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Metal Matters

Innovative Technologies and Social Change in Prehistory and Antiquity

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Innovative Metals: Copper, Gold and Silver in the Black Sea Region and the Carpathian Basin During the 5th and 4th Millennium BC

Svend Hansen

Introduction

It is a widespread opinion that the discovery, exploitation and processing of metal count as the socially most consequential technical innovations. Can this be asserted only retrospectively by an industrial society, in which life without metal is inconceivable and scientists constantly strive towards new metal alloys, a society in which copper and other metals in demand aim for the highest price on international commodity markets? Were the consequences that evolved from the early use of metal by prehistoric societies really as far-reaching as repeatedly propounded ever since V. Gordon Childe? Childe maintained that the key technologies such as the wheel, the ox-cart, the sailing boat and metallurgy as well were the decisive prerequisites for the emergence of complex societies (the »urban revolution«) in Egypt and the Near East.[1]

Is this assertion perhaps merely a matter of the perspective from which metals are viewed? Is there not equally reason to doubt that early metallurgy – according to today's criteria – was really an »innovative technique«?[2] Namely, technically the copper axe is not superior to the stone axe. One cannot chop down a tree more quickly or easily by using a copper axe rather than a stone axe. What then was the advantage in the use of copper? As is often in such cases, if no practical reasons are immediately at hand, then aesthetic, symbolic or ideological motives are sought.[3]

Nevertheless, the fact that the mining commenced with the 5th millennium BC in southeastern Europe and hardly later in other European regions, at first glance from a functionalist perspective, seems rather in need of explanation. Yet, a closer look reveals that the technical command of the metallurgical chain of production, the development of techniques in metalworking and the control over production represent determinative catalytic agents in the social transformation of Western Asia and Europe during the 5th and 4th millennium.

Apparently copper was initially used to make jewellery: The earliest metal finds are mostly small copper beads. Experimentation with metal, at first with native copper, began as early as the Pre-Pottery Neolithic in Anatolia, during the 9th millennium BC. In Aşıklı Höyük copper beads are found foremost in graves. In Çayönü there is a large spectrum of beads, pendants made of malachite and copper, and small tools such awls. There are even indications of the specialised production of beads.[4] As in Aşıklı Höyük, the objects are made of native copper that was either cold-hammered or formed in a warmed state.

Jewellery is a means of accentuating social relationships, and ever since the late Palaeolithic period ornamental beads of shell were exchanged over hundreds of kilometres. No other material was transferred over such great distances. Anatomically modern man was the first to use sea shells as jewellery, and this was quite innovative in itself. Namely, the durability of the shell material allowed the social message connected with shell jewellery to be conveyed to others for a long period of time. The gradual standardisation of the elements of a bead necklace, the combination of beads, their variations and their accumulation are characteristics, which – depending upon the beads – jewellery was able to communicate differentiated messages.[5] However, beads were not only jewellery; they also served to fend off evil; that is, they had the character of a talisman.[6] The early use of copper must be regarded under all of these general aspects. The earliest Neolithic copper was first used to make decorative beads.[7] It is, thus, pertinent that copper objects had »an immediate, social differentiating effect«.[8] And this was likely precisely Gordon Childe's thought, when he ascribed a significant role to metallurgy in the formation of complex structures of social organisation.

This, however, has been contested in various recent works, which argue that no central authority or control would be necessary for simple metallurgical production, nor did a controlling power arise in the beginning stages of metallurgy at least; the knowledge of and skills in metallurgy supposedly disseminated over larger distances by means of networks of relationships.[9] It is further argued that comparisons between cultures show that the use of metal did not lead to the emergence of more complex social organisation everywhere; indeed, some rather complex societies had no need for metal at all.[10] Finally, it has been pointed out that no specialised skill is needed to make small tools such as simple axes, and, therefore, some kind of social control over craftsmen and handwork does not need to be assumed.

1 Childe 1942/1982, 97; for Childe, see also Sherratt 1997/1998, 369–370; 1997, 59; 498.
2 Zimmermann – Siegmund 2002.
3 Smith 1981, 330–331.
4 Esin 2007, 214 ff. (Aşıklı Höyük); Özdoğan – Özdoğan 1999, 16 (Çayönü).
5 Kuhn – Stiner 2007, 45 ff.
6 Bar Yosef Mayer – Porat 2008, 8548 ff.
7 Cp. Wright – Garrad 2003, 267 ff.
8 Zimmermann – Siegmund 2002, 604.
9 Rovira 2002, 5 ff. pertaining to Spain; see also Kienlin 2008 on the Carpathian Basin; for the hoard from Nahal Mishmar and alleged absence of a social hierarchy in the Copper Age Levant, see Amzallag 2009, 498.
10 Cp. Carozza – Mille 2007, 181, on the social consequences of copper on the Late Neolithic period in southern France.

These arguments are correct in maintaining that between the 7th and 4th millennia BC in Eurasia very different societies came in touch with metallurgy, whose developmental course was not uniform. Nonetheless, there are recognizable trends in development in centres of metallurgical activities throughout the Caucasus, eastern Anatolia and the Balkans, trends that other geographic regions did not escape either, although some at considerably different times.

Archaeology without ethnological evolution

The inability to work out a uniform development in the use of metal between the Iranian highland and the European Central Mountains is matched by the lack of help offered by ethnology and its models of stages for reconstructing social and political structures in early societies. According to the neoevolutionist theory, which still predominates in archaeology today, the state is the result of the development of different ideal types of political control.[11] Whereas Elman R. Service differentiated the sequence »band-tribe-chiefdom-state«, Morton Fried assigned societies to the stages »egalitarian«, »ranked« and »state«. Service developed a concept that starts with differences in individual characteristics and skills, intelligence and energy, beauty and strength, all of which are present in all societies, including of course so-called egalitarian societies. Some individuals are viewed as being especially skilled, for example, to lead in war or to commune with the powers that are believed to be supernatural. In so-called Big-Man systems the presumptive leaders compete for status, which they gain through »redistributive feasts«. Yet, attached to this system is the danger of instability, for which reason it tends to transform charismatic leader-hierarchies into institutionalised lasting positions and offices. The term chiefdom is applied when the position of leadership is handed down from father to son, that is to say, inherited. These chiefs are either deities themselves or they monopolise access to the gods. This enables them to enforce consensus in society by means of »social engineering«. It is difficult, however, to distinguish these chiefdoms from primitive states.[12]

In actuality this »development« has not been observable anywhere, for ethnological observations mostly refer only to the 19th and 20th century. Therefore, considerations about the development of political systems are based exclusively upon contemplations about plausibility, that is, how a development might have been. And therein lies their weakness, for they cannot explicate the transition from the one to the other system, and, thus, they argue using the alleged advantages of the respective »more developed« systems, such as stability, which supposedly impelled a necessary development. Conversely, Stefan Breuer also reckons explicitly with the collapse of leadership, when – for instance – the system of prestigious goods cannot be used anymore. As a rule a simplification of social structure then sets in, so that one can speak of *devolution*.[13]

From ethnological observations of different, but *contemporary* types of social organisation on all five continents, evolutionists set up a seemingly logical sequence, which was altered to *temporal* succession (for example, the Melanesian *big man* and the Polynesian *chief*). Besides the rather questionable epistemological foundations for this sequencing, a review of the empirical reality behind the ideal types of political systems seems absolutely necessary, especially if they are applied to archaeology. In his scheme Ch. Strahm connected the early phase of metal-use with the big-man system, the developed phase of metallurgy (»Metallikum«) by contrast with the chiefdom system.[14] Accordingly, in the course of development, the positions of leadership and authority stabilised and become heritable. The market was controlled by a political apparatus, and the system based upon division of labour: a development that was first achieved in the Bronze Age. The scheme should describe the path from an egalitarian society to a stratified society. Notwithstanding, one could raise the question as to what is actually concealed behind these ideal types of political systems. So, J. G. Flanagan emphasises that no »real« egalitarian societies are known, in which age, gender and individual characteristics do not legitimise differences among the members.[15] A recent look at *big men* in New Guinea has shown that many accounts reported on the downright despotism and murderous power of *big men* and that the existence of chiefs must be assumed on New Guinea.[16] Thus, with reference to their practical consequences for individuals or groups, both systems are apparently quite similar.

Until now archaeology has attempted to balance the evaluation of its source material with anthropological schemes. Inevitably this has led mostly to the same result: prehistoric societies are generally assigned to the level of chiefdoms, somewhere between Palaeolithic bands and the ancient states. The seemingly plausible and unambiguous application of this scheme to the development of the Neolithic as well as the Bronze Age, however, arouses strong doubts as to its operative value, for societies obviously developed in many and different ways during the 12,000 years after the end of the last Ice Age. Early forms of state emerged in western Eurasia and in Egypt already in the 4th millennium BC, only 240 generations later, while the population in Australia long maintained »egalitarian« societies, well into the 20th century.[17]

The repeated imposing of presupposed universalities about forms of social and political organisation upon history leads to ever the same aporia. In its place, a way of looking at archaeological material should be developed that is free of seeming generalities. Namely, there are many ways – not just one – in which egalitarian societies develop into societies whose determining principle is inequality. It is, therefore, advisable, at least when describing the formation of a ruling authority, to loosen the strong ties between archaeology

11 Cp. esp. Service 1977; Fried 1967; for the most comprehensive presentation of this theory, see Carneiro 2003; for critique see Yoffee 2005, 8 ff., and Bernbeck 2008, 533 ff.
12 Service 1977, 359 ff.
13 Breuer 1998, 33; cp. also Eggert 2007, 255 ff. *contra* Breuer 1998.
14 Strahm 2005, 32.
15 Flanagan 1989, 246.
16 Cp. the overview by Roscoe 2000, 79 ff.
17 My definition of one generation being 25 years follows Ian Hodder's line of thought, Hodder 2006, 21.

and ethnology; for, it is archaeology that observes long-term developments, whereas the actual temporal depth of ethnological studies is, by contrast, quite shallow. Today, the field of ethnology has only historical documentation at hand. Archaeology, oppositely, can trace the course of mankind's development in specific spaces and time and name the discontinuities in history. It does not need ideal types of stages in order to interpret its source material socially and politically. Thus, archaeology addresses cultural peculiarities, instead of searching pointlessly for cultural universalities.[18]

The secret of metal

Metal as a raw material has very practical advantages, which were quickly recognised and soon appreciated. Its particular qualities became apparent in the course of time. Finds from aceramic settlements in eastern Turkey show that efforts were indeed made to search for this raw material, which went beyond the initial occasional and individual collecting of native copper. Since the early 6th millennium BC heavy weapons of native copper were produced in Anatolia, for example, the macehead found in Can Hasan. Copper finds from aceramic settlements have often been presumed a sign of experimentation with copper smelting. In the second half of the 7th millennium BC, the command of pyrotechnology had developed through work with the first pottery kilns to such an extent that attempts at smelting can be expected.[19] The first cast axes (Fig. 1), however, are attested clearly later, in the time after 5000 BC (Mersin-Yumuktepe, layer XVI).[20] And it is during this stage of development at the latest that the existence of specialised craftsmen can be reckoned.[21]

With the ability of casting a new quality was achieved: The special attractiveness of metal lay in the fact that it could be melted (Fig. 2). Every broken axe could be melted down and a new axe cast. Alternatively, a broken axe could be melted down in order to cast an object in demand, for instance, a bracelet or a chisel. Thus, united in metal were two remarkable features that were largely absent in other materials: reparability (that is, renewal) and convertibility. When the blade of a stone axe broke, the whole object had to be shortened considerably in order to repair it; in the worst case a new axe had to be made. The appropriate stone material was not always at hand; hence, there was a certain dependency upon exchange partners, who had access to the corresponding raw material for making axes. Otherwise, if stone quarries were accessible, the craftsman had to procure the stone material, for example silex, on his own, which could involve a journey of several days.

The generally sparse availability of raw material was the reason why in almost the entire history of mankind natural resources had to be dealt with sparingly; indeed, there was no »affluent society«.[22] After the short episode of the »throw-away society« in the 1960s, today reusability and durability are the dictates of consumer behaviour. At present the recycling quota for copper lies at c. 30–35 % worldwide. Secondary copper can be produced with 80 % less energy expenditure than primary copper; with the increasing energy costs a rise in this quota is quite probable.[23] It was estimated that 80 % of all copper produced since the 5th millennium is still in use.[24]

With the possibility of remelting an object and producing a new object came a new quality: namely, the material remained (almost) whole; it was not used up. Once exploited in the mine and processed, metal could be used again and again to produce new objects. Contrary to broken stone axes, it was, thus, sensible to accumulate metal to use when necessary. Metal could always be converted according to demand: pins made from swords or swords made from bracelets. All metal objects could, and usually were, reused (Fig. 2).[25] The enormous technical and social possibilities offered by metal represented a challenge to the hitherto way of thinking.[26]

The following should present the development of the use of metal in the Black Sea area and link it with the development in the rest of Europe. For this three periods in time will be distinguished: the development linked with the cemetery in Varna and lasting until c. 4200 BC (cp. Fig. 6), the subsequent middle Copper Age until c. 3500 BC (cp. Fig. 15), and finally phenomena that were more or less contemporary with the Baden culture in the Carpathians, until c. 2900 BC (cp. Fig. 32).

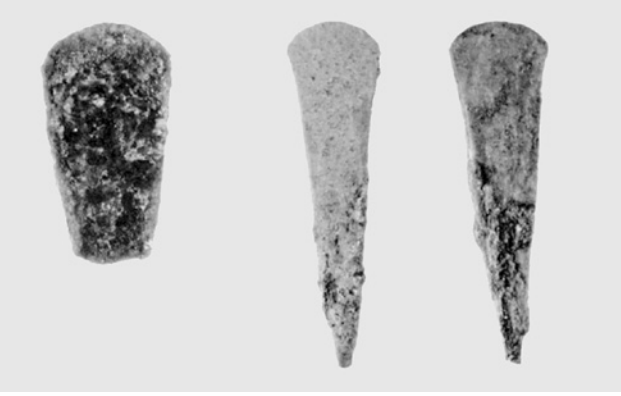

Fig. 1 Axes and chisels from Mersin (after Garstang 1953).

18 Cp. Foucault 2001, 89.
19 For pottery kilns, cp. Hansen Streily 2000, 69 ff.
20 Can Hasan: Yalçin 1998, 279 ff.; Mersin: Yalçin 2000; cp. also Yener 2000, 24–25. Cp. overviews of early metallurgy in Schoop 1995; Todorova 1999, 237 ff.
21 Cp. Ottaway 2001, 104.
22 Sahlins 1972.
23 The term »urban mining« refers to efforts being made today to gain valuable raw materials from waste disposal sites.
24 Süddeutsche Zeitung 22./23.1.2011, 34.
25 Therefore, the absence of metal in archaeological documentation is »normal«, while metal objects found are the exception. The latter were namely taken out of the circle of production–consumption–recycling and placed as offerings in graves or offered to powers believed to be supernatural. This aspect will be discussed later.
26 Cp. in one aspect Eliade 1980, esp. 149 ff.; Strahm 2005, 35 speaks of a cognitive revolution.

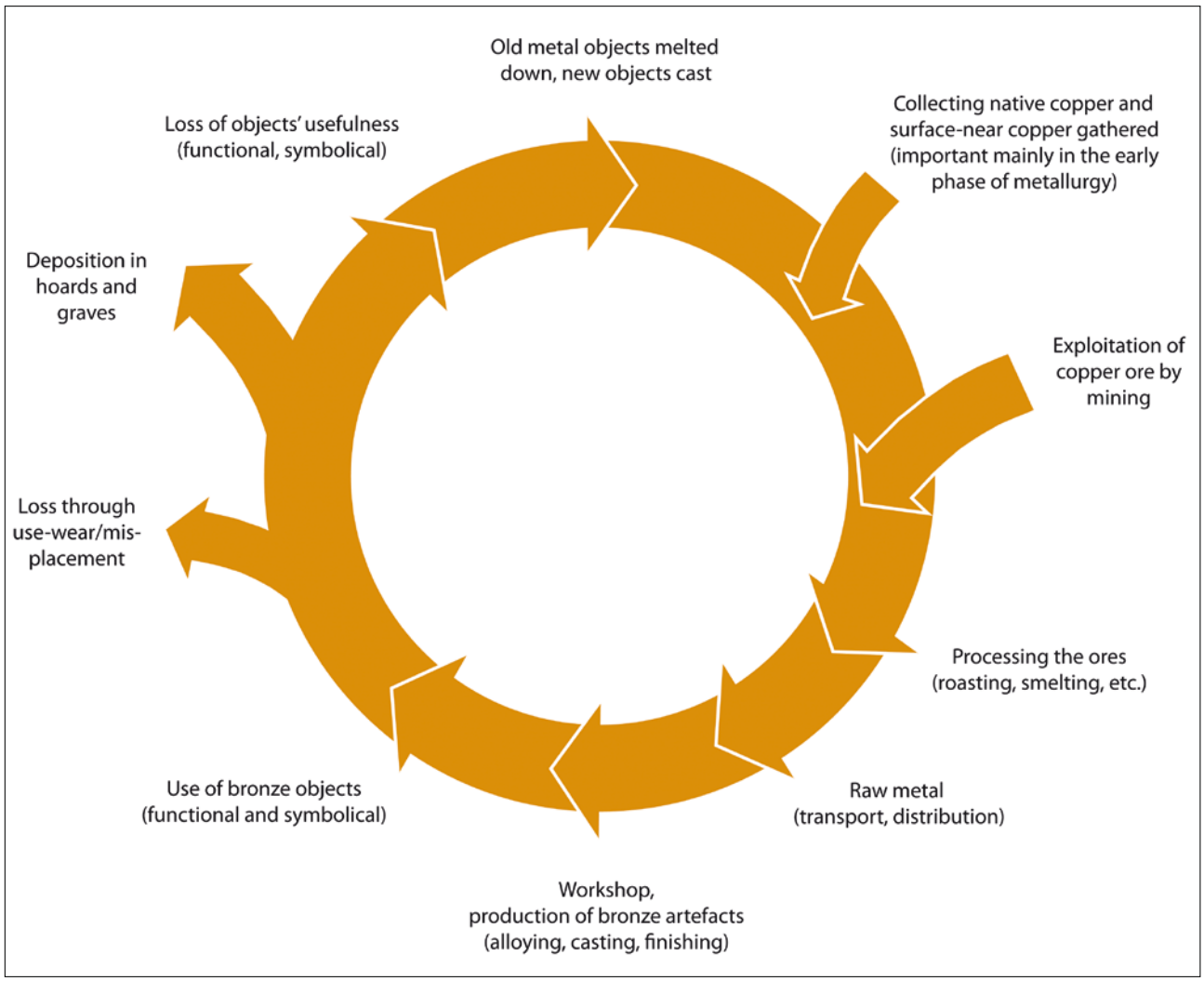

Fig. 2 Circulation process of the use of copper during early metallurgy (diagram by Anke Reuter).

Metallurgy during the Neolithic period in southeast Europe (c. 5000–4200 BC)

The Neolithic innovations such as clay vessels, polished adzes, domesticated sheep, swine and cattle as well as cultivated cereals, which arrived in Southeast Europe at the end of the 7th millennium BC, did not include the knowledge of copper working, as far as can be determined today.[27] A considerable increase in metal finds can be noted only later, starting with the second half of the 6th millennium BC and in particular during the 5th millennium BC. The appearance of a southeast European metallurgy, which obviously was not connected with the »Neolithic package«, was interpreted accordingly as an autonomous invention.[28] This theory seemed to find good support in the »first gold of mankind« in Varna. At the same time it was suggested that the emergence of metallurgy could have been an autonomous phenomenon in other places as well. These considerations successfully challenged the prevailing diffusionist model of explanation by V. Gordon Childe only in the short-term. Yet, they did not promote a better understanding of the large scale spatial and temporal associations. Most of the recent studies are in agreement that the development of Eurasian metallurgy commenced in southwest Asia and spread from there to the West.[29]

As in Turkey and the Middle East the picture of finds from the 6th and 5th millennia BC in Southeast Europe is likewise dominated foremost by ornamental objects. A necklace made of spondylus and malachite beads was found in the settlement of Aşağı Pınar (Turkish Thrace); the object can be dated to the time between 5080 and 4900 cal BC.[30] Beads

27 Cp. the map in Sherratt 1980, 108 fig. 15,5; recent detailed illustrations in Lichter 2005.
28 Renfrew 1969, 12 ff.; see for this phenomenon Özdoğan 2008, 139 ff.
29 Cp. Schoop 1995; Roberts et al. 2009, 1019; Roberts 2009, 461: »(…) there is no evidence for the independent invention of metallurgy in Western Europe.«
30 Özdoğan, M. – Parzinger 2000, 84 fig. 1.
31 Zalai-Gaal 1996, 1 ff.

and bracelets, mostly together with spondylus ornaments from the Mediterranean, were used as grave goods in cemeteries of the Lengyel culture in western Hungary.[31] Numerous beads made of malachite and copper are likewise attested in the cemetery at Durankulak on the Bulgarian Black Sea coast.[32] The small cemetery of Varna II yielded three unusually richly furnished graves. Among other finds, 31 gold beads, 139 beads of malachite and one copper armring were recovered from grave 3. A noteworthy find among the other grave goods is the green stone axe with a pointed neck, which is a link to the western European jade axe-circulation (Fig. 3).[33] This period of time is distinguished archaeologically by ornamental objects primarily; only very few tools, mainly small chisels or axes, are documented for example, in Kamnik, Slatino, Marica and Sesklo[34] and Alsónyék.[35]

Fig. 3 Varna II grave 3 (Photo: K. Dimitrov, Varna Museum).

Varna and the Copper Age in the west Black Sea area

At a somewhat greater time later a remarkably broad spectrum of copper tools and weapons appeared in the cemetery I at Varna. Besides the small axes, there are now shaft-hole axes and lanceheads in various forms. It is above all the great diversity of artefacts that lends Varna an extraordinary position within the circumpontic sphere. The profusion of such artefacts in the Carpathian Basin led Ferencz Pulszky, as early as 1876, to speak of an independent Copper Age there.[36] The question as to the provenance of these artefacts had to remain open at that time, as evidence of production was unknown. But with the discovery of mines in Rudna Glava/Serbia and Ai Bunar/Bulgaria, dated as early as the 5th millennium BC, the exploitation of copper ores could be definitively proven.[37] Copper had not been imported from afar, but instead procured locally; copper axes were not made from native copper, but were produced by casting.[38]

With the discovery of the cemetery of Varna the term ›Copper Age‹ took on a social dimension. Specifically, the graves found there contained not only a plenitude of copper tools and weapons, but also a wealth of objects made of gold. Furthermore, the enormous scale in the number and weight of grave goods was interpreted as an expression of great social differentiation. Initially Varna was dated to the Early Bronze Age: The multitude of metal objects and such a conspicuous social differentiation were hardly consistent with the »egalitarian« Neolithic society. However, against the background of ^{14}C datings it soon became clear that Varna should be dated to the 5th millennium BC. This realisation will be discussed further below.

Here only one grave will be singled out: grave 43 that held the remains of a 40–50-year old male in extended supine position (Fig. 4). His grave gifts included several weapons made of copper: two shaft-hole axes, one broad and one narrow one, and a copper spearhead or dagger (?) that is a singular piece in itself. The deceased male also had a pointed flint blade, with bilateral retouching and a rounded base. The stone axe with a wooden shaft covered with gold sheet can be understood as a sceptre. The »old-fashioned« stone axe formed a link to the past and with that established the deceased's legitimacy to power. A jade axe is an import from afar: The raw material derives from the Alps and the axe likely made its long way from western Europe to ultimately reach the Black Sea coast, where it was brought into the typical shape of east Balkan axes.[39] Among the many flint blades is one outstanding example of almost 40 cm in length. Its significance lies in the fact that there is still no plausible explanation for the strength and prowess that was necessary to strike such a long blade from the core. The spondylus from which the originally red bracelet was made came from the Mediterranean. The bracelet must have been repaired once, for which gold sheet was used, an indication indeed of how precious it was. This solitary piece was worn together with two arm rings of gold on the left arm. All together 1413 grams of gold were found in the grave. Aside from the armrings, there was a myriad of golden beads that had been attached to the bracelets or worn as necklaces. The various gold discs were likely sewn onto garments, so that the entire body of the deceased was covered in gold. A gold penis sheath lay in the pelvic area.

Gold was not only the metal of power in Varna; it was evidently also the stuff of life. For the first time gold was used to represent the living, which is a small innovation in itself. The gold astragal found in grave 36 (Fig. 5) is the first known metal copy of a bone original, that is, part of a living being; from the same grave came metal figurines of animals, the first found in Eurasia. The sceptre and the diadem were sym-

32 Todorova 2002, 62 pl. 107.
33 Иванов 1978, 86–87 pl. 4–7.
34 Todorova 1999, 241 fig. 4.
35 Zalai-Gaál 2008, 271 ff.
36 The standard work on early metallurgy is E. Chernykh's study in 1992. Cp. also Ottaway 2001, 87 ff. A good overview is offered in: Ottaway – Roberts 2008, 193 ff.; for the Copper Age, Pulszky 1877; Montelius 1895. The southeast European cultures of the 5th and 4th millennia BC are understood here as Copper Age. Cp. Korfmann 2004, 109 ff.
37 Jovanović 1971; Černych 1988, 145 ff.
38 Cp. recently Boroffka 2009.
39 On jade axes, see Pétrequin et al. 2002, 67 ff.; 2005, 264 ff.

Fig. 4 Varna, grave 43, reconstruction in the Varna Museum (Photo: S. Hansen).

Fig. 5 Varna, grave 36, selected grave goods (after Fol – Lichardus 1988).

bols of power then and are still understood as such today. In contrast to these richly furnished graves were burials that contained only few grave goods or none at all. The funerary gifts – especially those made of metal – served further as signs of social difference in life even after death. This is all the more noteworthy, for represented in Varna is only a part of a long-distance communication network and exchange system that encompassed Thrace, northeast Bulgaria and southern Romania. The societies participating in this system seem to have been hierarchically structured and economically based on processes entailing the division of labour. This feature has found support at least in new excavations conducted at the settlement Măgura Gorgana in Pietrele (Romania). Production was controlled, and commodities were collected and redistributed. The involvement in supra-regional systems of resource procurement and redistribution of goods should be emphasised just as much as the dissemination of shared symbols, as exemplified – for instance – by anthropomorphic figurines.[40] Moreover, Varna should probably be understood as the result of a specific development or a tradition, for the older cemetery of Varna II already comprises a disproportionate number of wealthy graves.

By contrast, coeval settlements provide little noteworthy information about the production of metal objects. Nevertheless, copper finds from habitation sites are evidence that metal was indeed a part of daily life and was circulated in greater amounts. Among the numerous objects that were recovered from settlements are various forms of ornamental pins and small rings. Awls (Fig. 6,6), some found still inserted in a bone shaft, were a widely used universal tool.[41]

40 Hansen et al. 2009, with further literature.

41 Some possible uses, but certainly not all are presented by Pearce 2000, 67 ff.

Copper and gold in other cemeteries of the 5th millennium BC

To this day no prehistoric cemetery has been found that compares with the rich furnishings in Varna. Hence the question: is Varna a special case?[42] Indeed, gold objects in such abundance as in Varna are unparalleled in Southeast Europe; on the other hand, analogous social phenomena have been noted in other places in the Carpathian Basin.

A pendant (Fig. 6,11) found in Varna links the cemetery with a number of finds from settlements in Bulgaria and southern Romania. Pendants like this one have been found in graves of the Tiszapolgár and Bodrogkeresztúr cultures of the Carpathian Basin (Fig. 7). Grave 10/56 in the cemetery at Tibava (Slovakia) contained such a pendant together with an axe and a bracelet, both made of copper, a stone axe as well as silex blades and several clay vessels (Fig. 8). The graves in Tibava and other Copper Age cemeteries in the Carpathian Basin are nowhere near as richly equipped as those in Varna, yet the most important and prestigious features of the grave goods are quite comparable with those in Varna: copper axes and adzes, long silex blades, copper bracelets, gold pendants. These copper goods were reserved for a small group of men: According to investigations carried out by Clemens Lichter, every ninth grave in Tibava contained an axe.[43] In the none too distant cemetery at Vel'ké Raškove there was one copper axe in every seventh grave.[44] Located near the mouth of the Prut River into the Danube, close to the village of Giurgiuleşti/Moldavia, was a burial mound that contained several graves (Fig. 9).[45] Of special interest is the sword found in grave 4. Its basic frame consists of a wooden staff tightly wrapped in leather; inserted in the two parallel sides of the staff is one row each of nine flint blades. Inserted in the antler point of the sword are five flint blades. The sword has a total length of c. 60 cm. This unique composite sword gives an impression of the wealth of innovative ideas to increase the distance between combatants and thereby to create a decisive advantage. All the more noteworthy is the copper stabbing weapon, 35 cm long, that lay near the right upper arm of the deceased (Fig. 9,1): It displays the technical potentiality of copper in its use for weaponry. The fact that this object was not a singular case, but rather one component of a trend, is affirmed by the 27-cm long stiletto found in the richly furnished grave at Reka Devnja in the Dobrudscha.[46]

Even though a »second Varna« has not been discovered yet, the cemetery is nevertheless not a special case of its own. The cemeteries at Tibava, Vel'ké Raškovce and Giurgiuleşti indicate that comparable tendencies in the differentiation in status and its manifestation with metal objects were operative in other regions in southeast Europe as well. They were rooted in a long-term development, which is already evidenced in the aforementioned late Neolithic cemeteries at Durankulak, Varna II and Alsónyék-Kanisza. Among the c. 2000 burials in the cemetery at Alsónyék-Kanisza in western Hungary, one grave stands out in its somewhat distant location apart from the rest of the graves and in its rich funerary furnishings. Aside from imported pottery and numerous spondylus objects and copper beads, it contained one stone axe, a large shoe-last celt, a stone adze, a white stone macehead, a long silex knife and a bucranium (Fig. 10–11).

Fig. 6 Metal types in use during 4600–4200 BC: 1–2,5,11,12 Varna (Fol – Lichardus 1988); 3 Pločnik (Сталио 1964); 4 Giurgiuleşti (Dergačev 2002); 6–9 Pietrele (Photo: S. Hansen); 10,14 Karbuna (Photo: S. Hansen); 13 Pauilhac (Eluère 1982). Various scales.

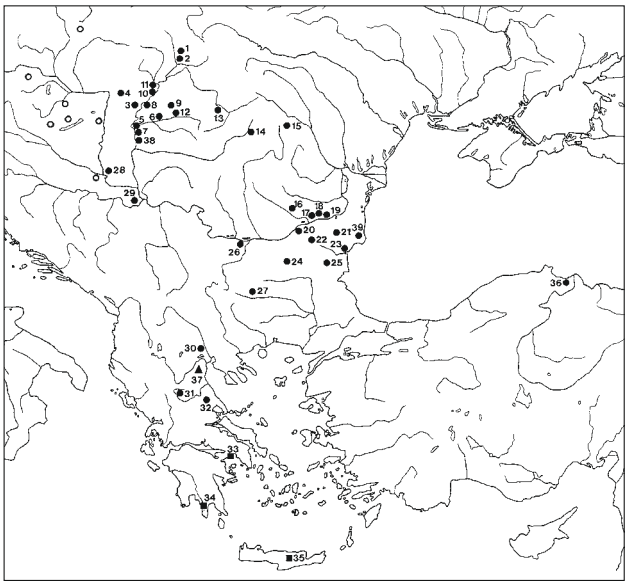

Fig. 7 Distribution of gold disc amulets (after Hansen 2007).

42 Cp. Kienlin 2008; Kienlin – Pernicka 2009, 271–272.
43 Šiška 1964, 293 ff.
44 Lichter 2001, 282 ff.
45 Dergačev 2002 pl. 11–15; Govedarica 2004, 85 ff. pl. 14–16.
46 Govedarica 2004, 106 ff. pl. 21,4–8; 22–24.

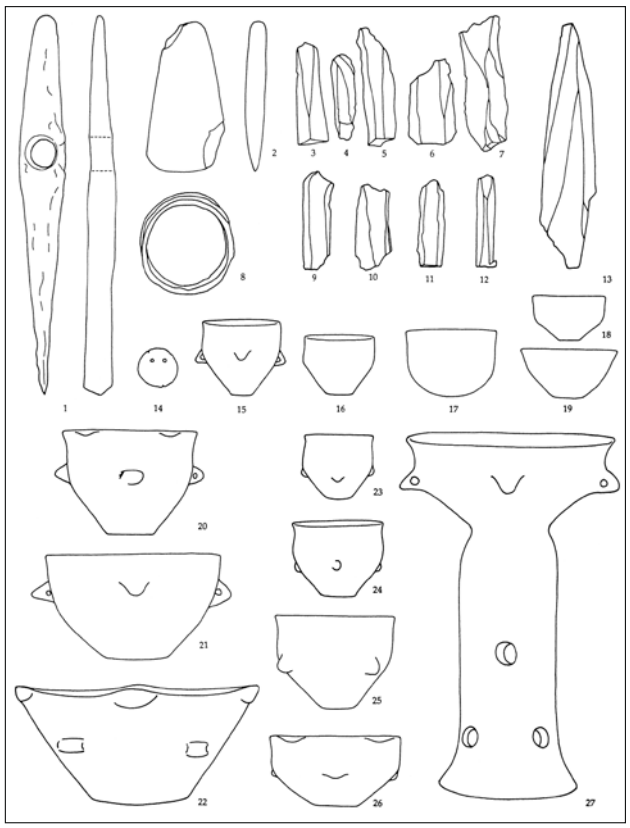

Fig. 8 Tibava, grave 10/56 (after Lichter 2001).

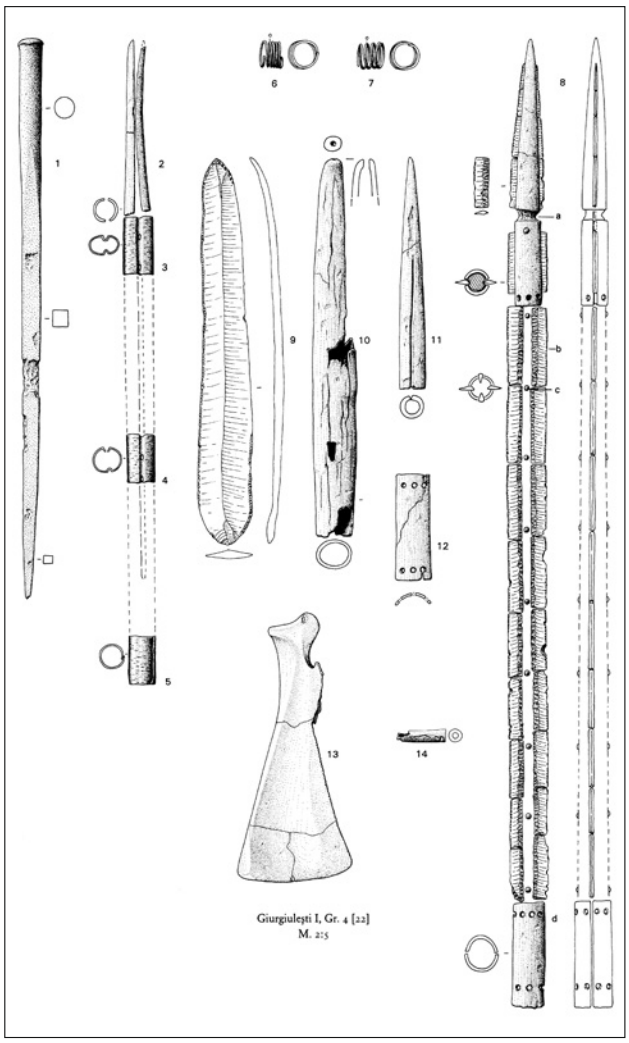

Fig. 9 Giurgiuleşti, grave 4 (after Dergačev 2002).

Fig. 10 Alsónyék-Kanisza, »chief's grave« (after Zalai-Gaál 2008).

Fig. 11 Alsónyék-Kanisza, »chief's grave« (after Zalai-Gaál 2008).

Metal as offering to imagined powers

The deposition of valuable objects in the grave at the time of burial was essential from the viewpoint of the surviving (family) members. According to beliefs, not placing offerings in the grave would have been understood as miserliness, indifference or such by the imagined powers in the afterlife or the deceased spirits themselves. In archaic societies in which generosity as a social and moral ideal stood in contrast to the actual paucity of goods, the deposition of metal objects in the grave increases the prestige of those who bury the dead even more. Presumably the motive was to mark forever the difference that distinguished the deceased from the rest of society. The axes found in the late Neolithic and early Copper Age graves in Alsónyék-Kanisa, Durankulak, Varna, Tibava as well as Vel'ké Raškovce were a distinction bestowed upon only a small group of persons.

Admittedly, upon closer examination one becomes aware that the copper axes are relatively small and light weight. The axe in grave 320 in Durankulak weighs 375 g, the axe in grave 977 only 309 g.[47] The axes found in Varna are likewise of light weight. Axes found in hoards, by contrast, weigh at least twice as much, some as much as 1250 g.[48] Astonishing differences in weight can be noted among the gold ornamental discs. The 31-cm large disc from a deposit in Transylvanian Moigrad weighs 750–800 g and is the heaviest gold object known from the Copper Age.[49] It is equal in weight with about 200 small gold pendants, known from graves and settlements (Fig. 12). The hoard found in Karbuna/Moldavia comprised 444 copper objects and 407 pieces made of other materials; they likewise can be linked to the social sphere that is represented in the rich graves in Varna.[50] The components of the hoard include, among others, a hammer axe of c. 500 g in weight and a 555-g broad chisel of copper as well as one axe of green stone and a larger axe made of white marble, which in view of the material is interpreted as archaicising symbols of power. Thirty-one copper pendants weighing up to 136 g represent till now singular pieces.

Already in the 6th millennium BC stone axes were sometimes placed outside of settlements at topographically distinctive locations; they are interpreted as having been intentionally deposited there to believed-supernatural powers. An increase in such depositions can be detected in the Copper Age, and the development and augmentation of these deposits in offering can be understood as an ideological innovation of that age. Like the gifts in graves, these offerings are primarily founded in the religious sphere, although they fulfilled a multitude of various social functions.

In his meanwhile ›classical‹ *Essai sur le don*, Marcel Mauss laid the groundwork for understanding the meaning of these gifts. Basing upon ethnographical material, in particular the Melanesian *kula*, Mauss recognised and explained that the seemingly voluntary archaic exchange was actually founded upon three obligations: to give, to take and to reciprocate. The person who wished to gain prestige was obligated to give. The recipient was obligated to accept the goods, if he did not wish to lose face. He consequently was obligated to return a gift. As a result of this cycle there was a constant circulation in goods between exchange partners, which served for social cohesion. The archaic exchange system is an institution in which all components of society are intertwined; all is intermixed. Mauss speaks of a »total« societal phenomenon, in which all kinds of institutions are expressed at once and for all: religiously, legally, morally and economically, not to mention the aesthetic phenomena from which each case draws.[51] The exchanged objects serve as a vehicle for social ties among the persons involved in the action of exchange. Mauss recognised that the exchanged articles were not simply inanimate things, but were handled as besouled objects and, thus, the exchanged item was never completely released from its former owner.

As shown above, all traditional societies were endeavoured to save on raw materials and to utilise an object as long as possible. However, this does not imply that the waste, squander and destruction of things were unknown to them. The *potlatch* among the Pacific Coast Indians of North

Fig. 12 Moigrad, gold disc (after Makkay 1989).

47 Todorova et al. 2002, 45; 78.

48 The two hammer-axes in Yunacite weigh 1250 and 900 g respectively (Mazanova 2004, 394 fig. 3). The hammer-axes from the hoard of Rakilovzi (dist. Radomir) range between 720 and 840 g in weight (Михайлов 2008, 35 ff. fig. 1–8; in all more than 6 kg of copper were retrieved).

49 Makkay 1989 pl. 9.

50 Dergačev 2002, 11 ff. pl. 1–8.

51 Mauss 1968, 17–18.

America is a system of exchanging goods, whose later and particularly antagonistic form is foremost found in literature.[52] Because the person giving could not withhold anything, these *potlatches* could lead to the total economic exhaustion of the giver. He who gave away most extravagantly gained most in prestige. In order to avoid the impression that great value was placed upon requital, the goods given were destroyed: boxes of fish and whale oil, wool blankets, even houses. The point was to out-do any rivals, to »flatten one's rival«. A chief could only retain his status, if he could prove that he was favoured by the spirits: he possessed fortune and wealth. He could prove his wealth only by giving away, by distributing and, thus, outdo the others.[53] The ultimate aim of the *potlatch* was to interrupt the interchange of goods, that is, to perform a *potlatch* that could not be reciprocated.[54]

Mauss emphasised that the *potlatch* also had its effects upon nature: »The exchange of goods between namesakes – the homonyms of the spirits – incite the spirits of the dead, the gods, things, animals, nature to be generous to them. The exchange of goods caused a surplus in riches …«.[55] Basically, presents made to the gods and other imagined spirits follow in the same logic: »I give as I am in their debt and I obligate the imagined powers to pay back: *do ut des*.«[56] Needless to say, this was a potentially precarious exchange in goods. Between those of equal social status acceptance of the goods was obligatory. Among the socially unequal, it was the prerogative of the higher ranking person to return the gift. Consequently, giving and taking between the gods and humankind was unpredictable.

With regard to metal depositions, the logic of exchange (giving, taking and giving back) had even further consequences. In the Copper Age only those persons who already held authority and who possessed a sizeable amount of copper were in the position to enter upon an exclusive relationship with the imagined supernatural powers. They could become engaged in socially obligatory relationships by offering valuable goods and could expect correspondingly large returns. Thus, here we have two social strategies that are documented by massive copper artefacts: In the grave the goods served to epitomise social distinction beyond death; among the living the communication with the supernatural powers was dominated by those persons who were able to give away metal objects and who were reliant to a great extent upon the benevolence of the supernatural powers.

New results of ^{14}C datings

It took some time before research finally resigned to the fact that according to radiocarbon datings the cemetery at Varna does indeed date to the 5th millennium BC.[57] Nonetheless, until recently preference was given to a date only at the end of the 5th millennium BC. However, now new datings show that the wealthiest graves in Varna were already installed between 4600 and 4500 cal BC.[58]

First of all, the new radiocarbon datings have revealed that the once-thought contemporaneity of the east Balkan phase of the early Copper Age (KGK VI) with the central Balkan Vinča D period no longer applies. According to the most recent compilations of ^{14}C datings by Dušan Borić, the Vinča D-phase already ended some time between 4650 and 4600 cal BC, and was then followed by the phases Proto-Tiszapolgár and Tiszapolgár A culture.[59] This was consequential for the evaluation of a group of »massive artefacts«, which stemmed from the settlement of Pločnik, some 300 km south of Belgrade. The group consists of four shaft-hole axes, 25 chisels, four armrings and one pin, amounting all together to a total weight of 16 kg (Fig. 13).[60] The objects were found in sepatate groups, which have been designated as hoards. Occasionally the thought has been voiced that the objects had been embedded later in the Vinča-layers, which would render them younger in age. But, a new evaluation of the find circumstances has shown that the objects were actually found in settlement layers.[61] The five stone axes, one hammer axe and twelve copper chisels designated as hoard II lay in

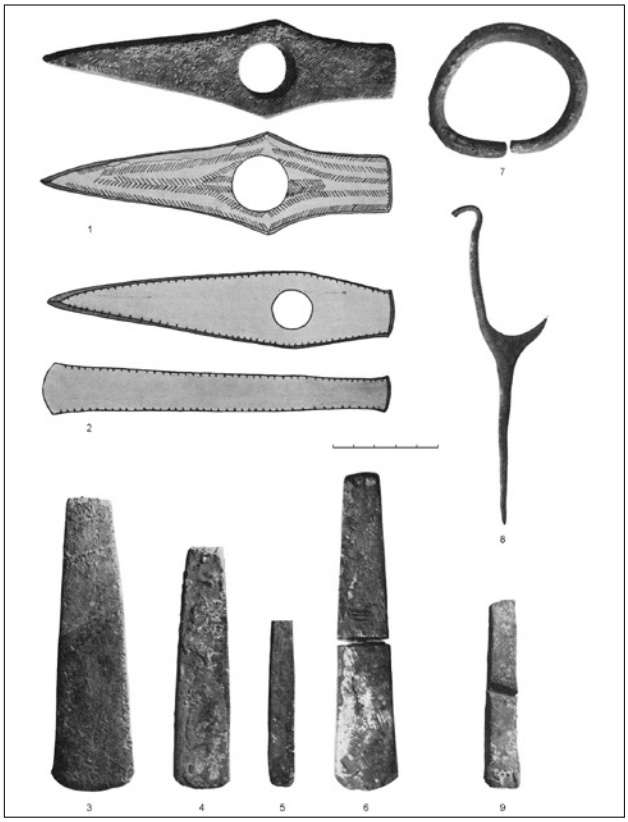

Fig. 13 Selection of copper axes and chisels from Pločnik (changed, after Сталио 1973).

52 Mauss 1968, 77 ff.
53 Mauss 1968, 92.
54 Godelier 1999, 85.
55 Mauss 1968, 40–41.
56 Gladigow 2005, 188.
57 Cp. Renfrew 1978; Korfmann 2004.
58 Higham et al. 2007.
59 Borić 2009, 191 ff.
60 Presentation of finds in Сталио 1964, 35 ff. and Сталио 1973, 157 ff.; cp. also Borić 2009, 209 ff.; Šljivar et al. 2006, 255.
61 Šljivar 1996, 85 ff.

the vicinity of a presumed melting oven, scattered over an area of about five metres.[62] According to the lead-isotope analyses at hand, however, the axes are not – surprisingly – made of copper from Rudna Glava.[63]

Recent excavations have variously documented individual chisels found in a secure contextual layer, whose beginning dates to 4850 cal BC,[64] thus, relocating the date of the so-called massive tools to an even earlier time and decreasing the temporal discrepancy between the production of jewellery and axes or chisels. In the settlement of Belovode, close to Rudna Glava, one mould, large amounts of malachite and finished products are evidence of metalworking there throughout the entire sequence of layers, from c. 5350 cal BC to 4650 cal BC.[65] Signs of the exploitation of the mine at Rudna Glava date to around about the same time; so, mining could have begun there as early as the 55th century BC.[66] The youngest date falls within the time around 4650 BC, that is, the end of the Vinča culture. Furthermore, traces of metalworking were found throughout the entire stratigraphical sequence in the settlement of Vinča itself.[67] Although the temporal priority of casting and the processing of copper have not been attested yet, it seems quite likely that both were achieved at the same time.[68] Theoretically this means that a much longer phase in the production of artefacts can be reckoned with, which is not yet visible archaeologically due to the filter-effect of sources.

At present, processes in early Balkan metallurgy cannot be denominated precisely according to date. The slender axes or chisels cannot be specified typologically. However, it can be stated with certainty that they were already disseminated over wide parts of the Balkans by the 49th century BC at the latest.[69] The aggregate find with the hammer axe in Pločnik demonstrates that these objects too should be dated to a time horizon that is prior to Varna and, thus, that they were produced over a clearly longer span of time than assumed until now. This could also be the reason for the formal heterogeneity among hammer axes of the Pločnik type.[70]

One of the consequences of the new datings is obvious: The metal phenomenon of Varna was possibly preceded by 500 years of mining and metallurgical activities in southeast Europe. Thus, the synchronisation of Varna with phenomena in the Carpathian Basin is in need of a broad re-examination based upon ^{14}C datings.[71]

The consequences for Europe

Objects produced in copper and gold during the 5th millennium BC have been documented in parts of southeastern Europe and in the Carpathian Basin in an impressive multiplicity of forms, whereas in many other regions only few metal objects have been attested. Various factors could have played a role in these circumstances. The paucity of finds in some parts of Europe may indeed reflect an actual shortage of copper. It is, however, just as conceivable that in these areas metal was dealt with differently. Whereas in southeast Europe and the Carpathian Basin metal was used for grave goods and offerings, in other places old metal was melted down and used to produce new objects (Fig. 2). This is readily assumed in the case of Turkey, supported by a number of clues, which might explain the »lacuna in finds« during the 5th millennium BC.[72]

Nonetheless, it is evident that copper objects had already found their way to the north in the 5th millennium BC, and surprisingly soon thereafter ores were sought in other places as well and attempts at metal processing ensued. The discovery of slag in a habitation layer of the Münchshofen culture at Mariahilfbergl near Brixlegg/Tirol[73] is evidence that the processing of sulfidic copper (*fahlerz* or ›grey ores‹) was already known in the Alps in the 44th/43rd century BC.[74] This indicates the transfer of pertinent knowledge and technology presumably from the ore deposits in the Carpathian Mountains into the Alpine region, which extended beyond a mere exchange of finished products or prestigious goods.[75] Pottery of the north Italian *vaso della bocca quadrato* culture was found in Brixlegg as well, which interestingly means that the first metal objects appeared south of the Alps between 4200 and 3900 BC.[76]

The innovations that appeared in the western Black Sea area, the central Balkans and the Carpathian Basin are traceable far beyond this »el Dorado« as well. Yet, these traces can likewise be explained as components of larger systems. The distant contacts already maintained in the second half of the 5th millennium BC are highlighted by a grave discovered long ago, in 1865, near Pauilhac, dép. Gers, in Gascogne, southwestern France (Fig. 14).[77] It contained six silex blades, the longest of which measures 34.5 cm; as mentioned above, the silex blade in grave 43 in Varna is – in comparison – 40 cm in length.[78] Special attention should be drawn to the 20.8-cm long diadem made of sheet gold; namely, it has comparable finds in Moigrad in Transylvania.[79] Likewise made of gold are seven elongated beads (lost today), for which there are comparisons in Varna grave 43. Among the other grave goods are two jade axes (27.8 and 25.3 cm in length), both perfectly

62 Šljivar et al. 2006, 255.
63 Pernicka et al. 1993, 37–38.
64 Borić 2009, 214.
65 Šljivar et al. 2006, 251 ff.; Borić 2009, 207 ff.
66 Borić 2009, 194 ff.
67 Antonović 2002, 27 ff.
68 Yalçin 1998, 286–287.
69 Pernicka – Anthony 2010.
70 Cp. Govedarica 2001.
71 Cp. Csányi et al. 2009: Basing upon ^{14}C dates, the cemetery of the Bodrogkeresztúr culture at Rákóczifalva-Bagi-föld can be placed between 4334 and 4075 cal BC, thus rendering it markedly older than expected.
72 Cp. esp. Lichter 2006, on İkiztepe.
73 Höppner et al. 2005, 298 ff.
74 Bartelheim 2007, 190; Bartelheim et al. 2007, 42 fig. 10 (however, until now no finished products can be assigned to this type of copper).
75 Höppner et al. 2005, 312.
76 Mottes et al. 2002, 122; Pedrotti 2001, 207–208 (for example, in Isera la Toretta; Trento).
77 Guilaine – Burens 2003, 210 ff.
78 For long silex blades found in a supra-regional context, see: Marquet 2006.
79 Guilaine – Burens 2003, 212; Makkay 1989 pl. 11.

Fig. 14 Gold diadem, boar-tusk pendants, long silex blades and one of the large jade axes from the grave in Pauilhac (after Eluère 1987).

polished.[80] The slightly outcurving blade of the axes is unusual, which can only be understood as the stone craftsman's answer in stone to copper axes with hammered, fine cutting edges. The phenomenon of jade axes, which predominated the image of ritual depositions in western Europe from 4700 BC onwards, had already been linked explicitly to the phenomenon of early copper axes in east central Europe.[81] Hence, the impression arises of corresponding and concurrent systems in the circulation of prestigious goods, whose exclusivity in the procurement of raw material fell short of none in the metal system. In this respect, it is no coincidence that a jade axe was present in Varna as well.

This automatically leads to the question: to what extent were copper axes known in western and northern Europe. The blade of the jade axes from Pauilhac, polished to a sharp edge, hints that occasionally copper axes were in use, even in western Europe. For typological reasons, various axes found in Portugal possibly date to the 5th millennium BC.[82] Ever since fragments of slag dated to the first half of the 5th millennium BC were discovered at the Neolithic site of Cerro Virtud, prov. Almería, evidence of early metallurgy on the Iberian Peninsula has been seen in a new light.[83] Likewise, occasional evidence of the exchange of finished products has been detected in northern central Europe, for example, a broad axe in Bülow, district of Teterow, Mecklenburg-Vorpommern.[84] Presumably more flat axes as well as some hammer axes of the Pločnik type can be assigned to this horizon, too.[85] Whereas during the 5th millennium BC metal played a role in an economical and ideological system in southeast Europe, in western Europe the possession and use of metal objects played a minor role. They seem to be limited or were not deposited. Be that as it may, the traces of Copper-Age mining in Brixlegg shows that experimentation with metal soon followed in central Europe.

The end of the 5th and the first half of the 4th millennium BC

Around 4250/4200 BC settlements in Bulgaria and on the lower Danube River were abandoned. For several hundred years thereafter apparently no further settlements were established, at least in some regions such as Thrace and the entire lower Danube. There is still no convincing explanation for this abandonment of settlement mounds, such as climatic change or the internal collapse of this complex exchange system. In any case, it is irrefutable that the surge of innovations that brought forth the first appearance of mining, the development of new weapons and the emergence of strict social hierarchies did not continue further in the western Black Sea area.

In the Carpathian Basin, oppositely, there was no noticeable profound disruption in the development of early metallurgy. Indeed, the spectrum of metal artefacts is even characterised by a remarkable multiplicity in axe-adzes (Fig. 15,1.3). Whereas concentrations of axe-adzes are prolific in Transylvania, eastern Hungary and Slovakia, the density of finds decreases rapidly in bordering regions.[86] These axes have been documented as grave gifts and in hoards, and mostly as single finds, that is, individual depositions (Fig. 16). When assessing the use of metal within the social sphere, reference should be made to analyses of cemeteries, for the number of settlements investigated does not suffice. For example, excavations in Rákóczifalva-Bagi-föld revealed a cemetery with 79 graves of the Bodrogkeresztúr culture. Among the grave goods of copper axes, several daggers and gold pendants, the excavators could recognise a dominant social hierarchy that surpassed the bounds of simple family kinship.[87]

New occurrences of copper ore in the metalliferous Carpathian Mountains must have been exploited, but little evidence of this has been detected until now.[88] A distinct increase in metal finds can be noted in the northern Alpine region as well, starting in 3800 BC. Some 80 copper objects

80 Cp. Pétrequin et al. 2005, 265 ff. fig. 23; for more detail see also Roussot-Larroque 2008, with a date in the first half of the 4th millennium BC.
81 Pétrequin et al. 2002, 90 fig. 12.
82 Monteagudo 1977, 23–24 no. 7; 16; 18, 21 pl. 1,7.16. 18; 2, 21.
83 Ruiz-Taboada – Montero-Ruiz 1999, 897 ff.; Montero Ruiz 2005, 189 with a discussion about Late Neolithic find complexes with evidence of metallurgy.
84 Lutz et al. 1997, 45–46.
85 For flat axes, see Klassen 2000, 98 ff., assigned to the Kaka type; hammer axes, see Govedarica 2010, 1 ff.
86 Schubert 1965, 274 ff. with distribution map in appendix 3; Łęczycki 2005, 52 ff.; detailed maps in Manzura 2003, 376 ff. map 3–9; recently Pop 2007, 49 ff.
87 Csányi et al. 2009.
88 Schalk 1998; 2010, 317 ff.

have been documented at sites ranging from upper Austria to central Switzerland.[89] They include tools, weapons and jewellery made of arsenical copper. This is also viewed as the beginnings of mining activities in the Mitterberg district of the Austrian Alps.[90] Narrow but thick flat axes appear during the late 5th or the early 4th millennium BC and become widespread: ranging from Bohemia to the area of the western Baltic Sea.[91] Their metal composition probably derives from the West Carpathians. Axes with a pointed neck, like those found in Iserlohn, Märkischer district (Fig. 17) or in Hertinghausen, dist. Kassel, can be seen as local productions that copy the stone axes of the Michelsberg culture.[92]

Similarly, flat axes were already present in Italy during the late Neolithic; they can be dated to the first half of the 4th millennium BC.[93] Slender flat axes like those found in the Bocca Lorenza cave near Santorso (Fig. 15,2) belong to one of the

Fig. 15 Metal types of the first half of the 4th millennium BC: 1 Mezőkeresztes (Patay 1984); 2 Bocca Lorenza cave (Pearce 2007); 3 Rákóczifalva-Bagi (Csányi et al. 2009); 4 Ogorodnoe (Photo: B. Govedarica); 5 Cucuteni (Schmidt 1932); 6 Tiszaluc-Sarkad (Patay – Szathmári 2001); 7 unknown site in western Hungary (Kovács – Raczky 1999); 8 Kotouč near Štramberk (after Jisl 1967). Various scales.

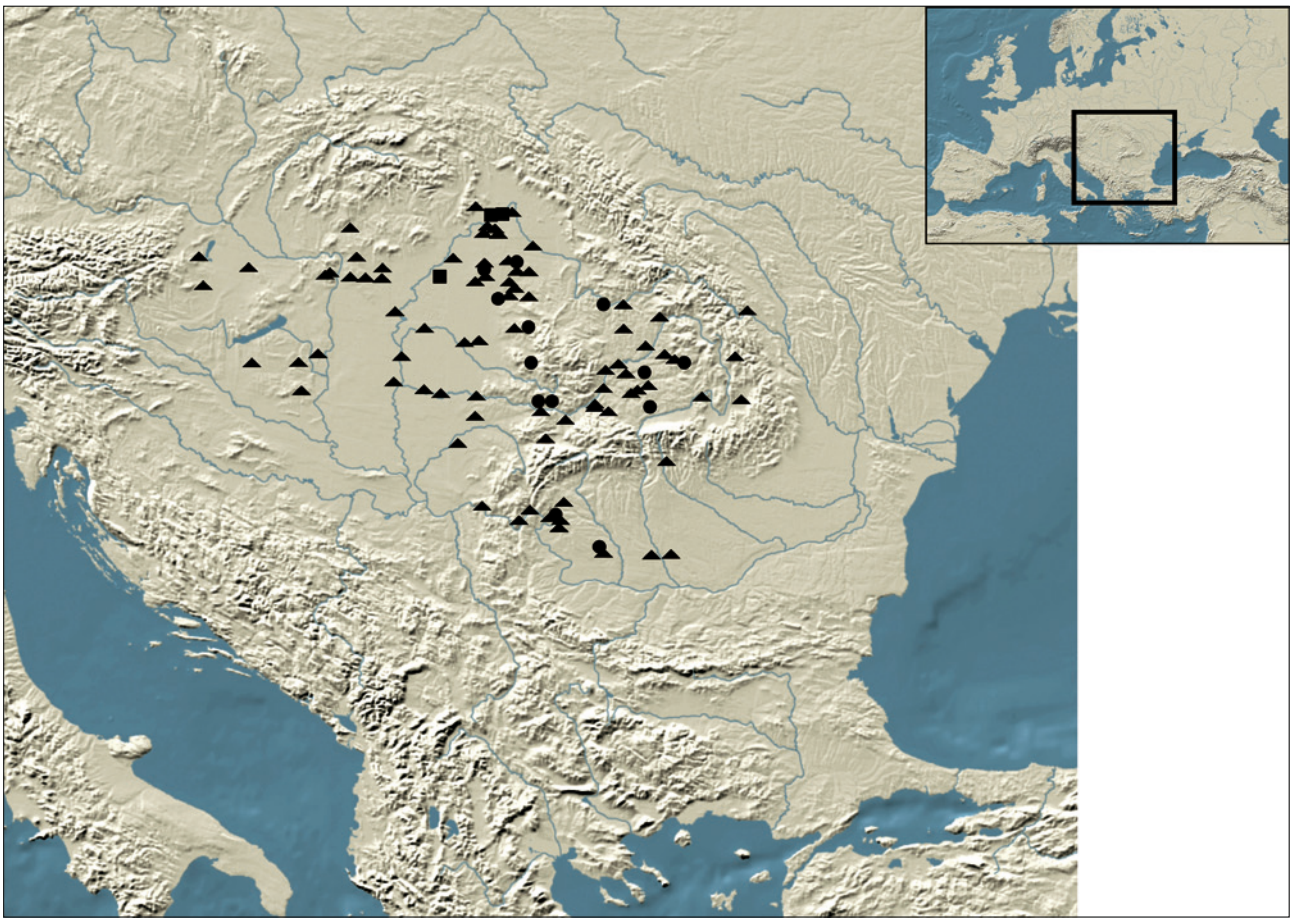

Fig. 16 Distribution of axe-adzes.

89 Cevey et al. 2006, 24 ff.; Bartelheim 2007, 191.
90 Stöllner et al. 2006, 87 ff.
91 Klassen 2000, 98 ff.; Müller 2001, 410 ff.
92 Hertinghausen: Kibbert 1980, 61 no. 18 pl. 4,18; Iserlohn: Baales et al. 2007, 41 fig. 54.
93 Pearce 2007, 38 ff.; cp. also Barfield 1996, 66 ff.

groups disseminated from the Po river valley as far as eastern Hungary and the Tisza River.[94] This important cultural link of the Italian Neolithic to the Carpathian Basin is likewise underlined by finds made there of Şiria-type axes. The spectacular hoard of Stollhof in lower Austria (Fig. 18) can be dated to the beginning of the 4th millennium BC. Aside from two massive flat axes the hoard contained eight copper and four gold (lost today) double spirals, two spiral armrings, several spiral tubes, a piece of copper sheet in the form of a boar tusk and two ornamental gold disks.[95] Among the oldest evidence of silver found north of the Alps is a comparable disk that measures 21.4 cm in diameter, which was discovered together with a copper double spiral pendant atop Kotouč Mountain near Štramberk in northern Moravia (Fig. 19).[96] Finally a slightly similar copper disk was found in the settlement of Hornstaad-Hörnle I.[97]

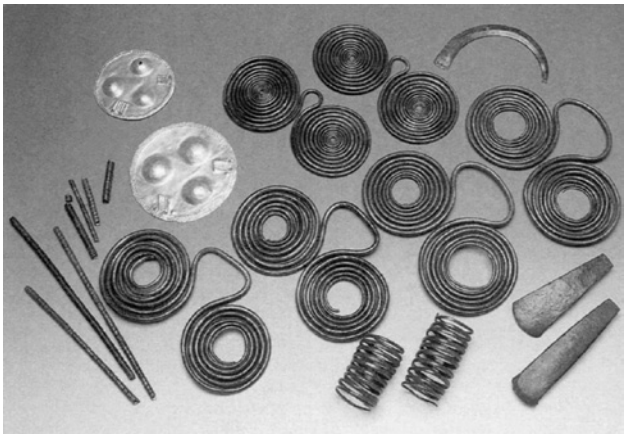

Fig. 18 Stollhof hoard (after Ruttkay 1995).

Fig. 17 Flat axe, single find in Iserlohn (Photo: Denkmalpflege Olpe).

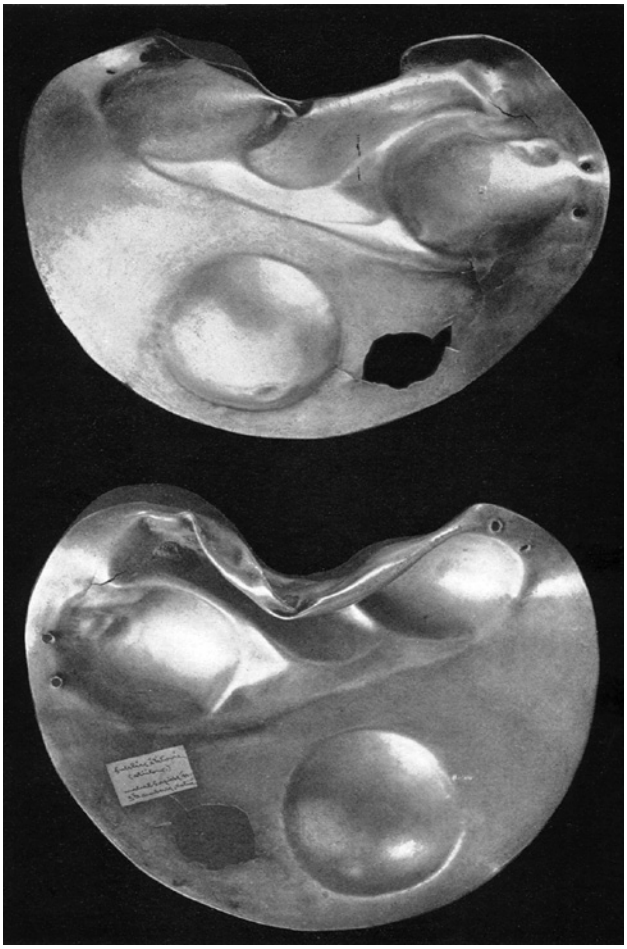

Fig. 19 Gold disc from Kotouč near Štramberk (after Jisl 1967).

94 For flat axes of the Gurnitz type, see Gleirscher 2007, 93 ff.
95 Mayer 1977, 45 ff. no. 93 pl. 117A; Ruttkay 1995, 143 fig. 13.
96 Jisl 1967.
97 Dieckmann 1987, 28 ff.

Daggers and knives

The enormous potential of copper casting was rapidly recognised by the mighty. The technique of cast introduced – at least theoretically – almost unlimited possibilities for producing new lethal weapons, and it is no coincidence that a strikingly large number of daggers were among the first of these metal objects. The long stiletto found in Reka Devnja and Giurgiuleşti (Fig. 6,4) still possess a massive cross-section, because they could not be produced in a thinner form. Unlike daggers made of bone, however, these first metal blades were not meant solely as thrusting weapons. With their sharpened edge they could also inflict severe cuts and slashes.

It was a truly significant technical innovation, indeed, when at the end of the 5th millennium BC at the latest and in the first half of the 4th millennium BC daggers were produced by casting. Thereby, arsenical copper (as much as 10 % arsenic) was likely an essential element for this process,[98] through which the formation of bubbles during casting and, thus, flaws in the blade could be diminished. Smaller blow holes in massive axes can be disregarded, but they are quite a problem when present in the blades of daggers. Namely, when a blade is resharpened, the bubbles are cut open, with the result that the blade is still pitted and notched, but not smoothed and sharpened.

It is generally assumed that naturally occurring copper and arsenic ores were the smelted product of sulfidic ores.[99] However, another proposal based on good arguments is that supplementary elements were intentionally added to copper for the purpose of changing the qualities of the material.[100] In various cases attention has been drawn to alloys or metal compositions that are specific to types of object. For example, the halberd found in the cemetery at Sabbione consists of copper with 4.5 % arsenic. Two flanged axes, oppositely, are made of pure copper.[101] Hence, the thought is near at hand that the metal craftsmen knowledgeably sought out different kinds of copper, and, further, that the silvery sheen of arsenic bronze was chosen for daggers. The dagger must have played an important role in the ideals of masculinity and heroism, as documented no less by its use as an individual grave good.[102] Its significance is likewise underlined by the countless rock carvings in the Alps that depict daggers (for example, at Mont Bego) and depiction on stelae.

Daggers of the first half of the 4th millennium BC that were found in the Carpathian Basin and the Alps display various methods of shafting: Aside from lancet-shaped blades there are also daggers with rivets.[103] The form and metal composition show that daggers were in great demand and were

Fig. 20 Maikop, dagger with silver rivets (after Кушнарева – Марковин 1994).

Fig. 21 Grotta del Fontino near Grosseto (after Vigliardi 2002).

98 Vajsov 1993, 141 fig. 36; Ivanova 2008, 72 ff.
99 Pernicka et al. 2002, 125 ff.
100 Lechtman 1996, 509.
101 Pearce 2007, 84–85; the same observation in de Marinis 1992, 402. Comparable differences in alloying were observed in daggers and/or other objects of the Mondsee group: Obereder et al. 1993, 7 fig. 4; cp. Northover 1989, 116, about an Irish halberd and large axes.
102 Cp. Maran 2001, 281; 2008.
103 Matuschik 1998, 214: dagger from Reute dated dendrochronologically to 3740 BC. Cp. a new find from Berg-Kempfenhausen in Pflederer et al. 2009, 131 fig. 7,3.

exchanged over great distances.[104] As of the middle of the 4th millennium BC daggers are documented in noticeably larger numbers. At the same time a break-through to longer blades occurred, an exceptional example of which is the 30-cm long dagger from the kurgan in Maikop, whose handle was secured with two silver rivets (Fig. 20).[105] Finally, the last quarter of the 4th millennium BC saw the successful production of swords, some with a length of over 60 cm (Fig. 32,1).[106] This technological mastery of casting, however, was probably limited to only a few workshops.

Nevertheless, on the whole there was a multifaceted variety of dagger forms. Among them are daggers with a two-part bone handle, held together by metal rivets, as found in graves in Ogorodnoe, Nerušaj and Durankulak in the northwestern Black Sea area.[107] Comparably large numbers of metal finds were found in the graves in Usatovo (Ukraine), too. There, not only a stele displaying an image was discovered in kurgan 3, but in addition grave 1 in the kurgan contained an axe, a dagger and an awl. In Italy as well, in the second half of the 4th millennium BC daggers belonged to funerary equipment. A dagger of the Gaudo type with a straight hafting plate, discovered in the burial cave of Grotta del Fontino near Grosseto/Tuscany, is associated with the ^{14}C date of 3220–3120 cal BC (Fig. 21).[108] Similarly, in southern France the oldest metal daggers, like the notched silex daggers, should be dated to the end of the 4th or the beginning of the 3rd millennium BC (cp. Fig. 22).[109] Occasional dagger blades have been found on the way to Scandinavia (Bygholm).[110] And in all of these regions daggers made of copper have many analogies made of flint. For the 3rd millennium BC it should suffice here to point out some exceptional daggers, such as the example made of gold from Mala Gruda.[111] Metal craftsmen still strove towards making longer blades: The almost 50-cm long cutting weapon in a grave of the Yamnaya culture in Kutuluk (dist. Samara) confirms this just as does the dagger of 22.7 cm in length from Sarretúdvári in eastern Hungary.[112] In this context ultimately mention must be made of halberds, which also appear as early as the 4th millennium BC (Fig. 32,5; 34), and develop into the characteristic weapon of the 3rd millennium BC.[113] Daggers and halberds reveal more distinctly than axes that the metallurgical activities and skills of the 4th millennium BC expanded far beyond the major centre of finds, the Carpathian Basin.

Fig. 22 Distribution of copper and bronze daggers.

104 The same applies, by the way, to the numerous silex daggers; see Tillmann 1993, 453 ff.
105 There are conflicting data concerning the length of the blade; see Govedarica 2002, 785 note 21.
106 Cp. swords from Arslantepe in Frangipane 2004.
107 Dergačev 1991 pl. 46,1–4; 47,1–4; Vajsov 2002, 159 ff. fig. 180.
108 Zanini 2002, 191 fig. 6; 200.
109 Vaquer et al. 2006, 158–159.
110 The copper blades from Bygholm and the flint points are viewed as halberds in Danish research: Ebbesen 1992, 103 ff.; see on the contrary: Lübke 1997/1998, 49 ff.
111 Primas 1996, 88 fig. 6.14.
112 Kuznetsov 2005, 325 ff. fig. 8; Dani – Nepper 2006, 34 fig. 5,7 (first half of the 3rd millennium BC).
113 See now: Ch. Horn, Studien zu den europäischen Stabdolchen (PhD thesis FU Berlin 2010).

Crisis or upheaval in the second half of the 4th millennium BC?

Opposite the prolificacy of metals in the Carpathian Basin during the first half of the 4th millennium BC, the metal inventory of the Baden culture in the second half of the 4th millennium BC has long been assessed as very modest: A crisis in metallurgy at that time has even been suggested.[114] A recent compilation of copper finds of the Coţofeni culture, which borders on the Baden culture in the east, has shown that massive artefacts in particular are no longer present. Axes and adzes are absent, but daggers and massive awls are still at hand.[115] Similarly, the metallurgy in other regions of Europe during the 4th and 3rd millennia BC is viewed neither as dynamic nor as innovative technology.[116]

In actual fact, however, there are arguments that would support the opposite viewpoint. The second half of the 4th and the early 3rd millennium BC represent a very innovative time in metal production in Eurasia, manifested by the initial appearance of different fundamental techniques, and the »secondary products revolution« as well.[117] Igor Manzura even speaks of a cultural revolution, in which new strategies were tested.[118] And regarding metalworking itself, aside from gold objects, now copper products with various and also object-specific alloys appear. For the first time a greater number of silver objects are present. In particular, experimentation by adding different elements to copper, including arsenic, antimony, silver and tin, opened up new potentialities for the production of weapons and artefacts, for these alloys improved the quality of the material and contributed towards mastering techniques in casting. Thus, a certain enjoyment in experimenting can be described during the second half of the 4th millennium BC, which contrasts with the picture of a crisis in metallurgical activities in western Europe.

The innovative potential of this time is also perceptible in the northern Caucasus. There, nearly 10,000 copper objects and 9500 gold and silver pieces are known from graves of the Maikop culture.[119] The main burial in the kurgan in Maikop was that of a male, accompanied by another male and a female.[120] All three persons were thickly strewn with ochre. Sixty-eight gold lion-appliques, 19 bulls and 38 rings originally adorned the garments of the deceased. The jewellery comprised stringed beads of gold, silver, turquoise and carnelian. Seventeen vessels made of metal (Fig. 23) and of stone stood at the eastern wall of the grave, and next to them were eight clay vessels. One copper dagger, knife and chisel as well as two axes and a transverse hafted pickaxe were also part of the funerary inventory. The grave at Maikop is usually dated to the middle of the 4th millennium BC or shortly before. This is confirmed indirectly by the date of a grave in the kurgan at Mar'inskaja (Fig. 24): According to dendrochronological examination by K.-U. Heußner, a beam in the cover of the grave chamber most likely dates to c. 3350 BC. The deceased was interred in a large grave pit that was lined with large river pebbles. The walls of the grave chamber were plastered and painted red. This person was covered with ochre, too. The grave goods included among others a stone sceptre – a standard symbol of power in the Maikop culture – as well as a copper dagger, an axe and an adze.[121]

Fig. 23 Maikop, selected grave goods (Кореневский 2004).

114 Cp. for example, Kalicz 1992, 13; Chernykh 1992, 55; Strahm 1994, 21 with illustration; Matuschik 1998, 29; Vajsov 2002, 161–162; Cevey et al. 2006, 25; Harrison – Heyd 2007, 196; Strahm – Hauptmann 2009, 120; Heyd – Walker in print.
115 Ciugudean 2002.
116 Roberts 2009, 473.
117 Cp. Sherratt 2004.
118 Manzura 2003, 392; Hansen in Hansen – Müller 2011.
119 Kohl 2007, 79.
120 For Maikop, cp. Govedarica 2002 and Kohl 2007, 57 ff.; for the dating of Maikop and subsequent cultures see also Shishlina et al. 2009, 481 ff.
121 Kantorović – Maslov 2008, 151 ff.

Fig. 24 Mar'inskaja, central burial (after Kantorovič – Maslov 2008).

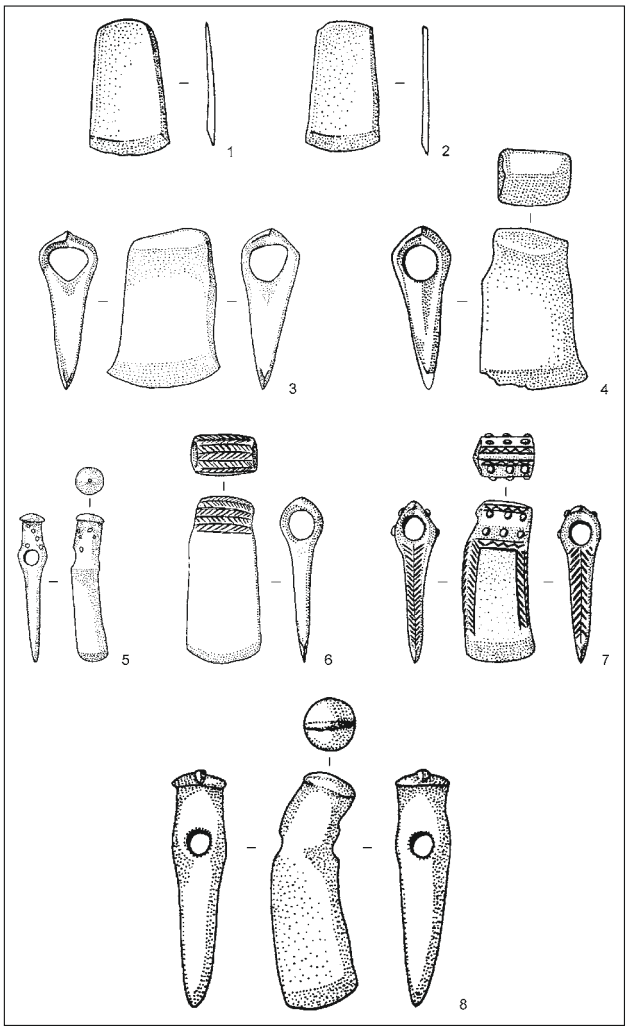

Fig. 26 Klady, grave 31/5 (changed, after Rezepkin 2000).

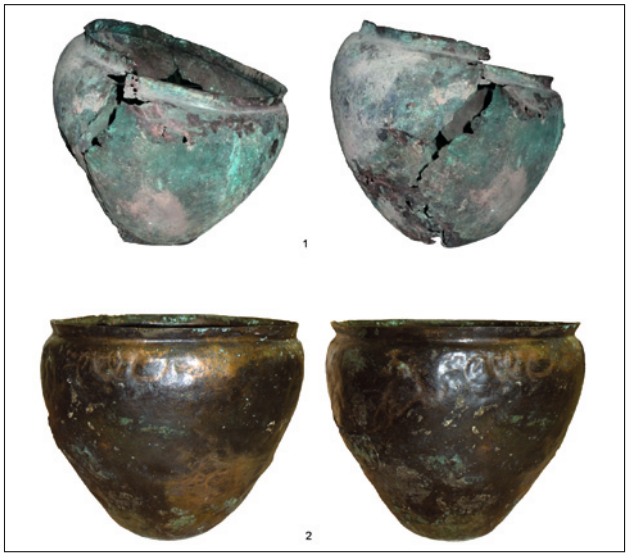

Fig. 25 Copper cauldrons from Maikop graves in Kislovodsk and Nalčik (Photo: S. Hansen).

The copper vessels in Maikop are not only an innovation in view of their metal; they also show that the technique of embossing was now employed for large-sized objects. Cauldrons of more than 50 cm in height were found in several of the later graves of the Maikop culture (Fig. 25). These technical innovations were not local developments, but should be seen instead within a dynamic association on a supra-regional scale. Individual objects from the area of Maikop display connections that reached as far as southern Mesopotamia and Susiana.[122] It was not until recently that Victor Trifonov identified the tumuli at Sé Girdan in northwestern Iran as graves of the Maikop type.[123] Still present in the looted tumuli were characteristic silver vessels, flat axes, shaft-hole axes and a myriad of gold, stone and glass beads.

The message of the goods in Maikop graves conveys something new in a societal respect, which can also be read in the extremely richly furnished grave 31/5 at Klady cemetery near Novosvododnaja.[124] The two-part stone chamber yielded several layers of six axes of different forms, nine daggers and one sword, among other objects (Fig. 26–27). This

122 Hansen 2009 with further references.

123 Трифонов 2000, 244 ff.; Muscarella 1969, 19 ff. fig. 23–29; 1971, 7 ff. fig. 4–14; for metals see Helwing 2009.

124 Rezepkin 2000, 63 ff. pl. 52–56.

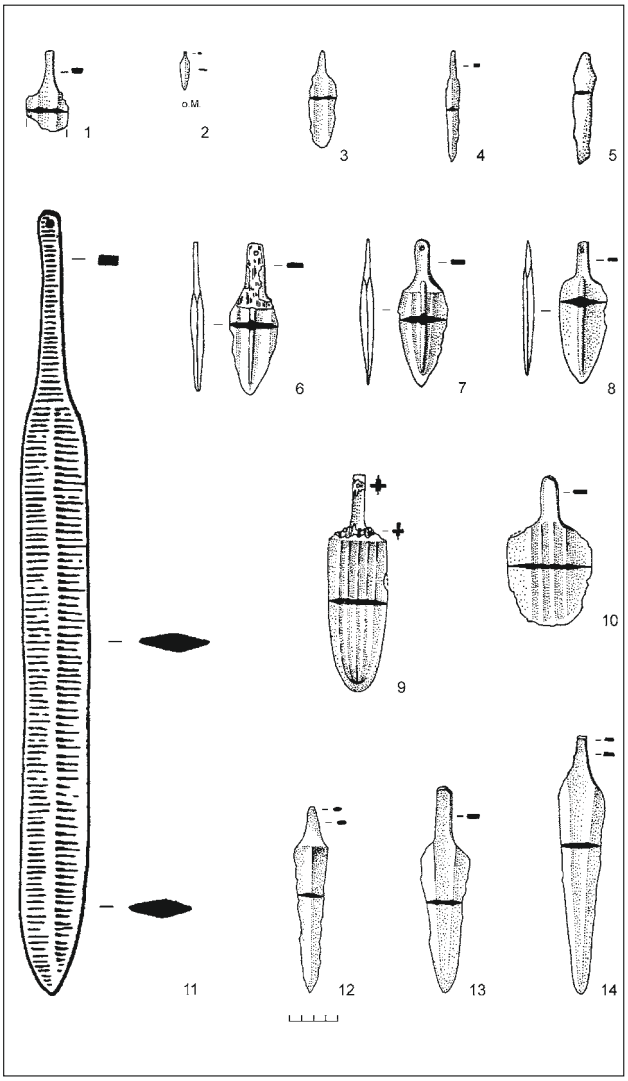

Fig. 27 Klady, grave 31/5 (changed, after Rezepkin 2000).

Fig. 28 Arco, stone stele (after Strahm 2005).

arsenal of weapons is that of an especially impressive »over-equipped« male, for they far exceed any functional armament. The »king's grave« at Arslantepe is similarly characterised by a large number of weapons.[125] Graves – frequently in stone cists – furnished with weaponry are attested by several examples in northern Mesopotamia, dating to the early 3rd millennium BC (Carchemish, Hassek Höyük).[126] This situation cannot be described in more detail here. Nonetheless, compared to the much older phenomena in Varna, it becomes clear that essential features of social marking as found in Maikop graves expanded beyond the narrow geographic realm of that culture and became temporally consistent.[127] As a detailed example, the point is made here about the metal sets, which can be composed of an axe-adze, an axe and a chisel or dagger and which are attested in many graves and also as single pieces in hoards of the later 4th and early 3rd millennium BC (Hassek Höyük, Usatovo, Mar'inskaya, Vozdviženskaja, Brno Líšeň and Velika Gruda, among others).[128] The standardisation and medial staging of grave goods find their match in stone stelae, which depict a new image of the warrior and the hero and which are found over a vast area, extending from the Caucasus to the Iberian Peninsula (Fig. 28).[129]

In the Carpathian Basin the tradition of »massive artefacts« of copper seems to disappear with the beginning of the Baden culture, which may have led to the impression of a crisis in metallurgy. However, new datings for the Maikop culture have brought forth new perspectives. The rather stout shaft-hole axes in the Carpathian Basin have long been compared typologically with axes of the northern Caucasus.[130] Now it is time to draw chronological conclusions. The hoard of Brno Líšeň (Fig. 32,3.9–10) is an important support for an early date of the stout axes in southeast Europe. The axe in this hoard finds good comparisons in Klady (Fig. 26,3–4), among others. The flat axe and the chisel with a pyramid-shaped end for shafting can be linked to Caucasian forms. The objects were found lying one across the other, a wide-

125 Frangipane 2004, 103 ff. with illustrations; Palumbi 2007, 28 ff.
126 Palumbi 2007, 36–37.
127 Cp. Hansen 2009.
128 Cp. also Primas 1996, 118–119 fig. 8.5–8.6.
129 Overview by Casini 1994.
130 As already by Vulpe 1970, 26.

spread manner of depositing weaponry during the Copper and Early Bronze Age.[131] The hoard was found in the hilltop settlement of Staré Zámky in the youngest settlement layer I, which – as recent investigations have shown – likely dates to the 4th millennium BC.[132] The slender axe with long shaft tube (type Kozarac) from Mala Gruda, dated to the early 3rd millennium BC, points indirectly to a date for the plump shaft-hole axes in the 4th millennium BC as well.[133] Thus, it can be postulated for the Carpathian Basin that stout shaft-hole axes date as early as the second half of the 4th millennium BC, as in the Caucasus.

Technically the shaft-hole axe represents an effective innovation in weaponry, as the shaft-hole is now removed to one end, thus rendering the axe greater striking power. The new weapon was a very successful development, whose production evidently reached many regions and whose dissemination spanned southeast Europe, northern Black Sea area, the Caucasus and Mesopotamia.

Metal finds are also rare outside of the Carpathian Basin, yet the quality of the finds points to a far more differentiated metalworking than recognisable in the few finds. The grave in Velvary in central Bohemia, discovered in 1899 (Fig. 29), constituted a large cist built of five heavy sandstone blocks. It contained four clay vessels and two detached handles (»ansa lunata« type), which E. Pleslová-Štiková assigned to the »Proto-Rivnač« phase, that is, a horizon that corresponds

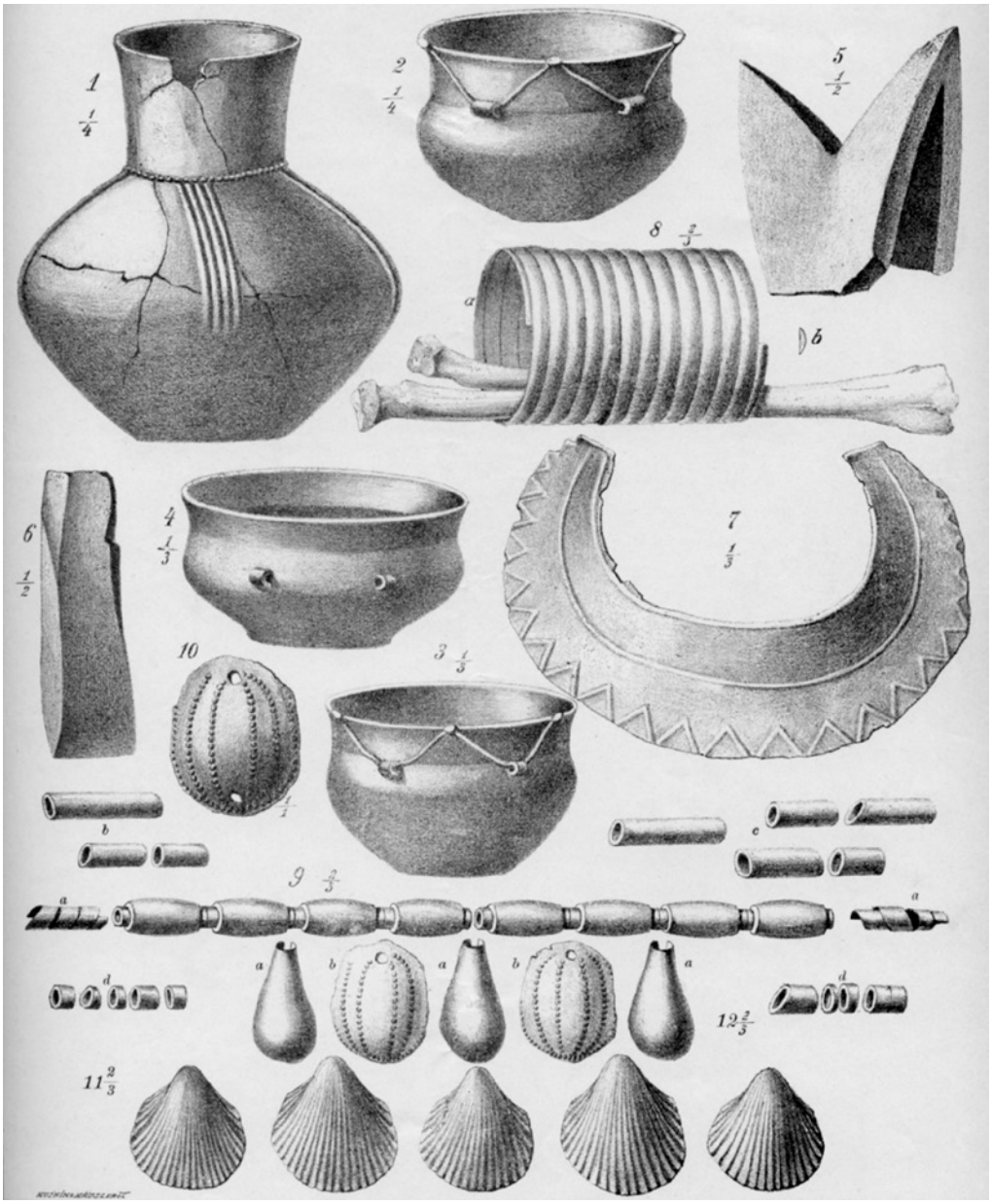

Fig. 29 Finds from the grave in Velvary, Bohemia (after Smolík 1890–1892).

131 Cp. Hansen 2002, 151 ff.

132 Cp. Bešenová 1956, 236 ff. fig. 1. According to Martin Furholt new ^{14}C datings suggest that the older layers III and II in Brno Líšeň should be dated between 3520 and 3360 BC (see Furholt in print; cp. also Furholt 2008, 19 fig. 2; the Jevišovice B-group in Moravia can be reckoned with after 3100 BC.

133 Primas 1996, 105–109. Two more silver shaft-hole axes stem from Stari Jankovci; see Balen – Mihelić 2003, 85 ff. fig. 1.

with the late Baden culture.[134] Further finds to mention are an axe of serpentinite, 355 limestone and bone beads and seven cardium shell pendants with a suspension hole. Of special note are the metal goods: eight beads, two spiral rings, 14 pendants in the shape of shells, two spiral armrings and one pectoral made of arsenical copper (3 % arsenic). The lunula-shaped pectoral is embossed and displays a raised zigzag decoration on the lower edge.

A relatively large number of metal objects is attested in central Germany as of 3350 cal BC.[135] Extraordinary finds are even documented in the area of the Funnel Beaker culture: The hoard from Bygholm near Horsens (Denmark) contained several flat axes, one dagger (halberd) and three spiral armrings. Further, the hoard from Bytyń (Poland) yielded, in addition to axes, a team of cattle in copper (Fig. 30), which confirms the knowledge of casting in the lost-wax form.[136] The flat axe in the hoard from Szeczecin-Śmierdnica indicates its date in this time horizon as well (Fig. 31); the hammer axe with knobbed butt (*Knaufhammeraxt*) finds comparisons in Scandinavia, the eastern Alps and the Carpathian Basin.[137] Various other copper axes found in northwestern Germany enable the confirmation of links with the Caucasus or the Black Sea coast (Fig. 32).[138]

Last but not least in focal view of metallurgical activities is the glacier mummy from Hauslabjoch, which can be dated according to ^{14}C-datings to the last quarter of the 4th millennium BC. Besides a silex dagger, the deceased carried a copper axe that compares with an axe in grave 102 in the long

Fig. 30 Team of cattle and accompanying flat axes from Bytyń (Photo: B. Walkiewicz, Museum Poznan).

Fig. 31 Hoard from Szeczecin-Śmierdnica (after Kunkel 1937).

Fig. 32 Metal types of the second half of the 4th millennium BC: 1 Novosvobdnaja-Klady (Rezepkin 2000); 2 Maikop (Govedarica 2002); 3, 9–10 Brno Líšeň (Benešová 1956); 4, 9 Se Girdan (Muscarella 1971); 5–6 Grotta del Fontino (Vigliardi 2002); 7 Szeczecin-Śmierdnica (Kunkel 1937); 8 Riesebusch (Photo: S. Hansen); 11 Reiffenhausen (Grote 2004); 12 Bygholm (Photo: S. Hansen); 13 Baden (Willvonseder 1937); 14 Bytyń (Photo: B. Walkiewicz, Museum Poznan); 15 Maikop (Кореневский 2004); 16 Velvary (Smolík 1890–1892). Various scales.

134 Smolík 1890/1892, 209 ff.; Pleslová-Štiková 1992, fig. 1–3.
135 Müller 2001, 412 ff. fig. 254.
136 Łęczycki 2004, 33 ff.; a copper figurine from »Dieburg«: Züchner 1989/1990, 66 ff. fig. 1–2.
137 Kunkel 1937, 75 ff. with illustrations; Łęczycki 2004, 48 fig. 7. The hoard was found under a block of reddish granite. For such axes see already Montelius 1895, 437.
138 For these axes see Hansen 2009, 34 ff. fig. 32–33.

known cemetery of Remedello-Sotto. Together with a silex dagger and four silex arrowheads, the axe from grave 102 belongs to the oldest horizon of the cemetery, dated between 3400 and 2900 BC.[139] In the meantime considerable evidence for the exploitation and use of copper in the Alps during the 4th millennium BC has been gained. The settlement at Arbon Bleiche yielded finds of awls, illustrating the use of metal to make tools and also that apparently large amounts of metal were indeed at disposal in the 34th century BC.[140] During the second half of the 4th millennium BC copper-arsenic alloys, two-part moulds and silver objects are attested in Italy.[141] The exploitation of copper in Ligurian Monte Loreta began around 3600 BC at the latest.[142]

Copper metallurgy did not remain in Liguria, but spread farther into southeastern France. In Languedoc a variety of Late Neolithic–early Copper Age pottery groups existed in a very small area, and some uncertainty still prevails about the dating of individual find complexes. Despite this, the first copper objects can be dated to 3300–3000 BC.[143] Admittedly, they comprise only a few pieces: in Roquemengarde, for example, only a dagger blade, various awls and one lead bead.[144] The finds, however, are symptomatic. The dagger displays an advanced command of metalworking and the lead bead is an indication of know-how in silver processing. Also in this association is the copper mine in Cabrières-Péret. dép. Herault in Languedoc, for which the oldest dates likewise fall before 3000 BC and continue for the entire 3rd millennium.[145]

Characteristic funerary furnishings with metal weapons are present as well. In Fontaine-le-Puits, dép. Savoie, a small group of graves was excavated already in 1908. Today they are assigned to the Rinaldone culture and can be dated to the last centuries of the 4th millennium BC. A flat axe of copper was found in grave A together with a copper dagger, a jade axe, one large and several smaller silex blades as well as 37 silex arrowheads, among others (Fig. 33).[146] Grave 3 in Rinaldone is comparable (Fig. 34); there two axes, three daggers, one halberd and 22 silex arrowheads were found, which can be dated to the last centuries of the 4th millennium BC or at the beginning of the 3rd millennium BC as well.[147]

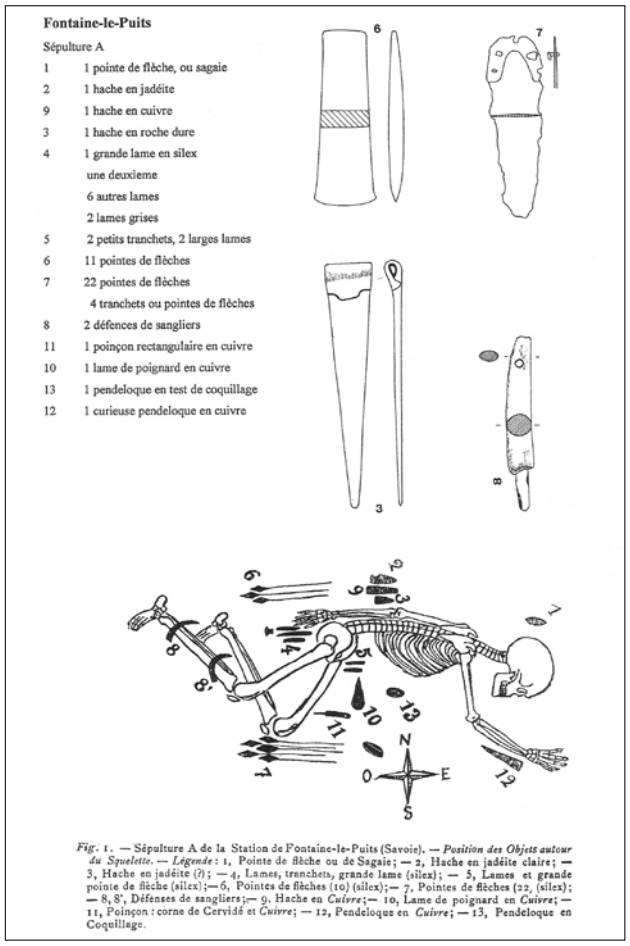

Fig. 1. — Sépulture A de la Station de Fontaine-le-Puits (Savoie). — Position des Objets autour du Squelette. — Légende : 1, Pointe de flèche ou de Sagaie ; — 2, Hache en jadéite claire ; — 3, Hache en jadéite (?) ; — 4, Lames, tranchets, grande lame (silex) ; — 5, Lames et grande pointe de flèche (silex) ;— 6, Pointes de flèches (10) (silex) ;— 7, Pointes de flèches (22, (silex) ; — 8, 8', Défenses de sangliers ;— 9, Hache en Cuivre ;— 10, Lame de poignard en Cuivre ; — 11, Poinçon : corne de Cervidé et Cuivre ; — 12, Pendeloque en Cuivre ; — 13, Pendeloque en Coquillage.

Fig. 33 Fontaine-le-Puits, dép. Savoie (after Müller 1909; Combier 1976; Strahm 2005).

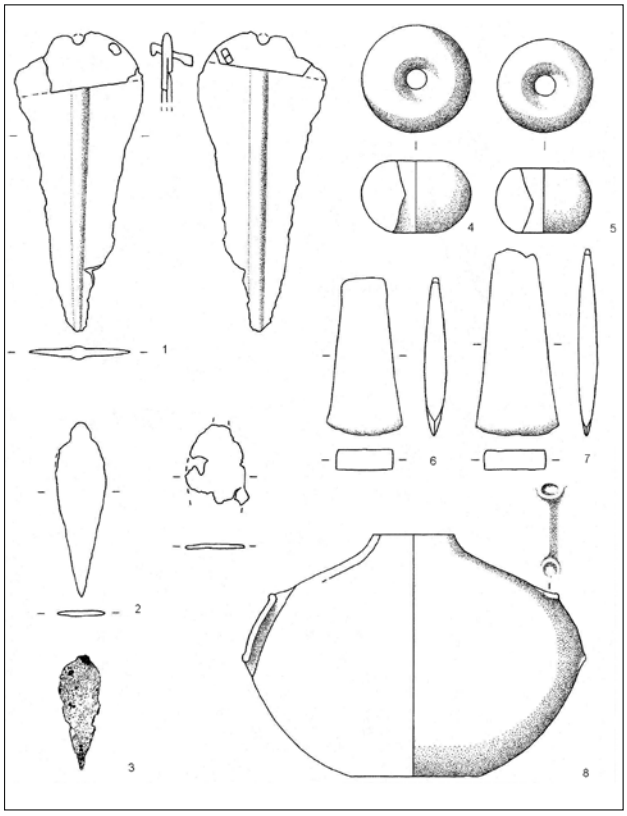

Fig. 34 Rinaldone, grave 3 (after Dolfini 2004).

139 Gleirscher 2003, 44 fig. 3; de Marinis 1992, 392 ff.; Pedrotti 2001, 192–193 fig. 9.
140 de Capitani et al. 2002, 72–73 fig. 95.
141 Cazella 1994, 11.
142 Maggi – Pearce 2005, 66 ff.; for Central Italy Dolfini 2010, 707 ff.
143 On the Ferrières cultures and the following Fontbouisse culture: Jallot 2003.
144 Guilaine 1991, 292 fig. 3; Guilaine – Burens 2003, 229.
145 Carozza – Mille 2007, 165 ff. fig. 7.
146 For grave A, see Müller 1909, 836 ff. fig. 5; Combier 1976, 169 ff. fig. 3,7,6; Strahm 2005, 29 fig. 1. The axe has comparisons in the Jura and at Lake Constance (Klassen et al. 2007, 107 fig. 5); traces of the shafting on the dagger cannot be recognised in the photograph by Müller (1909), but are visible in the photograph by Combier 1976; cp. also Vaquer et al. 2006, 158.
147 Dolfini 2004, 154 ff. pl. 3–5A.

Discussion

When people began during the pre-ceramic Neolithic to form native copper in order to make beads, they recognised the innate possibilities of this metal. In the form of beads copper became a medium that marked social standing and served as a protection against harm. Casting copper in order to produce massive objects can be supposed only in the late 6th millennium BC, after which the potential of copper-working increased abruptly. With this metal, technical and social innovations that were interrelated became possible. Thereby, four aspects seem to be of particular relevance:

- The primary accumulation of raw material and the possibilities for its transformation must have been attractive from the very beginning. These were, namely, closely connected with the possibility of an unlimited use in interchange between segments of society (for example, payment of the bride price).
- Linked with this were new possibilities with which metal could also assume the manipulation of imagined supernatural powers, provided that from the very start access to the raw material was socially limited or could be dominated rapidly. Because the relationship to the imagined supernatural powers could be monopolised to a certain extent, some kinship groups could legitimise their power lastingly.
- Local and regional exchange networks were integrated into large-scale exchange and communication systems through the procurement of copper as raw material and the finished metal products, which likely engaged even further transfer of knowledge. In this aspect these contacts became important resources in themselves.
- It is ultimately undeniable from a »practical view« that, above all, the possibilities for the development and production of lethal weapons were enlarged and the chances were also realised. Here particularly techniques in making blades should be emphasised, that is, lengthening the blades of thrusting weapons, so that one could hold the opponent at a distance.

These four factors alone did not cultivate the technical and social dynamic that can be recognised in the 5th and 4th millennia BC in southeastern Europe. According to recent datings, the transition to the exploitation and mining of metal ores began as early as the first half of the 5th millennium BC in the central Balkans and possibly somewhat later in the west Black Sea area. It cannot be decided archaeologically whether the new material triggered social friction within a relatively short time and was used by one group to dominate the other. It is more likely that the organisation of raw materials was already managed by leaders, some form of ›chiefs‹, who were responsible for far-reaching contacts. These persons had already functioned for a long while, organising the exploitation and above the consumption of the new resources. Nevertheless, the concentration of gold and copper as well as other status symbols at the core of the cemetery of Varna signify something qualitatively new. For the first time individual men were distinguished with symbols of power and their bodies were brought to shine with gold. However, these developments were confined initially to southeast Europe and the Carpathian Basin.

Whereas after 4250 BC the system of settlement mounds in the eastern Balkans and the production of goods organised there, including copper artefacts, collapsed, in the Carpathian Basin and the east Alps there was – conversely – an expansion of metallurgical activities, at first during the late 5th and early 4th millennium BC. In other regions in Europe, too, endeavours were made to produce copper objects, that is, to build up the entire chain of metal production. The dissemination of certain metal types was achieved through the establishment of supra-regional exchange networks.

Shortly before or around the mid 4th millennium BC a deceased male was placed in a grave at Maikop, furnished with a significant sum of metal goods, and an immense mound was raised over the burial. The monumental arrangement of the burial place was meant to have a seminal effect on future generations. Through the erection of the mound, the family of the deceased made a visible claim to property and privileges beyond his death. The furnishings in the graves were marked foremost by weaponry, as an ensemble or in an overly exaggerated amount. Unlike Varna, the image of the great warrior thus implicated spread to other regions in Europe as well, using the same means of representation: the equipment with weapons and the mound. This was accompanied by a further important innovation: large stone figures that should depict the mighty warrior forever.

The possibilities that metal offered for producing new weapons, above all longer and sharper blades and halberds, far surpassed traditional materials such as silex and bone. The demand for quality products stimulated experimentation with different metals and their alloys as well as with different methods of casting and techniques of metal processing. The metallurgical innovations that were developed through this experimentation were accompanied by further fundamental techniques that emerged during the course of the second half of the 4th millennium BC. They include, in particular, the wheel and the wagon as well as the plough and the domestication of the horse and woolly sheep, all in all key technologies, which were of immeasurable importance for the expansion of cultivation of crops and pasturage, for transportation and communication. Thus, it is not surprising that this development was associated with a change in social organisation, which is articulated – for example – by the burial of a single individual under a mound. The 4th millennium BC saw the emergence of a new *social dispositif*. It was the transition of one more regional type of power as seen in Varna into an interregional style of power representation from the Caucasus to Western Europe. This development is not covered by neo-evolutionist schemes.

Without doubt the second half of this millennium can be designated as a »hot period«, during which technical processes and social differentiation took place in an unusually dense way. Claude Lévi-Strauss once suggested the distinction between two ideal types of society: the »cold« and the »hot«: »the former seeking, by the institutions they give themselves, to annul the possible effects of historical factors on their equilibrium and continuity in a quasi-automatic fashion; the latter resolutely internalizing the historical process and making it the moving power of their development«. In the case of ›cold‹ societies »the order of temporal succession should have as little influence as possible on their content« [for example, through marriage regulations that would maintain a low birth-rate low]. ›Hot‹ societies, by contrast, adapt to and incorporate changes. Ultimately, a political life among ›cold‹ societies that

seemingly bases upon agreement is at the same time created to turn off that driving force in collective living that uses the distance between power and opposition, majority and minority, exploiters and the exploited. Such (cold) societies approached the zero-point in historical temperature. Through their limited population and their mechanical way of functioning, they differ from the ›hot‹ societies, which appeared in various parts of the world after the Neolithic revolution. They constantly tried out new differentiations between castes and classes, in order to draw from them the future and energy.[148]

Lévi-Strauss' distinction between cold and hot societies is of course metaphorical, yet it is a help in working out the particularities in the development in western Europe after the end of the last Ice Age, which led comparatively rapidly to the emergence of states. For there is no one simple answer to the question as to the reasons for the emergence of domination and control and the transformation of segmented societies to early states.[149] However, it should now be clear that the answer can hardly be reached following the neoevolutionist model in ethnology. Instead, the dynamics of processes in technical and social transformation can be distinguished in the long periods of time which archaeology is capable of surveying.

The development of metallurgical techniques that can be identified as innovations in the 5th and 4th millennia BC appear as the result of rather than the precondition for centralised authority. Early copper axes and adzes as tools are certainly not superior to those made of stone. Oppositely, the use of new materials to produce weapons, above all dagger blades, and the technical perfection in production opened new perspectives. Furthermore, the unlimited accumulation of metal was the basis for the expansion of exchange relations, as well as for warfare and all things connected with it. The ability to dispose over raw materials, the techniques, the knowledge and the finished products played an essential role in achieving and securing positions of power and sovereignty in society. The central element in the interconnection of technical and social apparently lies in the sphere of early metallurgy.

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