pl. 42/424), e. axe-adze of the Jászladány-type, undetermined variant; the pick arm was broken and the item was used as a hammer – it is possible that the item was part of the deposition; L: 11.9 cm, G: 410 g (Roska 1942a, 51-52; Patay 1943, pl. 50/13; Patay 1984, 82, pt. 456, pl. 45/456), f. axe-adze of the Jászladány-type, undetermined variant; both arms have been broken and the item was used as a hammer; L: 9.6 cm; G: 550 g (Pulszky 1881, 1, pl. 1/1; Pulszky 1884, 23, pl. 1; Nagy 1913, 307, pl. 4/13; Roska 1942a, 51-52; Patay 1943, pl. 50/11; Patay 1984, 83, pt. 466, pl. 46/466), g. piece of copper (Pulszky 1881, 1, pl. 1/1; Pulszky 1884, 23, pl. 2; Roska 1942a, 51-52; Patay 1943, pl. 50/12; Patay 1984, pl. 68/2A); 6. Second half of the nineteenth century (1881?); 7. Magyar Nemzeti Múzeum, Budapest, Inv. No. 2/1884; 8. Bodrogkeresztúr-type discovery; 9. Pulszky 1881, 1, pl. 1; Pulszky 1884, 23; Roska 1942a, 51-52; Patay 1943, pl. 50; Patay 1984, pl. 68/A.

Stray finds

Flat axe of the Szakálhat type, special variant

2. 1. **Hódmezővásárhely**, "Szakálhát-Bakay tanya", city of Hódmezővásárhely, county of Csongrád, Hungary; 2. Necropolis; 3. Natural levee; 4. Systematic excavations J. Banner, A. Bálint, 1934; 5. A flat axe of the Szakálhat type, special variant, was found in tomb no. 2 besides three vessels; 6. J. Banner, A. Bálint, 1934; 7. Tornyai János Museum, Hódmezővásárhely; Inv. No. 4386/34; 8. Bodrogkeresztúr-type discovery; 9. Banner, Bálint 1935, 86, 95, fig. 5/7; Patay 1958, 149, pl. 4; Patay 1984, 26, pt. 42, pl. 3/42; 10. On the same spot specialists have also found six awls and awl fragments (Banner, Bálint 1935, fig. 5/1-6, 8), made of copper, but also a piece of copper plate?; all of these elements lack a context and thus the dating remains uncertain; one must state that a settlement dated to the end of the Bronze Age (B2-C) was also found there. It is thus possible that at least some of them belonged to the Bronze Age settlement.

Hammer-axe, Agnița-type

3. 1. **"Békés"**, county of Békés, Hungary; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Hammer-axe, Agnița-type; the upper art is slightly corroded;

L: 12.4 cm; G: 246 g; 6. P. Patay, 1984; 7. -; 8. Bodrogkeresztúr-type discovery; 9. Patay 1984, 60-61, no. 275, Taf. 24/275.

4. 1. **Hódmezővásárhely**, "Kopáncs", city of Hódmezővásárhely, county of Csongrád, Hungary; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Hammer-axe, Agnița-type; L: 18.5 cm; 6. End of the twentieth century?; 7. Lost; 8. Bodrogkeresztúr-type discovery; 9. Szeremlei 1900, 209; Zalotay 1932, 77, pt. 40; Banner 1937, 111; Patay 1984, 61, pt. 277, Taf. 24/277; 10. Until the time of the Second World War, the item was preserved in the collection of the Calvin general school in Hódmezővásárhely; during the war it was stolen According to the drawing presented by P. Patay (Patay 1984, Taf. 24/277), the axe rather belongs to the Jászladány axe-adzes.

Hammer-axe, Mezőkeresztes-type

5. 1. **Gerla**, city of Békéscsaba, county of Békés, Hungary; 2. Cannot be stated; 3. Cannot be stated; 4.Stray find; 5. Hammer-axe, Mezőkeresztes-type; L: 36.2 cm; G: 2750 g; 6. J. Banner, 1940; 7. Gyula Museum, Inv. No. 60.76.1; 8. Bodrogkeresztúr-type discovery; 9. Banner 1940, 14; Patay 1984, 58, pt. 261, Taf. 23/261.

6. 1. **Lipova**, city of Lipova, Arad County, Romania; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Hammer-axe, Mezőkeresztes-type; 6. First half of the twentieth century; 7. Lost; 8. Bodrogkeresztúr-type discovery; 9. Vulpe 1975, 30, pt. 72; Mareş 2002, 258-259, pt. 1224.

7. 1. **Periam**, city of Periam, Timiş County, Romania; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Hammer-axe, Mezőkeresztes-type; 6. Second half of the twentieth century (1985?); 7. Cannot be stated; 8. Bodrogkeresztúr-type discovery; 9. Lazarovici 1985, 85, pl. 3/1; Mareş 2002, 277, pt. 1347A, pl. 20/4.

8. 1. **Szeged**, "Tápé-Káposztás", city of Szeged, county of Csongrád, Hungary; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Hammer-axe, Mezőkeresztes-type; 6. A. Tokody, second half of the twentieth century?; 7. Private collection, A. Tokody, Szeged; 8. Bodrogkeresztúr-type discovery; 9. Patay 1984, 58, pt. 265, Taf. 23/265.

9. 1. **Vinga**, municipality of Vinga, Arad County, Romania; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Hammer-axe, Mezőkeresztes-type; L: 43 cm, $l_{blade}$: 8.3 cm, G: 3060 g; 6. 1875; 7. Magyar Nemzeti Múzeum, Budapest, Inv. No. 73/1951.4; 8. Bodrogkeresztúr-type discovery; 9. Hampel 1876, 112, pl. 149; Hampel 1876a, pl. 7/14; Puszky 1877, pl. 2/23; Pulszky 1884, 68, pl. 2; Nagy 1913, 307, pl. 4/15; Roska 1942, 305, pt. 78; Roska 1942a, 59, pt. 212; Driehaus 1955, 7, list 7; Vulpe 1975, 30, pt. 72 A; Lazarovici 1975, 28, pt. 40; Patay 1984, 99, footnote 6, pt. 581, Taf. 54/581; Mareş 2002, 339, pt. 1762.

10. 1. **Zona Szeged**, city of Szeged, county of Csongrád, Hungary; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Hammer-axe, Mezőkeresztes-type; the upper part is slightly corroded, the pick arm was broken, and the item was used as a hammer; L: 13.9 cm; G: 1045 g; 6. Second half of the twentieth century

(1984?); 7. Magyar Nemzeti Múzeum, Budapest, Inv. No. 77/1902.1; 8. Bodrogkeresztúr-type discovery; 9. Patay 1984, 58, pt. 257, pl. 21/257.

Hammer-axe, Şiria-type

11. 1. **Hodmezővásárhely**, "Nagyfai Tiszakanyar", city of Hódmezővásárhely, county of Csongrád, Hungary; 2. Isolated tomb; 3. Cannot be stated; 4. Stray find; 5. Hammer-axe, Şiria-type, just one arm preserved; L: 7.4 cm; G: 105 g.; 6. End of the nineteenth century; 7. Tornyai János Museum, Hódmezővásárhely, Inv. No. 73, 31, 1; 8. Bodrogkeresztúr-type discovery; 9. Szeremlei 1900, 209; Zalotay 1932, 78; Banner 1937, 111; Patay 1961, 31-32, pt. 14; Patay 1984, 64, pt. 291, Taf. 25/291.

12. 1. **Şiria**, municipality of Şiria, Arad County, Romania; 2. Isolated tomb?; 3. Cannot be stated; 4. Stray find; 5. Hammer-axe, Şiria-type; L: 18.8 cm; G: 0.315 g. A stone axe and a few pottery fragments were also identified beside this copper axe; 6. End of the nineteenth century (1889?); 7. Magyar Memzeti Múzeum, Budapest, Inv. No. 74/1889.2; 8. Bodrogkeresztúr-type discovery; 9. Patay 1961, 98, pt. 71, pl. XXXVI/2; Patay 1968, 10, 20, pl. 4/3; Schubert 1965, 24; Bognár-Kutzián 1972, 140, footnote 245; Vulpe 1973, 229, footnote 84; Vulpe 1975, 32, pt. 76, Taf. 10/76; Patay 1984, 100, pt. 586, Taf. 55/586; Mareş 2002, 305-306, pt. 1494, pl. 23/4.

Axe-adze, Jászladány-type, variant Târnăviţa

13. 1. **Tîrnăvița**, municipality of Brănișca, Hunedoara County, Romania; 2. Deposit?; 3. Cannot be stated; 4. Stray find; 5. Axe-adze, Jászladány-type, variant Târnăviţa; the upper part is corroded; L: 18.2 cm; G: 580 g. It seems that the item was discovered together with an axe-adze, of the Jászladány-type, variant Petrești; 6. 1898; 7. Muzeul Civilizației Dacice și Romane Deva, Inv. No. 5234; 8. Bodrogkeresztúr-type discovery; 9. Vulpe 1975, 38, pt. 94; Mareş 2002, 306, pt. 1534, pl. 27/5.

14. 1. **Szeged Area**, city of Szeged, Csongrád County, Hungary; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Axe-adze, Jászladány-type, Târnăviţa variant; the upper part is corroded; L: 19.7 cm; G: 545 g; 6. Second half of the twentieth century (1984?); 7. Magyar Nemzeti Múzeum, Budapest. Inv. No. 78.1.1; 8. Bodrogkeresztúr-type discovery; 9. Patay 1984, 69, pt. 323, pl. 27/323.

Axe-adze, Jászladány-type, variant Orşova

15. 1. **Doboz**, municipality of Doboz, Békés County, Hungary; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Axe-adze, Jászladány-type, variant Orşova; L: 21.7 cm; G: 1160 g; 6. Second half of the nineteenth century (1871?); 7. Bodrogkeresztúr-type discovery; 8. Gyula Museum, Inv. No. 77.1; 9. Mogyoróssy 1871, 210; Banner 1940, 14; Roska 1942a, 32; Patay 1984, 71, pt. 342, Taf. 30/342.

16. 1. **Gutenbrun**, municipality of Zăbrani, Arad County, Romania; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Axe-adze, Jászladány-type, variant Orşova; L: 28 cm; G: 1005 g; 6. Second half of the nineteenth century (1897?); 7.

Bodrogkeresztúr-type discovery; 8. Muzeul Banatului, Timişoara?; lost?; 9. Milleker 1897, 47; Roska 1942, 281, pt. 28; Roska 1942a, 53, no. 182; Driehaus 1955, 7, list 6; Lazarovici 1975, 19, 28, list 6, pt. 19, fig. 9/1; Vulpe 1975, 54; Mareş 2002, 245-246, pt. 1123; pl. 29/8; 10. The village of Gutenbrun is currently integrated in the settlement of Zăbrani. In Vulpe 1975 the axe is listed as having been found in Lipova.

17. 1. **Magyercsanád**, municipality of Bökény, Csongrád County, Hungary; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Axe-adze, Jászladány-type, variant Orşova; L: 18.3 cm; G: 630 g; 6. First half of the twentieth century (1941?); 7. Not stated; 8. Bodrogkeresztúr-type discovery; 9. Bálint 1941, 6; Banner 1942, 72; Patay 1984, 71, pt. 337, Taf. 29/337.

18. 1. **Zăbrani**, municipality of Zăbrani, Arad County, Romania; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Axe-adze, Jászladány-type, variant Orşova; spectral analyses, performed by Junghans *et al*. 1968 (analysis 9179), have revealed the fact that besides copper, the axe contained traces of silver and nickel; 6. Second half of the twentieth century (1968?); 7. Muzeul Banatului Timişoara, Inv. No. 1913; 8. Bodrogkeresztúr-type discovery; 9. Junghans *et al*. 1968, 258-259; Vulpe 1975, 39, pt. 106, pl. 13/106; Lazarovici 1983, 18, pt. 153; Mareş 2002, 341-342, pt. 1771, pl. 31/2; Diaconescu 2009, 179, pt. 82.

Axe-adze, Jászladány-type, variant Şincai

19. 1. **Dorobanţi**, municipality of Dorobanți, Arad County, Romania; 2. Isolated tomb; 3. Cannot be stated; 4. Stray find; 5. Axe-adze, Jászladány-type, variant Şincai; found in a tomb, but no further data is available on the conditions of discovery. See the full description in Sava 2010; 6. A. Kasa, 1961; 7. Lost; 8. Bodrogkeresztúr-type discovery; 9. Barbu *et al*. 1999, 66, pt. 1; Luca 1999, 51, pt. 21; Sava 2010.

20-21. 1. **Pecica**, "Şanţul Mare", city of Pecica, Arad County, Romania; 2. Tell; 3. Terrace; 4. 5. M. Roska's excavation has revealed two Jászladány-type axe-adzes, Şincai variant; for both see a complete description in Sava 2011, 18-20, pt. 3-4. 6. M. Roska, 1911; 7. Museum Complex Arad; Inv. No. 887, 888; 8. Disk-handles-type discovery; 9. For Inv. No. 887 - Vulpe 1975, 41, no. 142, pl. 19/42; Lazarovici 1983, 13, pt. 4; Mareş 2002, 181, pt. 45, pl. 31/6; Diaconescu 2009, 162, pt. 2. For Inv. No. 888 - Vulpe 1975, 41, no. 144, pl. 19/144; Maxim 1999, 174, no. 730; Mareş 2002, 276-277, pt. 1338, pl. 33/4; Sava 2011, 18-20, pt. 3-4.

Axe-adze, Jászladány-type, variant Petreşti

22. 1. **Arad County**, Romania; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Axe-adze, Jászladány-type, variant Petreşti; see the complete description in Sava 2011, 23-24, pt. 9; 6. Second half of the twentieth century; 7. Arad Museum Complex; 8. Bodrogkeresztúr-type discovery; 9. Sava 2011, 23-24, pt. 9.

23. 1. **Sânleani**, municipality of Livada, Arad County, Romania; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Axe-adze, Jászladány-type, variant Petreşti; see a complete description in Sava 2011, 20-21, pt. 5; 6. S. Nicolae, 1971; 7. Arad Museum Complex, Inv. No. 15002; 8. Bodrogkeresztúr-type discovery; 9. Barbu *et al*. 1999, 110, pt. 1; Sava 2011, 20-21, pt. 5; 10. Discovered during agricultural works on the left side of the Arad-Oradea road, opposite the village.

24. 1. **Semlac**, "La Hada", municipality of Semlac, Arad County, Romania; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Axe-adze, Jászladány-type, variant Petreşti; see a complete description in Szentmiclosi 2003; 6. L. Hornoi, 1997; 7. Muzeul Banatului Timişoara?; 8. Bodrogkeresztúr-type discovery; 9. Szentmiclosi 2003.

25. 1. **Tăgădău**, municipality of Beliu, Arad County, Romania; 2. Cannot be stated; 3. Cannot be stated 4. Stray find; 5. Axe-adze, Jászladány-type, variant Petreşti; see a complete description in Boroffka, Luca, 1995, 226, 227; 6. Second half of the twentieth century (1995?); 7. Pierdut; 8. Bodrogkeresztúr-type discovery; 9. Boroffka, Luca 1995, 226, 227, fig. 1/16.

26. 1. **Tîrnăvița**, municipality of Brănișca, Hunedoara County, Romania; 2. Deposit?; 3. Cannot be stated; 4. Stray find; 5. Axe-adze, Jászladány-type, variant Petreşti; the upper part is corroded; L: 26.5 cm; G: 1310 g. It seems that it was found together with another axe-adze of the Jászladány type, variant Târnăvița; 6. 1898; 7. Muzeul Civilizației Dacice și Romane Deva, Inv. No. 5238; 8. Bodrogkeresztúr-type discovery; 9. Roska 1942, 282, pt. 44; Roska 1942a, 54, pt. 186; Driehaus 1955, 7, list 6; Vulpe 1975, 42, pt. 159, pl. 21/158; Mareş 2002, 306, pt. 1535, pl. 39/8.

27. 1. **Vica**, "Dealul Feru", municipality of Gurasada, Hunedoara County, Romania; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Axe-adze, Jászladány-type, variant Petreşti; L: 23.9 cm; G: 970 g; the axe was discovered at the base of the hill, at a depth of 0.50 m; 6. 1910-1912; 7. Muzeul Civilizației Dacice şi Romane Deva, Inv. No. 14393; 8. Bodrogkeresztúr-type discovery; 9. Vulpe 1975, 42, pt. 159, pl. 21/159; Maxim 1999, 193, pt. 1119; Mareş 2002, 329, pt. 1724, pl. 39/4.

Axe-adze, Jászladány-type, variant Brad

28. 1. **Arad**, city of Arad, Arad County, Romania; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Axe-adze, Jászladány-type, variant Brad; 6. First half of the twentieth century (1942?); 7. Zwinger Collection, Dresden, Inv. No. 5592; 8. Bodrogkeresztúr-type discovery; 9. Roska 1942a, 26, no. 10; Driehaus 1955, 7, list 6; Vulpe 1975, 44, no. 190 A, pl. 26/190 A; Mareş 2002, 181, pt. 44, pl. 40/2.

29. 1. **Békés**, "Povad", city of Békés, Békés County, Hungary; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Axe-adze, Jászladány-type, variant Brad; 6. P. Patay, 1984; 7. Munkácsy Mihály Múzeum Békéscsaba; 8. Bodrogkeresztúr-type discovery; 9. Patay 1984, 78, pt. 411, Taf. 39/411.

30. 1. **Cermei**, municipality of Cermei, Arad County, Romania; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Axe-adze, Jászladány-type, variant Brad; see a complete description in Sava 2011, 17-18, pt. 1; 6. A. Bánhídy, 1863; 7. Arad Museum Complex, Inv. No. 12449; 8. Bodrogkeresztúr-type discovery; 9. Vulpe 1975, 44, no. 191, pl. 26/191; Lazarovici 1983, 14, pt. 27; Barbu *et al.* 1999, 50, pt. 2; Maxim 1999, 149, pt. 231; Mareş 2002, 210, pt. 484, pl. 40/8; Diaconescu 2009, 164, pt. 11; Sava 2011, 17-18, pt. 1.

31. 1. **Satchinez**, municipality of Satchinez, Timiş County, Romania; 2. Deposit?; 3. Cannot be stated; 4. Stray find; 5. Axe-adze, Jászladány-type, variant Brad; the axe is broken in two pieces; L: 28 cm; G: 910 g; 6. First half of the twentieth century, (1942?); 7. Muzeul Banatului Timişoara, Inv. No. 1914-1915 or IV 1542; 8. Bodrogkeresztúr-type discovery; 9. Roska 1942, 340, pt. 49; Roska 1942a, 39, pt. 89; Driehaus 1955, 7, list 6; Vulpe 1975, 44, pt.194, pl. 27/194; Lazarovici 1975, 19, 29, pt. 32, fig. 9/2,6; Mareş 2002, 282-283, pt. 1407, pl. 42/7; 10. The presumed deposit included another fragment from a Jászladány-type axe-adze, undetermined variant. Lazarovici (1975) suggested the existence of a fourth fragment, but Vulpe (1975, 53, pt. 244) and Mareş (2002, 276, pt. 1301, pl. 49/8) suggest the fact that the latter was discovered in Orşova. Thus Vulpe 1970, pl. 29/215 (Inv. No. 1916) = Lazarovici 1975, fig. 9/4a-b (Inv. No. IV 1544) = Mareş 2002, pl. 45/7; Vupe 1970, pl. 27/194 (Inv. No. 1914-1915) = Lazarovici 1975, fig. 9/2a-b (Inv. No. IV 1542), 9/6a-b = Mareş 2002, pl. 42/7.

32. 1. **Sânpetru German**, "Hotarul Reck", municipality of Secusigiu, Arad County, Romania; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Axe-adze, Jászladány-type, variant Brad; see a complete description in Sava 2011, 21-22, pt. 6; 6. A. Hamerák, 1961; 7. Arad Museum Complex, Inv. No. 13767; 8. Bodrogkeresztúr-type discovery; 9. Dörner 1970, 456, fig. 11/5; Roman 1971, 91; Vulpe 1973, 227; Vulpe 1975, 44, no. 190, pl. 26/190; Mareş 2002, 295, pt. 1441, pl. 42/5; Barbu *et al*. 1999, 111, pt. 5/a; Luca 2006, 230, pt. 532/3/d; Luca 2010, 231, pt. 532/3/d; Sava 2011, 21-22, pt. 6.

Axe-adze, Jászladány-type, special variant

33. 1. **Sânpetru German**, "La Islaz", municipality of Secusigiu, Arad County, Romania; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Axe-adze, Jászladány-type, special variant; see a complete description in Sava 2011, 22-23, pt. 7; 6. M. Băbăţan 1967; 7. Arad Museum Complex, Inv. No. 14557; 8. Bodrogkeresztúr-type discovery; 9. Vulpe 1973, 227; Vulpe 1975, 45, no. 197, pl. 27/197; Barbu *et al.* 1999, 111, pt. 4; Mareş 2002, 295, 1442, pl. 44/9; Luca 2006, 230, pt. 532/1/b; Luca 2010, 230, pt. 532/1/b; Sava 2011, 22-23, pt. 7.

Axe-adze, Jászladány-type, undetermined variant

34. 1. **Arad County**, Romania; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Axe-adze, Jászladány-type, undetermined variant; see a complete description in Sava 2011, 23, pt. 8; 6. 1885; 7. Arad Museum Complx, Inv. No.

12483; 8. Bodrogkeresztúr-type discovery; 9. Vulpe 1975, 46, no. 211, pl. 28/211; Mareş 2002, 175, pt. 181, pl. 45/2; Sava 2011, 23, pt. 8; 10. Both Vulpe (Vulpe 1975, 46, pt. 211) and Mareş (Mareş 2002, 181, pt. 47) fail to indicate the correct inventory number of the item; instead of 12483, both indicate no. 12488.

35. 1. **Pecica**, "Bojhos szöllö", city of Pecica, Arad County, Romania; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Axe-adze, Jászladány-type, undetermined variant; see a complete description in Sava 2011, 18, pt. 2; 6. 1966; 7. Arad Museum Complex, Inv. No. 14433; 8. Bodrogkeresztúr-type discovery; 9. Sava 2011, 18, pt. 2.

36. 1. **Satchinez**, municipality of Satchinez, Timiş County, Romania; 2. Deposit?; 3. Cannot be stated; 4. Stray find; 5. Axe-adze, Jászladány-type, undetermined variant; just one part of an arm and part of the socketing mouth have been preserved. L: 8.5 cm; G: 365 g; 6. First half of the twentieth century, (1942?); 7. Muzeul Banatului Timişoara, Inv. No. 1916 or IV 1544; 8. Bodrogkeresztúr-type discovery; 9. Vulpe 1975, 46, pt. 215, pl. 29/215; Lazarovici 1975, 29, pt. 32, fig. 9/4; Mareş 2002, 282-283, pt. 1408, pl. 45/7.

37. 1. **Area of Szeged**, city of Szeged, Csongrád County, Hungary; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Axe-adze, Jászladány-type, undetermined variant; only the pick arm has been preserved, possibly later used as an axe; L: 11.2 cm; G: 540 g; 6. Second half of the twntieth century (1984?); 7. Magyar Nemzeti Múzeum Budapest, Inv. No. 77/1902.2; 8. Bodrogkeresztúr-type discovery; 9. Patay 1984, 85, pt. 495, pl. 48/495.

Axe-adze, Târgu Ocna type

38. 1. **Crăciunești**, municipality of Băița, Hunedoara County, Romania; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Axe-adze, Târgu Ocna type; L: 21 cm; G: 800 g; 6. First half of the twentieth century (1942?); 7. Muzeul Civilizației Dacice și Romane Deva, Inv. No. 5219; 8. Bodrogkeresztúr-type discovery; 9. Roska 1942, 110, pt. 73, fig. 132; Roska 1942a, 38, pt. 79, fig. 23; Junghans *et al*. 1968, 258-259; Andrițoiu 1971, 37, fig. 3; Vulpe 1975, 50, pt. 230, pl. 30/230; Maxim 1999, 154, pt. 322; Mareş 2002, 214-215, pt. 538, pl. 46/4.

Axe with double, cross blade, unknown type

39. 1. **Dezna**, municipality of Dezna, Arad County, Romania; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Axe with double, cross blade, unknown type; 6. First half of the twentieth century; 7. Lost; 8. Bodrogkeresztúr-type discovery; 9. Roska 1942, 68, pt. 37; Roska 1942a, 32, pt. 47; Vulpe 1975, 54; Maxim 1999, 156, pt. 372; Mareş 2002, 224, pt. 966.

40. 1. **Lipova**, city of Lipova, Arad County, Romania; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Axe with double, cross blade, unknown type; 6. First half of the twentieth century; 7. Lost during the Second World War; 8. Bodrogkeresztúr-type discovery; 9. Patay 1984, 100, pt. 584A; Mareş 2002, 253, pt. 1229A.

41. 1. **Sântana**, city of Sântana, Arad County, Romania; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Axe with double, cross blade, unknown type; 6. First half of the twentieth century; 7. Lost; 8. Bodrogkeresztúr-type discovery; 9. Roska 1942, 294, pt. 21; Roska 1942, 56, pt. 197; Driehaus 1955, 7, list 6; A. Vulpe 1975, 54; Maxim 1999, 182, pt. 902; Mareş 2002, 290, pt. 1443; Diaconescu 2009, 173, pt. 57.

42. 1. **Mezőhegyes**, "Drumul Aradului", city of Mezőhegyes, Békés County, Hungary; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Axe with double, cross blade, unknown type; L: 18.5 cm; 6. First half of the twentieth century (1941?); 7. Lost; 8. Bodrogkeresztúr-type discovery; 9. Bálint 1941, 6; Banner 1942, 72; Patay 1894, 93, pt. 537.

Other items

43. 1. **Pecica**, "Şanţul Mare", city of Pecica, Arad County, Romania; 2. Tell; 3. Terrace; 4. Systematic excavation; 5. a. dagger blade (Roska 1942, fig. 275/3; Roman 1971, fig. 34/1; Mareş 2002, pl. 55/5), b-c. Two bracelets with open ends, made of wide plate, rectangular in section (Roska 1942, fig. 275/1, 4; Roman 1971, fig. 34/3), d. ring fragment? (Mareş 2002, 276-277, pt. 1341A), e-f. two blade fragments (Roska 1942, fig. 275/6, 7; Mareş 2002, pl. 63/11, 12), g-j. four piercers (Roska 1942, fig. 275/2, 5, 6, 9; Mareş 2002, pl. 7/20, 22, 25; 8/25); 6. M. Roska 1911, 1923; 7. Arad Museum Complex; Inv. No.: M. Roska's 1911 excavations: 1804-1819 (metal). M. Roska's 1923 excavations: 5609-5618; 5630 (metal); 8. Disk-handles-type discovery; 9. Roska 1942, 224, pt. 45, fig. 275/1-9; Roman 1971, 85, pt. 13, fig. 34/1-3; Mareş 2002, 276-277, pt. 1339-1347, pl. 7/20, 22, 25; 8/25; 55/5; 63/11-12.

44. 1. **Magyardombegyház**, "The Szabadi Mihály House", municipality of Magyardombegyház, Békés County, Hungary; 2. Stray tomb; 3. Not stated; 4. Stray find; 5. A tomb with an inventory consisting of six vessels and a piece of copper was discover during excavations for the foundations of a house; 6. Szabadi M., 1927; 7. Not stated; 8. Bodrogkeresztúr-type discovery; 9. Patay 1961, 54, pt. 24.

*Discoveries of the Baden-Coţofeni chronological horizon*

1. 1. **Crăciuneşti**, "Peştera cu trei intrări" or "Peştera Şura de Mijloc", municipality of Băiţa, Hunedoara County, Romania; 2. Settlement?; 3. Cave; 4. Stray find; 5. In 1975 geologist L. Popov has donate to the museum in Deva artifacts discovered in this cave, among which the blade of a copper dagger, Bădeşti type; L: 8.5 cm; l: 3.2 cm; 6. L. Popov, 1975; 7. Muzeul Civilizaţiei Dacice şi Romane Deva; 8. Coţofeni-type discovery; 9. Andriţoiu 1978, 58, footnote 5, pl. II/9; Ciugudean 2000, 34, pl. 133/5; Mareş 2002, 221, pt. 538A, pl. 54/5.

*Aeneolithic (the exact chronological stage cannot be established)*

1. 1. **Gyula**, "Galbácskert", city of Gyula, Békés County, Hungary; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Fragment from an axe of unknown type; the blade and part of the arm have been preserved; 6. First half of the

twentieth century (1940?); 7. Lost during the Second World War; 8. Eneolithic; 9. Banner 1940, 14; Banner 1942, 77; Roska 1942a, 37, pt. 67; Patay 1984, 95, pt. 558, pl. 52/558.

2. 1. **Lipova**, city of Lipova, Arad County, Romania; 2. Cannot be stated; 3. Cannot be stated; 4. Stray find; 5. Hammer-axe, unknown type; 6. First half of the twentieth century; 7. Lost during the Second World War; 8. Aeneolithic; 9. Patay 1984, 100, pt. 584 A; Mareş 2002, 259, pt. 1229A.

**Discussions**

The first copper artifacts discovered in the area of the Lower Mureş and Crişul Alb were part of the Tisa-type manifestations. No traces of copper ore extraction or processing have been discovered so far in the area under discussion, despite the fact that the number of artifacts is rather high. I will briefly mention below the context of the artifacts, when possible, alongside some characteristics of the area of discovery in connection to the researched items.

The chronological horizon of the Tisa discoveries on the Lower Mureş and Crişul Alb starts with the first use of copper-made items (Fig. 12). Along this line of though I will mention the fact that F. Móra's 1908 excavation in the tell from Čoka "Kremenyák" has led to the discovery of such artifacts. In pit no. 2 (measuring 2 m in diameter and 0.80 m in depth) Móra has uncovered a two-handle vessel that contained 14 malachite beads and 2 hematite bars (Banner 1960, 18, Pl. LV/20; LII/33; LII/32, 34; XLV/44/50; LVI/1, 2, 5, 7; XLV/45/58; XLV/65; XLV/49; XLV/4, 6, 19). Besides these artifacts, the same vessel contained other jewelry items, made of other materials. According to P. D. Gulmac, one fragment of a copper bracelet was also found besides the hematite bars and the beads mentioned above (Gulmac 1991, 264).

Another discovery that I. Bognár-Kutzián attributes to the Tisa discoveries consists of a copper bracelet discovered inside the tell in Hódmezővásárhely "Kopáncs-Kökénydomb" (Bognár-Kutzián 1963, 333, 336; Bognár-Kutzián 1976, 70).

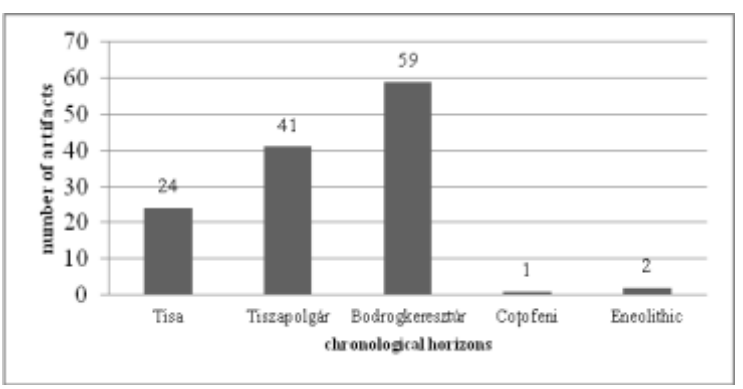


Fig. 1. Copper artifacts according to the chronological horizon

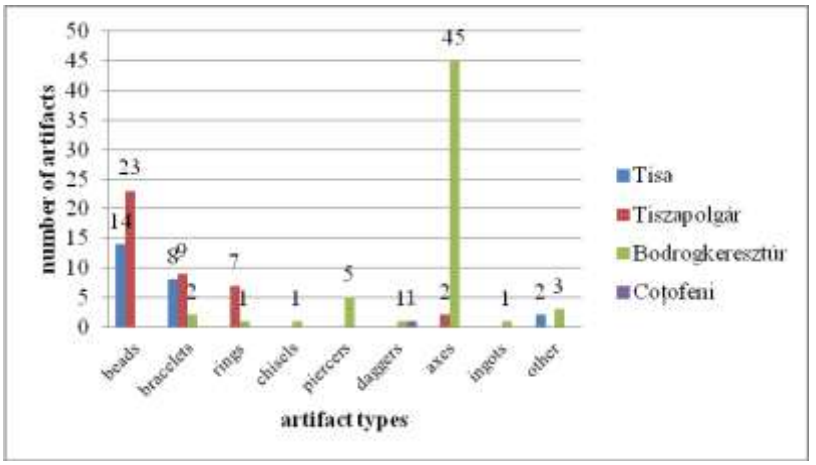


Fig. 2. Copper items associated with metal horizons

In another Tisa tell, i.e. the one in Hódmezővásárhely "Gorzsa" (Horváth 1987, 46), F. Horváth identified copper beads in some male tombs (that probably belong to phase B) (Due to the fact that not all metal items from this site have been published, I have included in the present analysis the three bracelets ilustrated in Horváth 1987, Fig. 38 and the three bracelets published by Gazdapusztai 1963, pl. IV/1-3). Horváth stresses the fact that the beads were worn as a necklace. Other artifacts have also been found there: a copper bracelet was discovered in the tomb of a woman, placed on the humerus, while a necklace and a bracelet on the humerus have been deposited in a small girl's grave. Metallographic analyses have been performed and they have proven the fact that all the copper items were cold hammered. Before Horváth's ample research, three copper bracelets have been identified in G. Gazdapusztai's excavation. Two of the bracelets were found in tomb no. 2 (one in the shape of a spiral and the other with closed ends), while the third, with overlapping ends, was discovered in the habitation layers of the tell (Gazdapusztai 1963, 47, Pl. IV/1-3).

The onset of the Tiszapolgár-type manifestations can be equated with a wide spread of copper items, and this phenomenon can easily be noted in the area under discussion as well (fig. 13). The necropolis in Deszk (Bognár-Kutzián 1963, 420-421; Bognár-Kutzián 1972, 22-34, pt. 213, Pl. XXXIII/6-9; XXXIV/1, 3-5) excavated by F. Móra between 1930 and 1931 contains numerous such items. Four rings and 21 beads were discovered in necropolis A, distributed thus: tomb no. 4 contained three rings and 20 beads, tomb no. 8 contained one bead, while tomb no. 9 contained one ring. Five bracelets and one ring were found in necropolis B: one ring in tomb no. 2, two bracelets in tomb no. 4, two bracelets in tomb no. 8, and one bracelet in tomb no. 11. One must state the fact that 31 copper items were identified in the above mentioned tombs.

Another necropolis where artifacts made of copper have been discovered is the one in Hódmezővásárhely "Népkert". Different town planning works have disturbed 17 tombs there. I. Bognár-Kutzián managed to reconstruct the funerary inventory of just six of these tombs (Bognár-Kutzián 1972, 44-47, pt. 202, Pl. XXXV/1-5). Copper artifacts were discovered in four: two beads in tomb no. 1, two beads in tomb no. 2, one multi-spiral bracelet in tomb no. 3, while one bracelet has been noted in tomb no. 4. Still in Hódmezővásárhely, but on the spot called "Szakálhát - Bakay tanya", J. Banner uncovered a tomb (no. 1) that contained two copper rings placed on a necklace (Bognár-Kutzián 1972, 47-51, pt. 199).

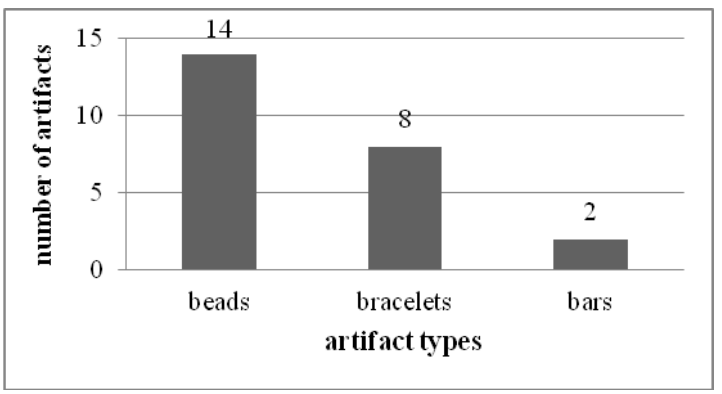


Fig. 3. Copper items associated to Tisa-type discoveries

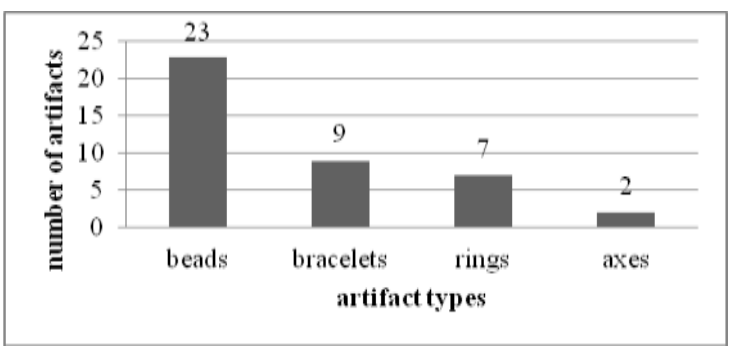


Fig. 4. Copper items associated to Tiszapolgár -type discoveries

To the Tiszapolgár chronological horizon one can attribute the Pločnik-type hammer-axe from Lipova (Roska 1942, 146, pt. 30; Roska 1942a, 40, pt. 100; Vulpe 1975, 20, pt. 16, Pl. 2/16; Lazarovici 1975, 28, list 4, pt. 20; Mareş 2002, 258, pt. 1223, Pl. 12/3) and the Čoka-type axe discovered on the eponym site of Čoka "Kremenyák" (Childe 1929, 75, Pl. 38; Roska 1942a, 31, Pl. 29; Banner 1960, 19, 34, Pl. LVII/1; Bognár-Kutzián 1972, 140, Fig. 26; Patay 1984, 8, 6, 100, no. 585; Taf. 55/585). As for the axe from Lipova, its conditions of discovery remain unknown. The axe from Čoka was found in the Tisa tell, but the stratigraphic

observations are unclear and thus one cannot make further clarifications (Bognár-Kutzián 1972, 140, Fig. 26). In the same tell from Čoka specialists have discovered, besides the axe, a knife blade, a cylindrical tube, and a bracelet that according to J. Banner belong to the Copper Age (Banner 1960, 34), but due to the lack of contexts of these discoveries I chose not to include them in the present analysis.

Besides these discoveries belonging to the Tiszapolgár horizon, one can also mention beads made of copper discovered in Szeged "Tápé-Lebő" (Korek 1958, 152; Bognár-Kutzián 1963, 331; Bognár-Kutzián 1976, 71). Unfortunately, there is no mention of their number in specialized literature.

The Bodrogkeresztúr horizon is remarkable, as compared to the previous chronological stages, through the wide distribution of massive copper items, such as Mezőkeresztes-type hammer-axes and Jászladány-type axe-adzes (fig. 14-15). This statement can also be tested on the basis of discoveries made on the Lower Mureş and on Crişul Alb (fig. 1, 2, 5-7).

This chronological horizon also includes the deposit of copper items from Szeged "Szillér" (Pulszky 1881, 1, Pl. 1; Pulszky 1884, 23; Roska 1942a, 51-52; Patay 1943, Pl. 50; Patay 1984, Pl. 68/A), discovered during the second half of the nineteenth century. The deposit consists of six, possibly seven items: one chisel, one piercer, one piece of copper, one flat axe of Szakálhat-type, variant Sălacea, and three axe-adzes of the Jászladány-type. Initially, one of these axes was not considered part of the deposit (Pulszky 1881, 1, Pl. 1; Pulszky 1884, 23, Pl. 3), but the analysis of the inventory registry from the Magyar Nemzeti Múzeum in Budapest has revealed that the axe-adze was discovered together with the rest of the items (Patay 1943, Pl. 50/13; Patay 1984, 82, pt. 456, Pl. 45/456).

Numerous other axes, most lacking clear contexts, have also been discovered, in addition to the above mentioned deposition. Out of the 49 axes identified in this area, 45 belong to the Bodrogkeresztúr horizon. Two of the four remaining artifacts, those in Lipova and the one in Čoka, belong to the Tiszapolgár horizon, while the other two represent items that cannot be attributed to any certain chronological horizon. One can easily observe that the great majority of axes belong to the Jászladány type (fig. 6). For the area taken into consideration, I have catalogued 28 axes of the Jászladány-type, six hammer-axes of the Mezőkeresztes type, two axes each of the hammer-axes type Agnita and Şiria, two flat axes of the Szakálhat type, and one axe-adze of the Târgu Ocna type (fig. 6). Among the Jászladány-type axes, one encounters the variants of Târnăviţa, Orşova, Şincai, Petreşti, Brad, and the special variant of the axe from Sânpetru German "La Islaz" (Vulpe 1973, 227; Vulpe 1975, 45, no. 197, Pl. 27/197; Mareş 2002, 295, pt. 1442, Pl. 44/9; Barbu *et al.* 1999, 111, pt. 4; Luca 2006, 230, pt. 532/1/b; Luca 2010, 230, pt. 532/1/b). Among the Jászladány-type axe-adzes, those part of the Brad and Petreşti variants are predominant (fig. 7).

On the basis of the distribution map of copper axes in the area under analysis here, one can note that the majority of the axes are concentrated in the Mureş Valley (fig. 14, 15). The wide distribution of axes in the Mureş Valley fits the distribution

of Bodrogkeresztúr sites. Another observation is that the axes were mainly identified in the plain area, except for a few discoveries.

The distribution of the copper axes of this chronological horizon indicates four major concentration areas. The first concentration of such artifacts consists of the nine axes identified in the area of the present-day city of Lipova (Mareş 2002, 258-259, pt. 1223 – 1229), the axe from Guttenbrun (Mareş 2002, 245-246, pt. 1123, Pl. 29/8), and the axe from Zăbrani (Mareş 2002, 341, pt. 1771, Pl. 31/2). The second concentration can be observed around the settlements of Pecica-Periam and consists of the discoveries from Pecica "Şanţul Mare" (Vulpe 1975, 41, no. 142, Pl. 19/42; Lazarovici 1983, 13, pt. 4; Mareş 2002, 175, pt. 45, Pl. 31/6; Diaconescu 2009, 162, pt. 2 (for inv. no. 887); and for inv. no. 888: Vulpe 1975, 41, no. 144, Pl. 19/144; Maxim 1999, 174, no. 730; Mareş 2002, 276, pt. 1338, Pl. 33/4), Pecica "Bojhos szöllö", Periam (Lazarovici 1985, 85, Fig. 3/1; Mareş 2002, 277, pt. 1347A, Pl. 20/4), Sânpetru German "La Islaz" (Vulpe 1973, 227; Vulpe 1975, 45, no. 197, Pl. 27/197; Barbu *et al.* 1999, 111, pt. 4; Mareş 2002, 295, 1442, Pl. 44/9; Luca 2006, 230, pt. 532/1/b; Luca 2010, 230, pt. 532/1/b), Sânpetru German "Hotarul Reck" (Dörner 1970, 456, Fig. 11/5; Roman 1971, 91; Vulpe 1973, 227; Vulpe 1975, 44, no. 190, Pl. 26/190; Barbu *et al.* 1999, 111, pt. 5/a; Mareş 2002, 295, pt. 1441, Pl. 42/5; Luca 2006, 230, pt. 532/3/d; Luca 2010, 231, pt. 532/3/d), and Semlac (Szentmiklosi 2003). Another micro-region where several axes have been found is that of River Crişul Alb, consisting of the discoveries from Békés (Patay 1984, 78, pt. 411, Pl. 39/411), Doboz (Patay 1984, 71, pt. 342, Pl. 30/342), Gerla (Patay 1984, 58, pt. 261, Pl. 23/261), Gyula (Patay 1984, 95, pt. 558, Pl. 52/558), and Sarkad (Patay 1984, 95, pt. 549, Pl. 52/549). A higher number of artifacts is also noted in the area where the Mureş flows into the Tisa; one can mention the deposit from Szeged "Szillér" (Pulszky 1881, 1, pl. 1; Pulszky 1884, 23; Roska 1942a, 51-52; Patay 1943, pl. 50; Patay 1984, pl. 68/A), an axe discovered in Szeged, "Tápé-Káposztás" (Patay 1984, 58, pt. 265, Taf. 23/265), and three axes discovered in the area of the city of Szeged, without topographic specifications (Patay 1984, 85, pt. 495, pl. 48/495).

One can only state that the concentration of axes around the settlements of Pecica-Periam is also doubled by that of sites belonging to this chronological horizon. Thus, a number of Bodrogkeresztúr sites have ben discovered, in time, in this area – in Sânpetru German "Fântâna Vacilor" (Dörner 1970, 451-455; Roman 1971, 91-92; Rusu 1971, 81; Roman 1973, 60; Lazarovici 1975, 25, Fig. 7/1-11; Lazarovici 1985; Pădurean 1982, 34; Luca 1999, 54, no. 45, Fig. 24-25), Sânpetru German "Malul Înalt" (Roman 1973, 59; Roman, Németi 1978, 12), and Pecica "Forgaci" (Pădurean 1982, 29-60; Pădurean 1985, 37, pt. XXIV/A/c; Lazarovici, Munteanu 1982, 125; Lazarovici 1983, 11-12, no. 108; Lazarovici 1985, 85, 88; Luca 1990, 89-92; Luca 1993, 49-86; Luca 1999, 10, 13-14,17, 53, pt. 35; ground plan 1-4; Fig. 4-18), but there are also sites characteristic to the disk-handles horizon, such as those in Pecica "Şanţul Mare" (Roman 1971, 85-90) and Pecica "Cărămidăria Ogorul" (Sava 2010a).

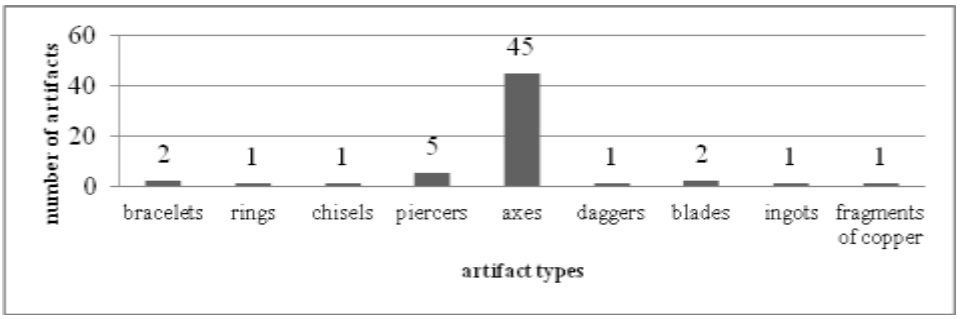


Fig. 5. Copper items associated to the Bodrogkeresztúr – disk-handles horizon

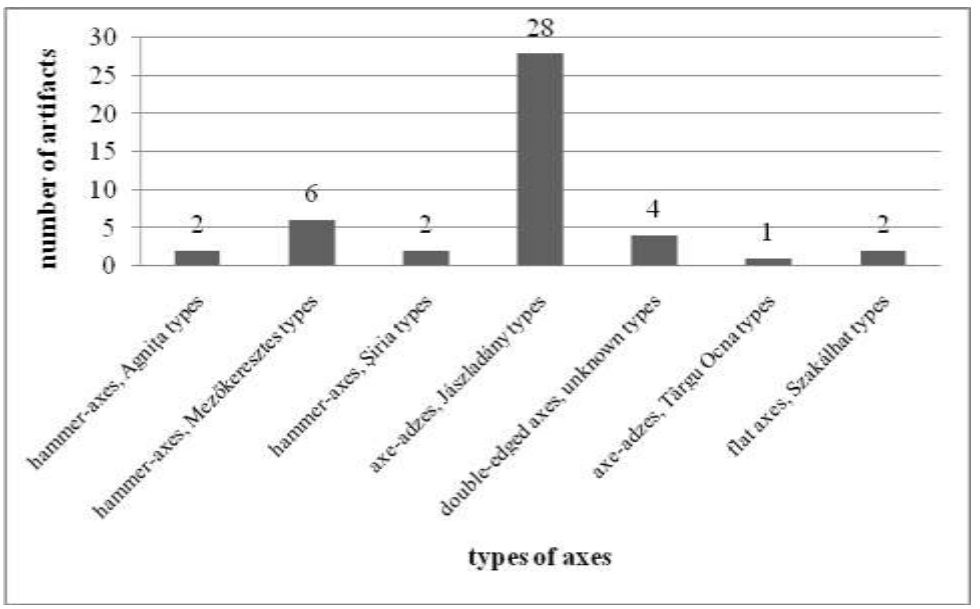


Fig. 6. Copper axes asociated to the Bodrogkeresztúr horizon

Besides the massive copper items mentioned above, one undetermined piece of copper was identified in Magyardombegyház "The Szabadi Mihály House" (Patay 1961, 54, pt. 24). Besides the six vessels the copper item was part of the funerary inventory of a deceased identified by chance.

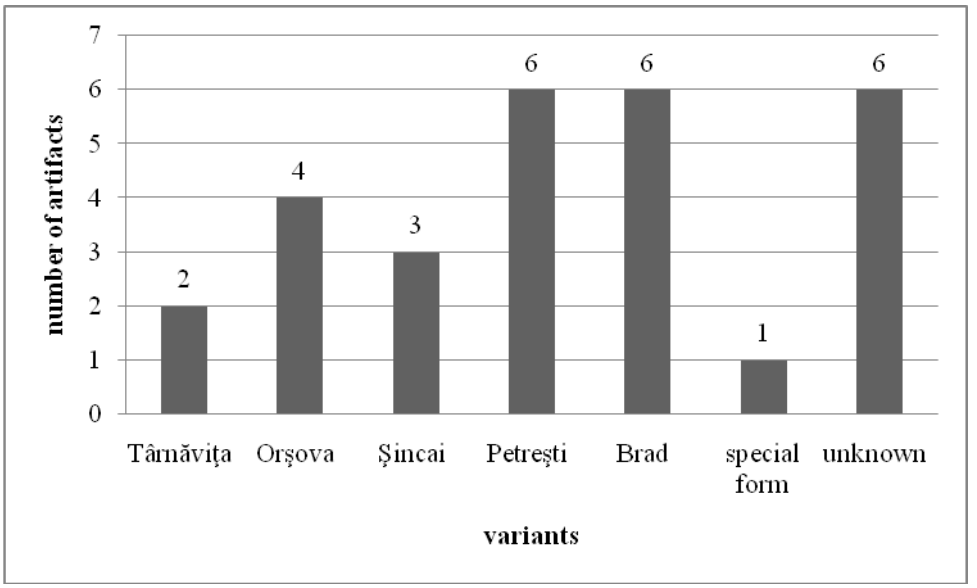


Fig. 7. Jászladány-type axes discovered

The copper artifacts from Pecica "Şanţul Mare" are attributed to the chronological horizon of the disk-handles. M. Roska's 1910 and 1911 excavations have revealed, in the lower level of the tell, attributed to the disk-handles, the following artifacts: one dagger blade, one ring, two bracelets, two blades, and four piercers (Roman 1971, 85, Fig. 34/1-4, 10; Mareş 2002, 276-277, Pl. 7/20, 22, 25; 8/25; 55/5; 58/9, 10; 63/11, 12). Besides them, the inventory registry of the Archaeology Department of the Museum Complex in Arad records the discovery of two Jászladány axes on that spot.

The onset of the Cernavodă III-Boleráz chronological horizon marks the scarcity of copper discoveries and this fact is visible in the area under investigation as well. I can mention a single find, the one in Crăciuneşti "Peştera cu trei intrări" (fig. 16). One Bădeşti-type dagger blade that has been attributed to the Coţofeni-type manifestations was identified inside this cave (Andriţoiu 1978, 58, footnote 5, Pl. II/9; Ciugudean 2000, 34, pl. 133/5; Mareş 2002, 220-221, pt. 538A, Pl. 54/5).

**Conclusions**

As the graph illustrated in fig. 1 also indicates, the first copper items in the Lower Mureş can be associated to Tisa-type pottery. The number of discoveries increases constantly until the onset of the Bodrogkeresztúr pottery and of the disk-handles pottery. From the end of this horizon and until the Early Bronze Age, no metal items have been discovered in the area under research, except for the dagger in Crăciuneşti "Peştera cu trei intrări".

All the discoveries part of the Tisa manifestations are jewelry items (fig. 2, 3). The onset of the Tiszapolgár pottery leads to a diversification of the metal items.

One starts finding rings and axes of the Čoka and Pločnik types, but the jewelry items remain the most numerous by far (fig. 2, 4). For the Bodrogkeresztúr horizon and that of the disk-handles, the number of jewelry items decreases, while the number of axes increases significantly (fig. 2, 5). By far, the most spread are the axe-adzes of the Jászladány-type (fig. 6).

Rom the perspective of the types of discoveries, part of the Tisa-type manifestations, the majority of items are found in settlements (fig. 9). With the onset of the Tiszapolgár pottery, the majority of items are found in tombs (fig. 9). A special situation is encountered in the chronological horizon of the Bodrogkeresztúr pottery. Then, a large part of the items, massive axes with socketing hole, has no clear context of discovery (fig. 9); a good part of them are singular finds.

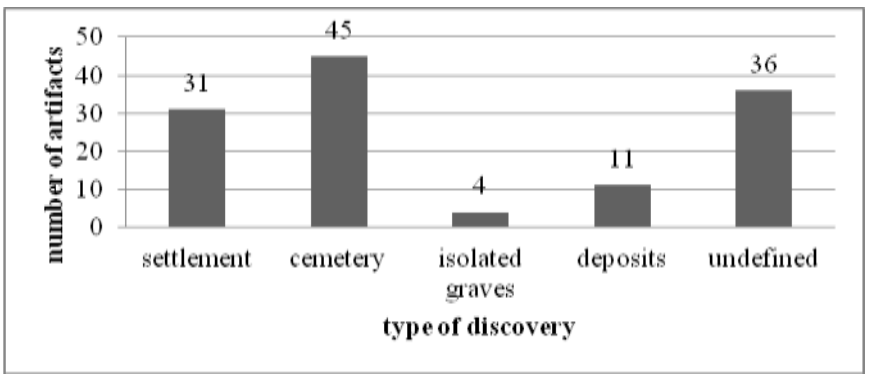


Fig. 8. Copper items discovered on the Lower Mureş and on Crişul Alb

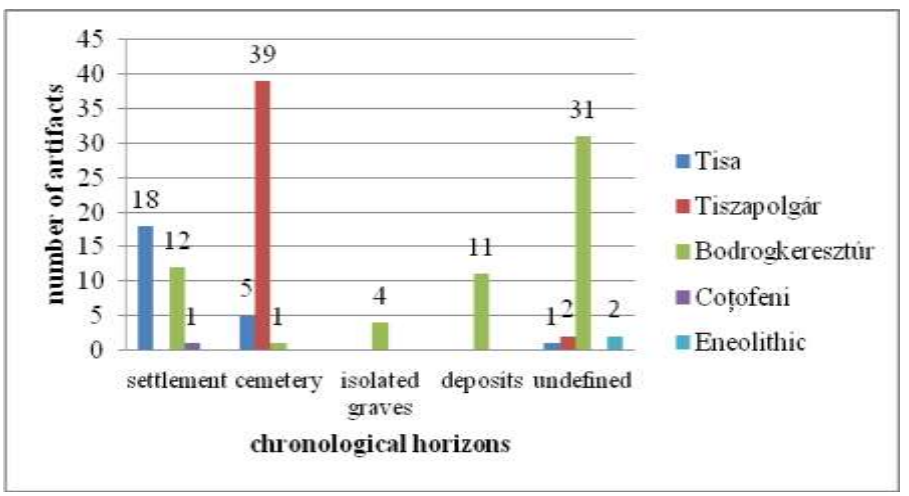


Fig. 9. Copper items discovered on the Lower Mureş and on Crişul Alb, according to the type of discovery and the chronological horizons.

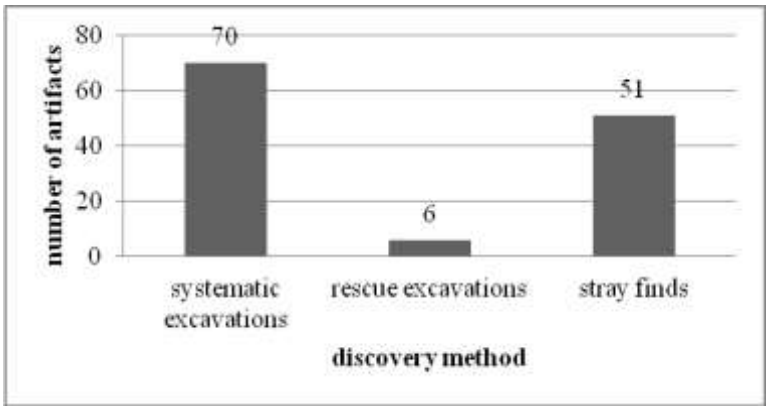


Fig. 10. Copper items discovered on the Lower Mureş and on Crişul Alb

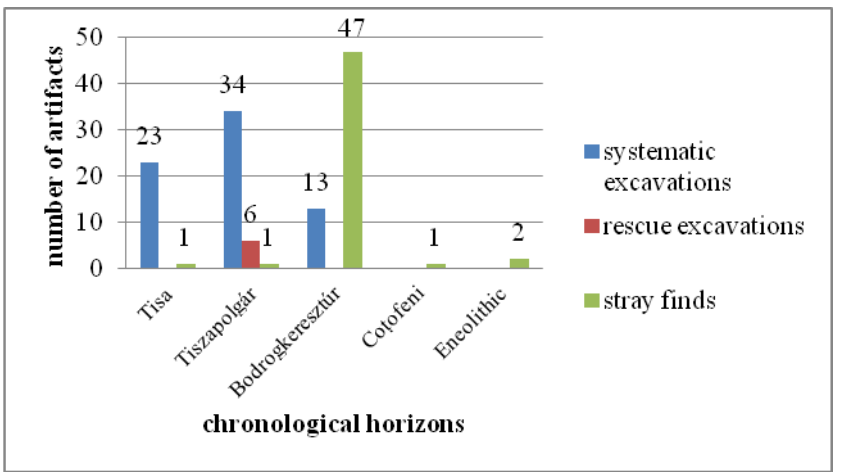


Fig. 11. Copper items discovered on the Lower Mureş and on Crişul Alb, according to the method of discovery and the chronological horizons.

The majority of items part of chronological horizons with Tisa and Tiszapolgár pottery were discovered through systematic archaeological excavation (fig. 11). The situation changes with the onset of the Bodrogkeresztúr pottery, as one notes that the majority of items are discovered as stray finds.

Fig. 12. Distribution of copper artifacts at the Tisa chronological horizon
(the numbers on the map coincide with those in the repertory of discoveries)

Fig. 13. Distribution of copper artifacts at the Tiszapolgár chronological horizon
(the numbers on the map coincide with those in the repertory of discoveries)

Fig. 14. Distribution of copper artifacts at the Bodrogkeresztúr - disk-handles chronological horizon
(the numbers on the map coincide with those in the repertory of discoveries)

Fig. 15. Distribution of Jászladány-type axe-adzes according to type
(the numbers on the map coincide with those in the repertory of discoveries)

Fig. 16. Distribution of copper artifacts at the Baden-Coţofeni chronological horizon
(the numbers on the map coincide with those in the repertory of discoveries)

**Acknowledgments**

This work was possible with the financial support of European Social Fund, Operational Programme Human Resources Development 2007 - 2013, Priority no. 1 "Education and training in support for growth and development of the knowledge society", Key Area of Intervention 1.5 "Doctoral and post-doctoral research support" Title: "MINERVA - Cooperation for elite career in PhD and post doctoral research", ID POSDRU 159/1.5/S/137832. I hereby wish to thank Dr. Sabin Adrian Luca for the welcome discussions on this topic. I also wish to express my gratitude to Dr. Tobias Kienlin for granting me access to some materials for the bibliography. The text was translated in English by Dr. Ana-Maria Gruia.

## BIBLIOGRAPHY


| | |
|---|---|
| Aldea 1979 | Al. I. Aldea, Obiecte de cupru descoperite în aşezarea neo-eneolitică de la Ghirbom (com. Berghin, jud. Alba). *Apulum* XVII, (1979), 25-29. |
| Andel 1958 | K. Andel, Pohrebisko z doby medenej v Tibave na Vychodnom Slovensku. *SlovArch* VI/1, (1958), 39-49. |
| Andriţoiu 1978 | I. Andriţoiu, Descoperiri arheologice la Crăciuneşti (com. Băiţa, jud. Hunedoara). *Apulum* XVI, (1978), 55-72. |
| Antonović 2002 | D. Antonović, *Copper processing in Vinča. New contributions to the thesis about metallurgical character of Vinča Culture*. Starinar 52, 2002, 27-45. |
| Antonović 2006 | D. Antonović, Malachite finds in Vinča Culture: Evidence of Early Copper Metallurgy in Serbia. *Metalurgija* 12/2, (2006), 85-92. |
| Banner 1937 | J. Banner, A hódmezővásárhelyi ref. gimnázium régiséggyüjteménye I. *DolgSzeeg* 13, (1937), 107-120. |
| Banner 1940 | J. Banner, Újabb adatok a bodrogkeresztúri kultúra elterjedéséhez. *AÉ Ser. III* 1 (1940), 13-18. |
| Banner 1942 | J. Banner, *Das Tisza-, Maros-, Körös- Gebiet bis zur Entwicklung der Bronzezeit*, Szeged, (1942). |
| Banner 1960 | J. Banner, The Neolithic Settlement on the Kremenyák Hill at Csóka. *ActaArchHung* XII, (1960), 1-82. |
| Banner, Bálint 1935 | J. Banner, A. Bálint, A szakálháti őskori telep. *DolgSzeg* 11, (1935), 76-96. |
| Barbu *et al*. 1999 | M. Barbu, P. Hügel, G. P. Hurezan, E. D. Pădureanu, *Repertoriul arheologic al Mureşului Inferior. Judeţul Arad*, Timişoara, (1999). |
| Bálint 1941 | A. Bálint, *Csanád, Arad és Torontál k.e.e. vármegyék részeti katasztere*, Makó, (1941). |
| Bognár-Kutzián 1963 | I. Bognár-Kutzián, *The Copper Age Cemetery of Tiszapolgár-Basatanya*, Budapest, (1963). |
| Bognár-Kutzián 1972 | I. Bognár-Kutzián, *The Early Copper Age Tiszapolgár culture in the Carpathian Basin*, Budapest, (1972). |
| Bognár-Kutzián 1976 | I. Bognár-Kutzián, On the Origins of Early Copper-Processing in Europe. (Ed. J. V. S. Megaw), *To illustrate the monuments. Essays on archaeology presented to Stuart Piggott*, London, (1976), 70-76. |
| Borić 2009 | D. Borić, Absolute Dating of Metallurgical Innovations in the Vinča Culture of the Balkans. (Ed. T. L. Kienlin, B. W. Roberts), *Metals and Societies. Studies in honour of Barbara* |

| | |
|---|---|
| | *S. Ottaway*, Bonn, (2009), 191-245. |
| Boroffka, Luca 1995 | N. Boroffka, S. A Luca, Archäeologische Metallfunde aus der Schulsammlung Beliu, Kr. Arad. (Ed. T. Soroceanu) *Bronzefunde aus Rumänien*, Berlin, (1995), 225-229. |
| Cambel 1974 | H. Cambel, The Southeast Anatolian Prehistoric Project and its Significance for Culture History. *Belleten* 38, (1974), 361—377. |
| Chapman 1981 | J. Chapman, *The Vinča culture of South-East Europe. Studies in chronology, economy and society*, Oxford, (1981). |
| Childe 1929 | V. G. Childe, *The Danube in Prehistory*, Oxford, (1929). |
| Ciugudean 2000 | H. Ciugudean, *Eneoliticul final în Transilvania şi Banat: Cultura Coţofeni*, Timişoara, (2000). |
| Ciugudean 2002 | H. Ciugudean, The Copper Metallurgy in the Coţofeni Culture (Transylvania and Banat). *Apulum* XXXIX, (2002), 95-106. |
| Comșa 1974 | E. Comşa, Unele date privind începuturile folosirii aramei în neoliticul României. *In Memoriam Constantini Daicoviciu*, Cluj-Napoca, (1974), 73-84. |
| Černych 1978 | E. N. Černych, Ai Bunar, a Balkan copper mine of the forth millenium B.C. *PPS* 44, (1978), 203-217. |
| Diaconescu 2009 | D. Diaconescu, *Cultura Tiszapolgár în România*, Sibiu, (2009). |
| Dombay 1960 | J. Dombay, *Die Siedlung und das Gräberfeld in Zengővárkony. Beitrage zur Kultur des Aeneolithikums in Ungarn*, Bonn, (1960). |
| Dörner 1970 | E. Dörner, Cercetări şi săpături arheologice în judeţul Arad. *MCA* IX, (1970), 445-466. |
| Driehaus 1952-1955 | J. Driehaus, Zur Datierung und Herkunft donanländischer Axt- typen der frühen Kupferzeit. *Archaeologia Geographica* 3-4, (1955), 1-8. |
| Esin 1999 | U. Esin, Copper objects from the Pre-Pottery Neolithic site of Aşikli (Kizilkaya Village, Province of Aksaray, Turkey). (Ed. A. Hauptmann), *The beginnings of metallurgy: proceedings of the International Conference The Beginnings of Metallurgy, Bochum 1995, Der Anschnitt Beih. 9, Dt. Bergbau-Museum, Bochum*, Bochum, (1999), 23-30. |
| Gazdapusztai 1963 | G. Gazdapusztai, Későneolitkori telep és temető Hódmezővásárhely - Gorzsán. *MFMÉ*, (1963), 21-48. |
| Gulmac 1991 | P. D. Gulmac, *The advent of metallurgy in prehistoric Southeast Europe*, Berkeley, (1991), (teză de doctorat). |
| Hampel 1876 | J. Hampel, *Catalogue de l'exposition préhistorique des musées de province et des collections particulières de la* |

| | |
|---|---|
| | *Hongrie*, Budapest, (1876). |
| Hampel 1876a | J. Hampel, *Antiquités préhistoriques de la Hongrie*, Esztergom, (1876). |
| Hansen 2009 | S. Hansen, *Kupferzeitliche Äxte zwischen dem 5. und 3. Jahrtausend in Südosteuropa*. Analele Banatului S. N. XVII, 2009, 140-158. |
| Hansen 2011 | S. Hansen, *Metal in South-Eastern and Central Europe between 4500 and 2900 BCE*. In: Ü. Yalçın (Hrsg.), Anatolian Metal V. Bochum 2011, 137-149. |
| Hegedus 1983 | K. Hegedus, The settlement of the Neolitic Szakálhát group at Csanytelek-Újhalastó. *MFMÉ*, (1982-1982), 7-54. |
| Horedt 1976 | K. Horedt, Die ältesten neolithischen Kupferfunde Rumäniens. *Jschr. mitteldt. Vorgesch* 60, (1976), 175-181. |
| Horváth 1987 | F. Horváth, Hódmezővásárhely-Gorzsa. A settlement of the Tisza Culture. *The Late Neolithic of the Tisza Region*, (1987), 31-46. |
| Horváth T. 2008 | T. Horváth, Balatonőszöd – an Unususl Baden Settlement? (Ed. M. Furholt, M. Szmyt, A. Zastawny, E. Schalk), *The Baden Complex and the Outside World. Proceedings of the 12th Annual Meeting of the EAA in Cracow 19 – 24th September 2006*, Bonn, (2008), 71-87. |
| Jacanović, Šljivar 1998 | D. Jacanović, D. Šljivar, Belovode, Vinča culture settlement and problem of the early copper metallurgy. (Ed. Florin Draşovean), *The Late Neolithic of the Danube Region. Interanational symposium on the problems of the Transition from Middle to Late Neolithic in the Middle Danube Region, June 1997, Timişoara, România*, Timişoara, (1998), 187-203. |
| Jovanović 1971 | B. Jovanović, Early Copper Metallurgy of the Central Balkans. *Actes du VIIIe Congres International des Sciences Prehistoriques et Protohistoriques, Beograd 9-15 septembre, 1971, Tome premier-Rapports generaux*, Beograd, (1971), 131-140. |
| Jovanović 1972 | B. Jovanović, Technologie minière de l'Enéolithique Ancien centre-balkanique. *Starinar* XXIII, (1972), 1-14. |
| Jovanović 1982 | B. Jovanović, *Rudna Glava, najstarije rudarstvo bakra na Centralnom Balkanu*, Bor-Beograd, (1982). |
| Jovanović 1990 | B. Jovanović, Continuity of the prehistoric mining in the Central Balkans. *Ancient mining and metallurgy in South-East Europe, International Symposium, Donji Milanovac, 20-25 mai*, Donji Milanovac, (1990), 29-35. |
| Jovanović 1991 | B. Jovanović, La métallurgie énéolithique du cuivre dans les Balkans. Et ses sources en matieres premieres. (Ed. J.-P. |

| | |
|---|---|
| | Mohen, C. Éluère), *Découverte du Métal*, (1991), 93-102. |
| Jovanović 1992 | B. Jovanović, Les débuts de l'utilisation du métal dans les Balkans dans l'analyse archéométallurgique. *SP* 11-12, (1992), 262-267. |
| Jovanović 1994 | B. Jovanović, Gradac Phase in the Relative Chronology of the Late Vinča Culture. *Starinar* XLIII-XLIV, (1992-1993), 1-11. |
| Jovanović 2006 | B. Jovanović, Gradac Phase of the Vinča Culture – Origin of a Typological Innovatin. (Ed. N. Tasić, C. Grozdanov), *Homage to Milutin Garašanin*, Belgrade, (2006), 221-233. |
| Junghans *et al*. 1968 | S. Junghans, E. Sangmeister, M. Schröder, *Kupfer und Bronze in der frühen Metallzeit Europas. Die Materialgruppen beim Stand von 12000 Analysen*, Berlin, (1968). |
| Kalicz 1992 | N. Kalicz, The oldest metal finds in Southeastern Europe and the Carpathian Basin from the 6th to 5th milenia B.C. *AÉ* 119/1-2, (1992), 3-14. |
| Kalicz, Raczky 1984 | N. Kalicz, P. Raczky, Preliminary Report on the 1977-1982 Excavations at the Neolithic and Bronze Age Tell Settlement of Berettyóújfalu-Herpály. Part I: Neolithic. *ActaArchHung* XXXVI, (1984), 79-136. |
| Kalicz, Raczky 1987 | N. Kalicz, P. Raczky, Berettyóújfalu – Herpály. A settlement of the Herpály culture. (Ed. P. Raczky) *The late Neolithic of the Tisza Region*, Budapest-Szolnok, (1987), 105-125. |
| Korek 1958 | J. Korek, Lebő-halmi ásatás 1950-ben. *AÉ* 85, (1958), 132-155. |
| Korek, Patay 1956 | J. Korek, P. Patay, A Herpályi-halom kőkorvégi és rézkori települése. *FA* VIII, (1956), 23-42. |
| Lanord, Contenson 1973 | F. Lanord, H. Contenson, Une pendeloque en cuivre natif de Ramad. *Paléorient* 1, (1973), 109-115. |
| Lazarovici 1970 | Gh. Lazarovici, Vinča A în Banat. *AMN* VII, (1970), 473-488. |
| Lazarovici 1975 | Gh. Lazarovici, Despre eneoliticul timpuriu din Banat. *Tibiscus* 4, (1975), 9-32. |
| Lazarovici 1977a | Gh. Lazarovici, *Gornea – preistorie*, Reşiţa, (1977). |
| Lazarovici 1979 | Gh. Lazarovici, *Neoliticul Banatului*, Cluj-Napoca, 1979. |
| Lazarovici 1983 | Gh. Lazarovici, Principalele probleme ale culturii Tiszapolgár în România. *AMN* XX, (1983), 3-31. |
| Lazarovici 1985 | Gh. Lazarovici, Noi descoperiri Bodrogkeresztúr în Banat. *Banatica* 8, (1985), 83-90. |
| Lazarovici, Munteanu 1982 | Gh. Lazarovici, I. Munteanu, Aşezarea eneolitică de la Slatina-Timiş. *StComCaraş* IV, (1982), 121-135. |

| | |
|---|---|
| Luca 1990 | S. A. Luca, Despre cea mai timpurie fază a culturii Bodrogkeresztúr în România. Aşezarea de la Pecica-Forgaci. *Studia Thracologica* 8, (1990), 89-92. |
| Luca 1993 | S. A. Luca, Observaţii privind faza clasică a culturii Bodrogkeresztúr în România. Aşezarea de la Pecica-Forgaci (jud. Arad). *AB N.S.* II, (1993), 49-84. |
| Luca 1999 | S. A. Luca, *Sfârşitul eneoliticului pe teritoriul intracarpatic al României: Cultura Bodrogkeresztúr*, Alba Iulia, (1999). |
| Luca 2001 | S. A. Luca, *Aşezări neolitice pe valea Mureşului (II). Noi cercetări arheologice la Turdaş-Luncă. Campaniile anilor 1992-1995*, Bucureşti, (2001). |
| Luca 2006 | S. A. Luca, *Descoperiri arheologice din Banatul Românesc-Repertoriu*, Sibiu, (2006). |
| Luca 2010 | S. A. Luca, *Descoperiri arheologice din Banatul Românesc. Repertoriu*, Sibiu, (2010). |
| Luca *et al.* 2000 | S. A. Luca, H. Ciugudean, C. Roman, A. Dragotă, Faza timpurie a culturii Vinča în România. *Angvstia* 5, (2000), 37-72. |
| Maddin *et al.* 1991 | R. Maddin, T. Stech, J.D. Muhly, Çayönü Tepesi. (Ed. J.-P. Mohen, C. Éluère) *Découverte du Métal*, (1991), 375-386. |
| Madin *et al*. 1999 | R. Maddin, J. D. Muhly, T. Stech, Early metalworking at Çayönü. (Ed. A. Hauptmann, E. Pernicka, T. Rehren, Ü. Yalçin), *The Beginnings of Metallurgy*, Bochum, (1999), 37–44. |
| Makkay 1996 | J. Makkay, Copper and gold in the Copper Age of the Carpathian Basin. (Ed. T. Kovács), *Studien zur Metallindustrie im Karpatenbecken und den benachbarten Regionen. Festschrift für Amália Mozsolics zum 85 Geburtstag*, Budapest, (1996), 35-53. |
| Mareş 2002 | I. Mareş, *Metalurgia aramei în neo-eneoliticul României*, Suceava, (2002). |
| Maxim 1999 | Z. Maxim, *Neo-Eneoliticul din Transilvania*, Cluj-Napoca, (1999). |
| Milleker 1897 | B. Milleker, *Délmagyarország régiségleletei a honfoglalás előtti időkből,* I, Timişoara, (1897). |
| Mogyoróssy 1871 | J. Mogyoróssy, Békésvármegyei leletek. *AÉ* 4, (1871), 210. |
| Mohen 1990 | J.-P. Mohen, *Métallurgie préhistorique. Introduction à la paléométallurgie*, Paris, (1990). |
| Muhly 1989 | J. D. Muhly, Çayönü Tepesi and the Beginnings of Metallurgy in the Ancient World, (Ed. Hauptmann, E. Pernicka, G. A. Wagner), *Archäometallurgie der Altel Welt/Old World Archaeometallurgy*, Bochum, (1989), 1-11. |

| | |
|---|---|
| Müller-Karpe 1991 | A. Müller-Karpe, Aspects of Early Metallurgy in Mesopotamia, (Ed. E. Pernicka, G. A. Wagner), *Archaeometry '90. International Symposium on Archaeometry*, 2-6 April, 1990, Heidelberg, Germany, (1991), 105-116. |
| Nagy 1913 | G. Nagy, Szkytha leletek I. *AÉ* XXXIII, (1913), 259-318. |
| Nestor 1954 | I. Nestor, Asupra începuturilor metalurgiei aramei şi a bronzului în R. P. R. *Studii şi referate de istoria României* I, (1954), 41-59. |
| Novotny 1958 | B. Novotny, *Die Slowakei in der jungeren Steinzeit*, Bratislava, (1958). |
| Özdoğan, Özdoğan 1999 | M. Özdoğan, M. Özdoğan, Archaeological evidence on the early metallurgy at Cayonu Tepesi. (Ed. A. Hauptmann, E. Pernicka, T. Rehren, Ü. Yalçin), *The Beginnings of Metallurgy*, Bochum, (1999), 13–22. |
| Patay 1943 | P. Patay, Rézkori lelet Mezősasról. *DolgSzeg* 19, (1943), 135-138. |
| Patay 1958 | P. Patay, Kupferz eitliches Gräberfeld in Polgár am Bascókert genannten Hügel. *ActaArchHung* 9, (1958), 141-154. |
| Patay 1961 | P. Patay, *A Bodrogkereszturi Kultura Temetöi*, Budapesta, (1961). |
| Patay 1968 | P. Patay, A tiszavalki rézfokos. *FA* 19, (1968), 9-23. |
| Patay 1984 | P. Patay, *Kupferzeitliche Meissel, Beile und Äxte in Ungarn*, Prähistorische Bronzefunde IX, 15, München, (1984). |
| Pădurean 1982 | E. D. Pădurean, Noi descoperiri eneolitice în judeţul Arad. *Ziridava XIV*, (1982), 35-48. |
| Pădurean 1985 | E. D. Pădurean, Contribuţii la repertoriul arheologic de pe valea Mureşului inferior şi a Crişului Alb. *Crisia* XV, (1985), 27-52. |
| Puszky 1877 | F. Pulszky, L'âge de cuivre en Hongrie. (Ed. F. Rómer ) *Congrès international d'anthropologie et d'archéologie préhistoriques: Compte-rendu de la huitième session à Budapest, 1876*, Budapest, (1877), 220-236. |
| Pulszky 1881 | F. Pulszky, Szegedi leletek. *AÉ* 1, (1881), 1-6. |
| Pulszky 1884 | F. Pulszky, *Die Kupfer-Zeit in Ungarn*, Budapest, (1884). |
| Raczky *et al.* 1996 | P. Raczky, W. Meier-Arendt, Z. Hajdú, K. Kurucz, E. Nagy, Two unique assemblages from the Late Neolithic tell settlement at Polgár-Csőszhalom. (Ed. T. Kovács), *Studien zur Metallindustrie im Karpatenbecken und den benachbarten Regionen. Festschrift für Amália Mozsolics zum 85 Geburtstag*, Budapest, (1996), 17-30. |

| | |
|---|---|
| Radivojević *et al*. 2010 | M. Radivojević, T. Rehren, E. Pernicka, D. Šljivar, M. Brauns, D. Borić, *On the origins of extractive metallurgy: new evidence from Europe*. Journal of Archaeological Science 37, 11, 2010, 2775-2787. |
| Roman 1971 | P. Roman, Strukuränderungen des Endäeneolithikums im Donau-Karpaten-raum, *Dacia N.S.* XV, (1971), 31-169. |
| Roman 1973 | P. Roman, Modificări structurale ale culturilor Eneoliticului Final din regiunea Carpato-Danubiană. *Banatica* II, (1973), 57-77. |
| Roman, Németi 1978 | P. Roman, J. Németi, *Cultura Baden*, Bucureşti, (1978). |
| Roska 1942 | M. Roska, *Erdély Régészeti Repertóriuma*, I, Cluj, (1942). |
| Roska 1942a | M. Roska, A rézcsákányok. *KözCluj* II/1, (1942), 15-77. |
| Rusu 1971 | M. Rusu, Cultura Tisa. *Banatica* I, (1971), 77-84. |
| Sava 2010 | V. Sava, Restituiri arheologice. Un topor de cupru din colecţia dr. Kasa Antal (Dorobanţi, judeţul Arad). *Banatica* 20/1, (2010), 129-141. |
| Sava 2010a | V. Sava, Săpătura lui Egon Dörner de la Pecica „Cărămidăria C.A.P. Ogorul", judeţul Arad. Descoperirile Preistorice. *BAM* V/1, (2010), 53-81. |
| Sava 2011 | V. Sava, Topoare de cupru din colecţia Complexului Muzeal Arad. *Sargetia S. N.* II, (2011), 17-52. |
| Schubert 1965 | F. Schubert, Zu den südosteuropäischen Kupferäxten. *Germania* 43, (1965), 274-295. |
| Smith 1969 | C. S. Smith, Analyses of the Copper Bead from Ali Kosh. Appendix II, (Ed. F. Hole, K. V. Flannery, J. A. Neely), *Prehistory and Human Ecology of the Deh Luran Plain*. Mémoires of the Museum of Anthropology 1, Michigan, (1969), 427—478. |
| Solecki 1974 | R. S. Solecki, A copper Mineral Pendant from Northern Iraq. *Antiquity* 43, (1974), 311-314. |
| Solecki *et al*. 2004 | R. S. Solecki, R. L. Solecki, A. P. Agelarakis, *The Proto-neolithic Cemetery in Shanidar Cave*. Texas A&M University Press, Texas 2004. |
| Suciu 2009 | C. I. Suciu, *Cultura Vinča în Transilvania*, Sibiu, (2009). |
| Szentmiklosi 2003 | A. Szentmiclosi, An Eneolithic Copper Axe discovered at Semlac (Arad County). *Apulum* XL, (2003), 59-71. |
| Szeremlei 1900 | S. Szeremlei, *Hód-Mező-Vásárhely története*, I, Hódmezővásárhely (1900). |
| Šljivar 1996 | D. Šljivar, The Eastern Settlement of the Vinča Culture at Pločnik: a Relationship of its Stratigraphy to the Hoards of Copper Objects. *Starinar* XLVII, (1996), 85-97. |

| | |
|---|---|
| Šljivar 2006 | D. Šljivar, The Earliest Copper Metallurgy in the Central Balkans. *Metalurgija* 12/2, (2006), 93-104. |
| Šljivar *et al.* 2006 | D. Šljivar, J. Kuzmanović-Cvetković, D. Jacanović, New Contributions Regarding the Copper Metallurgy in the Vinča Culture. (Ed. N. Tasić, C. Grozdanov), *Homage to Milutin Garašanin*, Belgrade, (2006), 251-266. |
| Virág 2003 | Z. M. Virág, Early Metallurgy in the Carpathian Basin. (Ed. Z. B. Kiss), *Hungarian Archaeology at the turn of the Millennium*, Budapest, (2003), 129-132. |
| Vlassa 1967 | N. Vlassa, Unele probleme ale neoliticului Transilvaniei. *AMN* IV, (1967), 403-424. |
| Vlassa 1969 | N. Vlassa, Einige Bemerkungen zu Fragen des Neolithikums in Siebenbürgen. *Študijné Zveti* 17, (1969), 513-540. |
| Vulpe 1973 | A. Vulpe, Începuturile metalurgiei aramei în spaţiul carpato-dunărean. *SCIV* 24/2, (1973), 217-237. |
| Vulpe 1974 | A. Vulpe, Probleme actuale privind metalurgia aramei şi a bronzului în România. *RevIst* 27, (1974), 243-255. |
| Vulpe 1975 | A. Vulpe, *Die Äxte und Beile in Rumänien II*, Prähistorische Bronzefunde IX, 5, München, (1975). |
| Vlassa 1976 | N. Vlassa, *Neoliticul Transilvaniei*, Cluj-Napoca, (1976). |
| Zalotay 1932 | E. Zalotay, Csongrad vármegye őskori települése. *DolgSzeg* 8, (1932), 49-120. |