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EUROPEAN BRONZE AGE CUIRASSES

ASPECTS OF CHRONOLOGY, TYPOLOGY, MANUFACTURE AND USAGE

In general, Bronze Age European metal defensive armour is rare. From the very first beginnings of full metal defensive armour around 1500 BC onwards, only around 30 cuirasses, 65 greaves, 95 shields and 120 helmets are known (a total of around 310 objects). The only area in Europe where all types of armour were found is the Carpathian Basin, including the southern parts of Moravia and Slovakia. Full metal cuirasses have been found only in France, the Carpathian Basin (Hungary, Slovakia and the Czech Republic) and Greece. There is also a miniature of such a cuirass from Brandgraben (Bez. Liezen/A) and a potential fragment from Winklsaß (Lkr. Landshut/D) (**tab. 1**). The development of offensive weapons always leads to the need for better protection, to an improvement of the defensive armour, which then influences the development of more effective weapons – a continuous and mutual influence. Full metal defensive armour, as an improvement on organic defensive armour and organic defensive armour with metal enforcement, was used from 1500 BC on and should be viewed as the leading type of defensive armour until the 16th century AD, when they could no longer resist a new improvement of offensive armour – firearms. The development, improvement and usage of metal defensive armour have thus influenced our history for more than 3000 years.

The European Bronze Age cuirasses are made up of a breast- and backplate, which were usually rivetted together on the left side. The oldest metal body defensive armour, the panoply from Dendra (periféria Peloponnisou/GR) is made up by several parts: a body cuirass, shoulder guards, breastplates and lower protection plates. From the Near East and Egypt, though these are also taken into account as a possible area of origin for full metal armour (Schauer 1982a), no such armour is known. In these areas, corselets with bronze scales were common, which are rarely found in Greece and the rest of Europe. Only a few finds are known, e. g. from Mycenae (periféria Peloponnisou/GR) (LH IIIC), Troy (İl Çanakkale/TR) (1400 BC), Nuzi (prov. Kirkuk/IRQ) (16th-15th centuries BC), (potentially) Pylos (periféria Peloponnisou/GR), Kanakia (periféria Attikis/GR) (a scale with the stamp of Ramses II) and Pyla-Kokkinokremos (district Lanarka/CY) (LH IIIC; Yalouris 1960, 52-53). Further finds are known from Gastria-Alaas (district Famagusta/CY) (Grave 12; 1075-1050 BC), Boğazköy (Hattuša/today Boğazkale; İl Çorum/TR) (18th century BC; 14th-13th centuries BC), Tell Açana (Alalach; İl Hatay/TR) (14th century BC), Ras Schamra (Ugarit; prov. Latakia/SYR) (14th century BC), Enkomi (district Famagusta/CY) (12th century BC) and more (Catling 1977, 88-96). A depiction of an

No.	findspot	find circum-stances	type	museum	inv. no.
1	Dendra, Greece	grave 8	Greek	Archaeological Museum, Nauplion	22956
2	Dendra, Greece	grave 12	Greek	Archaeological Museum, Nauplion	14.230 (old); 19.001-2
3	Arsenal Thebes, Greece	settlement	Greek	Archaeological Museum of Thebes	40.520-40.555
4	Municipal Conference Centre, Thebes, Greece	settlement	Greek	Archaeological Museum of Thebes	27370.1,3, 16-17
5	Čierna nad Tisou, Slovakia	hoard	Carpathian	Archeologické múzeum SNM Bratislava	15/40
6	Čaka, Slovakia	grave	Carpathian	Archeologické múzeum SNM Bratislava	I 8. 22025
7	Ducové, Slovakia	hoard in settlement	Carpathian	Archeologické múzeum SNM Bratislava	I. Č. 22.025
8	St. Germain-du-Plain, France	river find	Carpathian	Musée d'Archéologie Nationale, France	2757
9	Pázmándfalu, Hungary	hoard	Carpathian	Rómer Flóris Múzeum Győr	–
10	Nadap, Hungary	hoard	Carpathian	Szent István Király Múzeum, Székesfehérvár	–
11	Brno-Řečkovice, Czech Republic	hoard	Carpathian	Moravské zemské muzeum Brno	–
12	Danube, Hungary	river find	Carpathian	Magyar Nemzeti Múzeum, Budapest	–
13	unknown	unknown	Western	Metropolitan Museum New York	9,41
14	unknown	unknown	Western	Museum für Kunst und Gewerbe, Hamburg	1917.1232
15	Graye-et-Charnay or Véria, France (former Grenoble and Naples)	deposit	Western	Musée d'Armée, Paris	B 4
16		deposit	Western	Musée du Louvre, Paris	BR 1132
17-23	Fillinges, France (7)	deposit	Western	Musée d'Art et d'Historie, Genéve/John Woodman Higgins Armoury collec-tion	14.057-14.061, 14.181, 16.931-16.932, 23.451; 2675 or 2875
24-30	Marmesse, France (7)	deposit	Western	Musée d'Archéologie Nationale, France	83.753-758; 86.197-199

Tab. 1 European Bronze Age cuirasses.

Egyptian bronze scale corselet was found in the grave of Ramses III, as well as a depiction on the chariot of Thutmose IV (Catling 1977, fig. 17b-c). From the grave of Ken-Amun in Thebes (gov. Luxor/ET) (during the reign of Amenophis II; see Schauer 1982a, fig. 8) another scale armour depiction can be noted. Whether the neck protection of this corselet is made of metal, and thus it would be potentially similar to Dendra, is not clear. The discussion can be widened to the cuirass or panoply depictions on the Linear-B, Tiryns (periféria

Fig. 1 Dendra (periféria Peloponnisou/GR), grave 8. – (Photo R. d'Amato / A. Salimbeti, by courtesy of the Nauplion Museum; after d'Amato/Salimbeti 2011, 28 fig.).

Peloponnisou/GR) and Pylos tablets (see below p. 12); we cannot be sure, however, if the depicted armour is made of metal, organic material or a combination of both. Nonetheless, we have to consider LH II (or older) notes on Egyptian lists of goods from Syria (products of raiding or presents) which mention »bronze cuirasses« and »bronze battle dresses« (Müller-Karpe 1976, 70).

The first metal armour appeared in Greece around 1500 BC and ranges from single body part protection to complete panoplies. So far, Dendra and Thebes can be considered to be the two main find spots, with almost complete, undecorated cuirasses. While the oldest metal armour, which was found in Dendra (Grave 8) consists of a right shoulder plate made only of bronze sheet (**fig. 1**), the slightly younger panoply from Dendra (Grave 12) is proof of the fast adaptation, development and improvement of defensive armour (**fig. 2a-b**). The panoply consists of 15 separate pieces of bronze sheets: two pieces for the protection of chest and back, which are joined on the left side by a hinge; two large shoulder-guards and two triangular plates are attached to the shoulder-guards, which protected the armpits once the arms were raised; one neck guard; two triangular bronze sheets covering the breastplate; six bronze sheet rings, which were attached to the cuirass, three at the front and three at the back to protect the lower parts of the body (for detailed measurements see Verdelis 1967, 9-18).

The chronologically and geographically closest finds to the Dendra panoply derive from Thebes (periféria Stereas Elladas/GR) and were found in the Arsenal (**fig. 3**) and the Municipial Conference Centre (**fig. 4**). They differ slightly from the Dendra panoply: the belt plates are narrower, the shoulder guards smaller and lacking the »wings« which cover the Dendra panoply at chest and back; the lower edge of the cuirass is continuous and the edges of cuirass, shoulder and arm guards are not rolled as on the Dendra panoply. These differences, as Eleni Andrikou noted, are less the result of different Argive and Boeotian workshops, and more indications of the development and improvement of the armour, easing the mobility of the warrior (Andrikou 2007, 402 f.). The smaller, simpler form of the cuirasses from Thebes thus resulted in higher flexibility, speed and comfort.

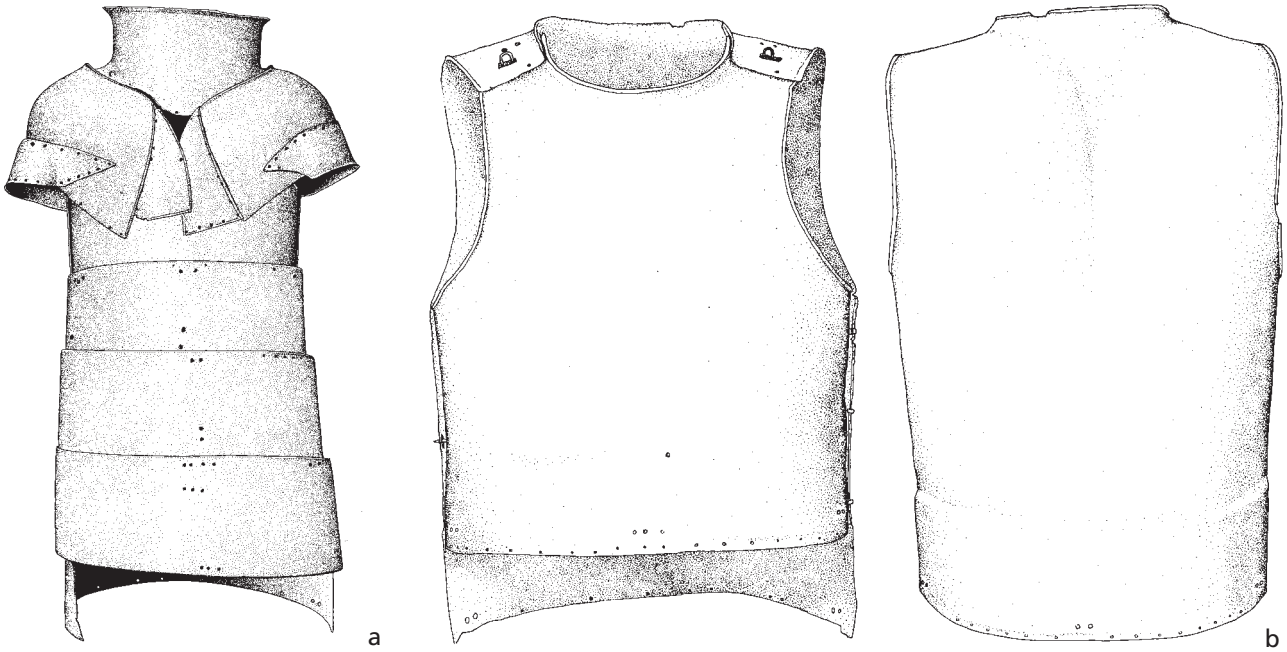

Fig. 2 Dendra (periféria Peloponnisou/GR), grave 12. – (After Müller-Karpe 1980, pl. 242; Schauer 1982a, 122 fig. 6).

Fragments of further potential Greek cuirasses have also been found at Nichoria (periféria Peloponnisou/GR), Phaistos (periféria Kritis/GR) and Mycenae (see p. 6 and 27). These all belong to the rather small time frame of LH II-IIIB2 (c. 1500-1300 BC). The »next« cuirass in Greece, the cuirass from Argos (periféria Peloponnisou/GR), dates to the 8th century BC. So far, this 500 year gap without any known finds remains unexplained, but is most likely connected to changes in deposition, burial traditions and the state of research, rather than the hypothetical non-existence of full metal armour. However, it was in this very period that the first cuirasses in the Carpathian Basin appeared. The most well known are the cuirasses from Čierna nad Tisou (okr. Trebišov/SK) (**fig. 5**), Čaka (okr. Levice/SK) (**fig. 6**), the Danube, Ducové (okr. Piešťany/SK) (**fig. 7**) and Nadap (Kom. Fejér/H) (**fig. 8**), accompanied by further fragments and fragmented cuirasses from other find spots from the Hungarian Basin, but also from southern Germany. These cuirasses, decorated with embossed ribs and engravings, are usually dated from Bz D-Ha A. Another cuirass, which is generally associated with the same group, was found in Saint-Germain-du-Plain (dép. Saône-et-Loire/F), central-eastern France (**fig. 9**). It is the only complete cuirass of the Carpathian group aside from the Danube cuirass (Jankovits 1999/2000, 195 note 41; Szathmári 2003, 63), while all the other cuirasses of the same type were parts of deposits or graves and are heavily fragmented, thus making it hard to detect traces of manufacture and usage.

In the surrounding area, in straight-line distance of less than 230 km, the two most famous deposits of Western-European cuirasses were found, with 14 cuirasses in total – Marmesse (dép. Haute-Marne/F) and Fillinges (dép. Haute-Savoie/F). Close to the finds of Marmesse and Fillinges, two further cuirasses were found at Graye-et-Charnay or Véria (both dép. Jura/F). Two other cuirasses, characterised mainly by their *Punktbuckel* ornamentation, with unknown find spots also belong to this group. The chronology of the Western-European cuirasses is still under discussion, since they were found without chronological significant associated finds (see the section on chronology and typology).

When discussing Bronze Age full metal cuirasses, it is important to briefly discuss further possibilities for metal body protection. Band sheets were fixed on the bottom of the cuirass (as we can note on the finds

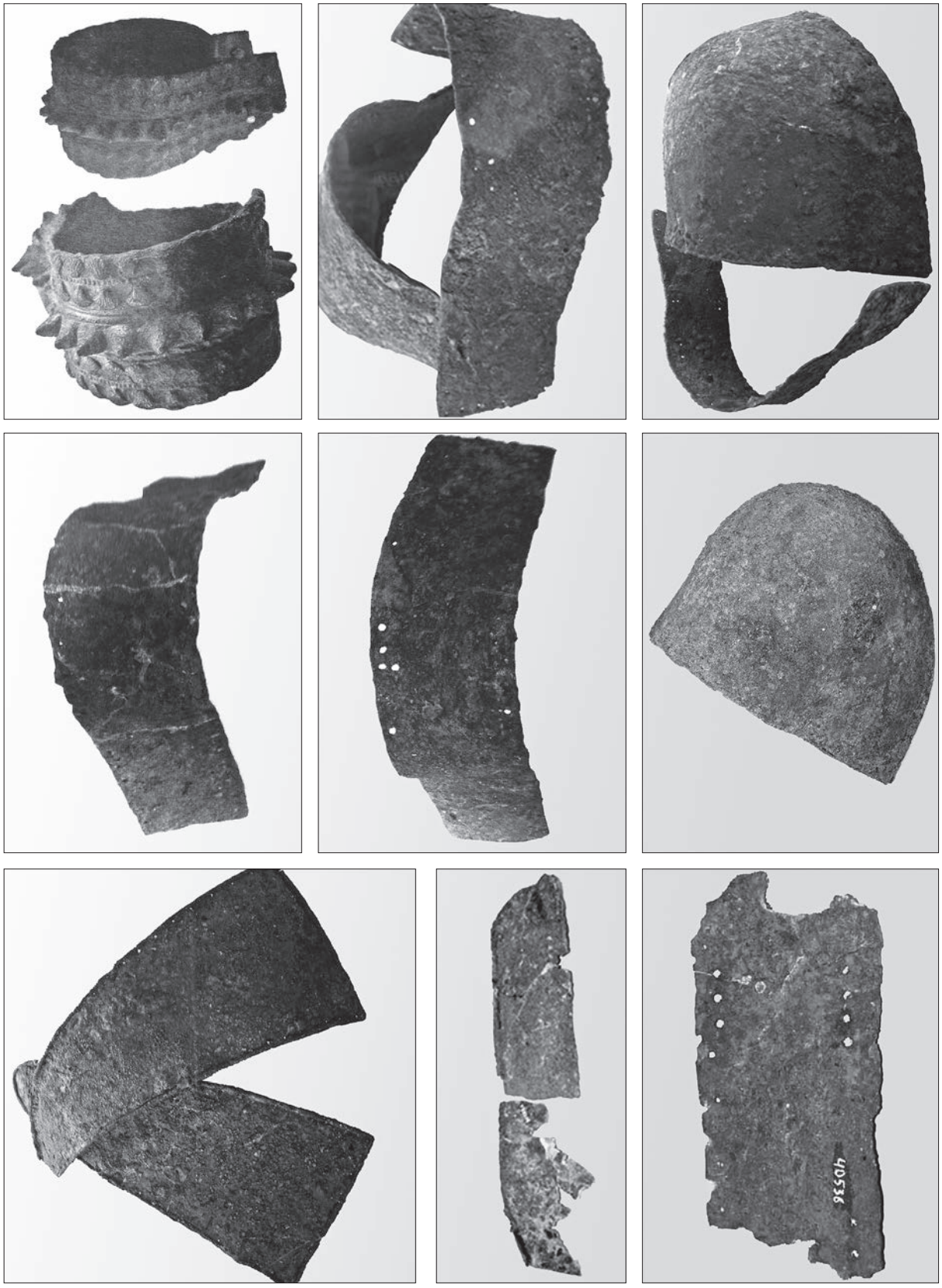

Fig. 3 Thebes (periféria Stereas Elladas/GR), Arsenal. – (After Andrikou 2007, pls C-CI; d'Amato/Salimbeti 2011, 39 fig.).

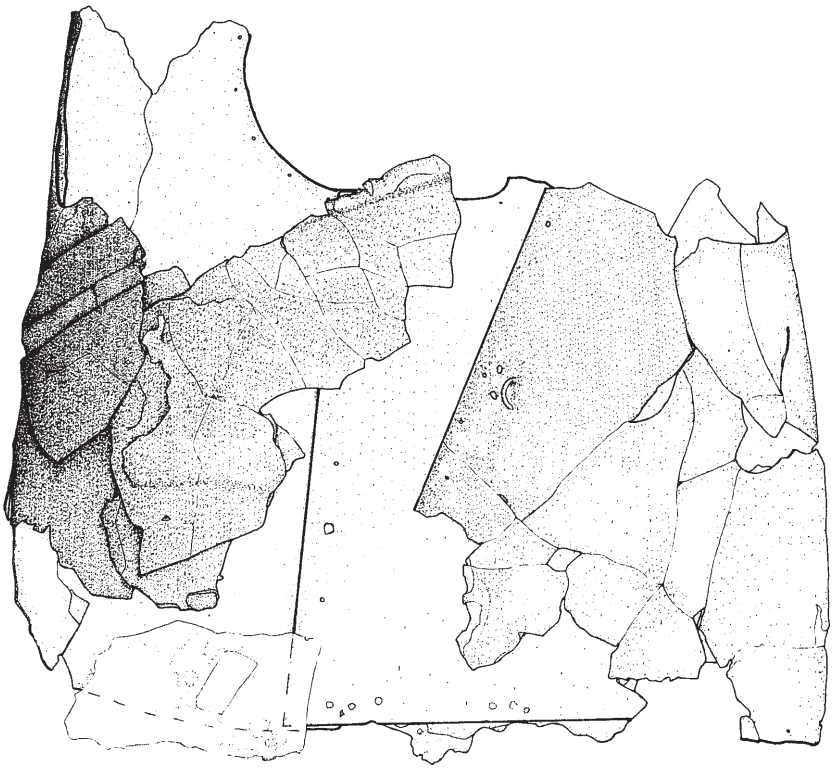

Fig. 4 Thebes (periféria Stereas Elladas/GR), Municipial Conference Centre. – (After Andrikou 2007, pl. CII, b).

from Dendra and Thebes) as protection for the lower parts of the body. They were joined together with leather or metal strips, as the bigger 3-4 mm diameter holes indicate. For the application of, or on, organic materials, smaller holes with only 2 mm diameter were used. Further band sheets have also been found in Greece (Andrikou 2007, 403, with further literature):

1. Phaistos, Tombe dei nobili (LM III): two fragments; Archaeological Museum Herakleion; measurements: 29.5 cm × 12 cm
2. Mycenae, Chamber Tomb 15 (LH IIIA-B): two fragments; National Archaeological Museum Athens, inv. no. 2781; measurements: 22.5 cm × 6-7.7 cm and 17.3 cm × 8 cm
3. Mycenae, Chamber Tomb 69 (LH IIIA/B1; 1350-1300 BC): Two fragments (one gilded and one curved, the latter appears to be part of a girdle). The band sheets exhibit small holes around the edges; National Archaeological Museum Athens, inv. no. 3034; measurements 45.6 cm × 5.5 cm and 4.8 cm × 5.9 cm.

The interpretation of these band sheets differs widely – belts, breast shields or *mitra* have been some of the most notable suggestions. However, their relation with the cuirass from the Arsenal of Thebes, and potentially also to the »things hung or attached around« (o-pa-wo-ta) from the Linear B tablets is obvious (Andrikou 2007, 403). Since we also take into account that local organic cuirasses or armour, as well as the Greek cuirasses, can be viewed as ancestors of the Carpathian cuirasses, it is worth noting the few finds of organic cuirasses or jerkins with attached bronze sheet collars:

1. Hesselberg (Lkr. Ansbach/D) deposit in settlement (Bz D): Germanisches Nationalmuseum Nürnberg, inv. no. Vb8676,6; measurements: 24 cm × 6.7 cm (Weiss 1998, 543, fig. 6, 1; Kytlicová 1988a, 306-321, fig. 1, 2; 2, 2). The decoration of the collar is similar to the cuirasses from Ducové and Saint-Germain-du-Plain.
2. Milavče (okr. Domažlice/CZ), grave, hill C1 (Bz D/early Milavče-period; Kytlicová 1988a, 319); Národní múzeum, Praha, inv. no. unknown (Jankovits 1999/2000, 195; 1998/1999, 543 fig. 6, 2; Kytlicová 1991, 23 pl. 26, 11-14. 18; Kytlicová 1988a, 306-321 fig. 1, 1; 2, A1-2; 2, 5); Kytlicová 1988b). Olga Kytlicová

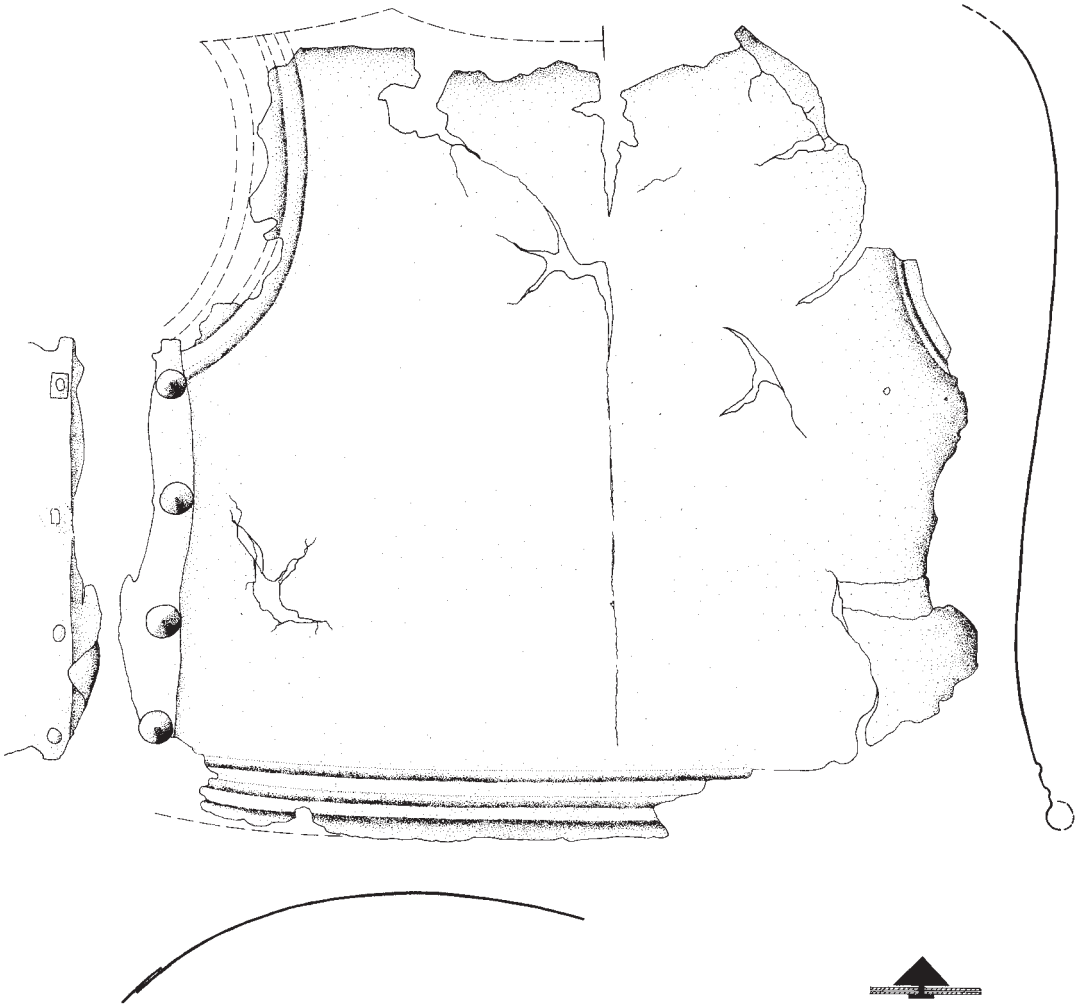

Fig. 5 Čierna nad Tisou (okr. Trebišov/SK). – (After Schauer 1982a, 125 fig. 9).

described a flat bronze sheet collar, aligned by nails and buckles, two discs with similar nails and buckles attached, as well as bronze-decorated pieces of leather, like fragments of a leather jerkin with bronze attachments (1991, 23 pl. 26, 11-14. 18).

3. Kourion Kaloriziki (district Limassol/CY) Grave 40 (12th century BC; McFadden 1954): Cyprus Museum, Nicosia(?), inv. no. M 1019; measurements: 18.6 cm length, 0.1 mm thick (Kytlicová 1988a, 306-321, fig. 1, 3; 4; McFadden 1954, no. 35 pl. 26, 35).

Also, Björn-Uwe Abels noted 21 rivetted bronze sheets with buckle decoration from the Heunischenburg (Lkr. Kronach/D) and interpreted them as residues of leather jerkins with bronze applications. However, these might also be fragments from rims or belts (Weiss 1998, 543 fig. 7; Abels 1985/1986, 14 fig. 19, 8-17).

Phalerae are not discussed in the following text, since their usage as defensive armour still remains unclear. As Svend Hansen (1994, 12) pointed out, grave and hoard finds containing *phalerae*, or decorated discs, do not usually support one interpretation of usage more than any other interpretation. They have never been found fixed on leather. However, from Grave 3 at Trimbs (Lkr. Mayen-Koblenz/D) there are three discs with a diameter of 16 cm. They have several holes parallel to the edge, to fix them onto an organic base (Sperber 2011, fig. 9, 2) – in a similar way to those on the cuirass from San Antonio de Calaceite (prov.

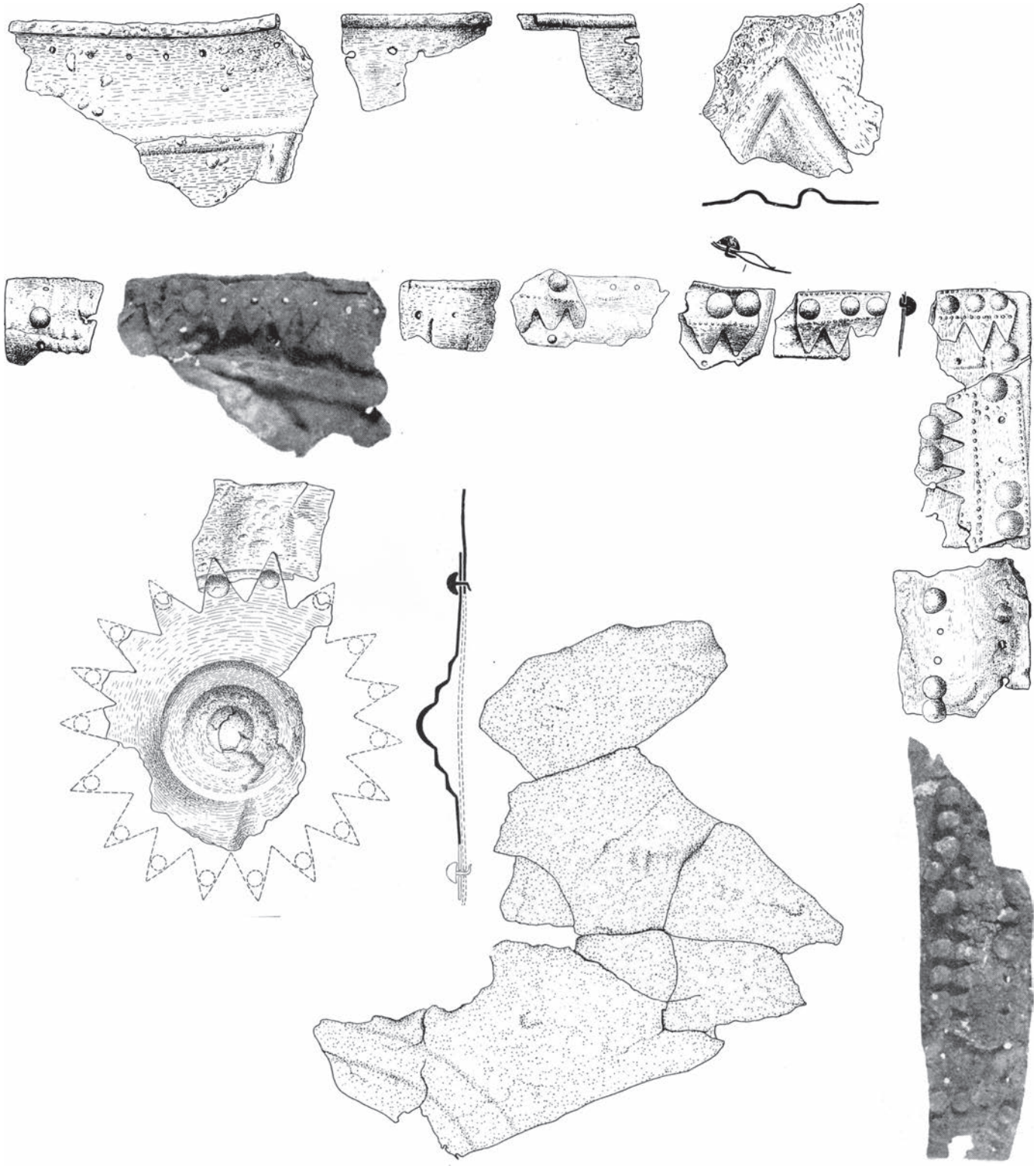

Fig. 6 Čaka (okr. Levice/SK). – (After Točík/Paulík 1960, 77B; Jockenhövel 1971, pl. 60).

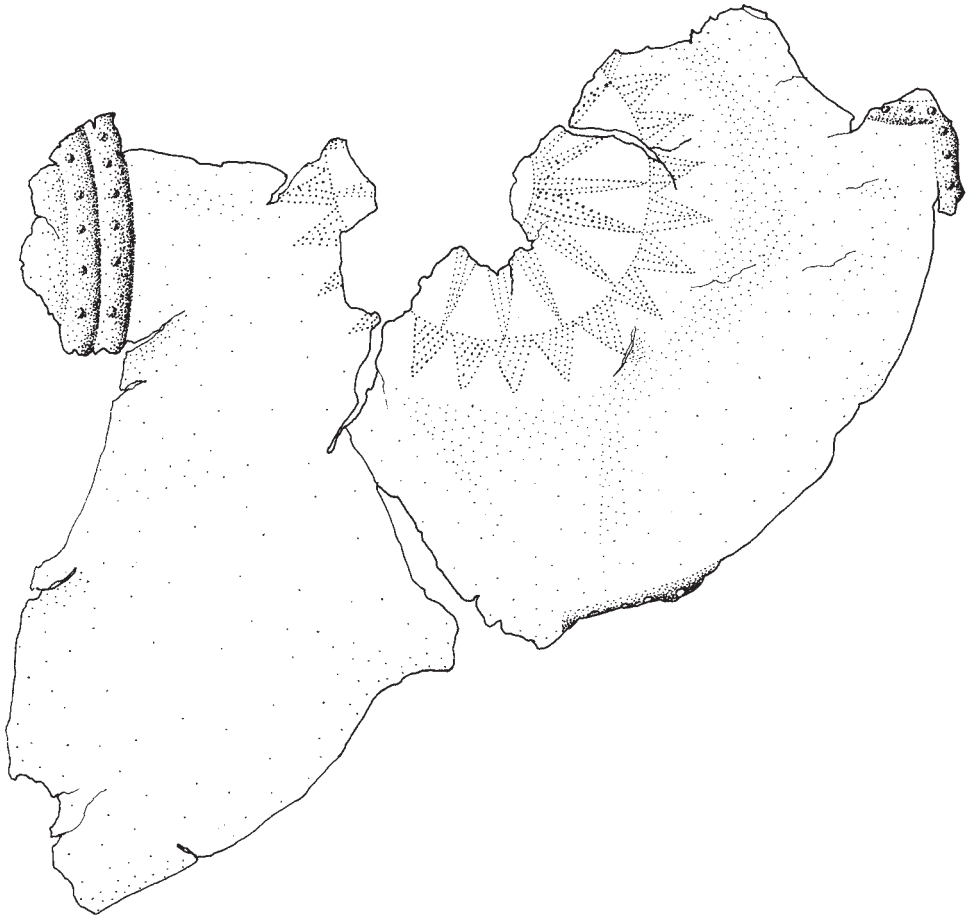

Fig. 7 Ducové (okr. Piešťany/SK). – (After Schauer 1982a, 118 fig. 5).

Teruel/E) from the 6th century BC (Sperber 2011, 25 note 103 pl. 3, 4). Of course this does not exclude the possibility that *phalerae* or *Kompositpanzer* also had a defensive function (i. e. the pair of *phalerae* in the grave in Acholshausen [Lkr. Würzburg/D]), as Gero von Merhart (1954) and Peter Schauer (1978; 1982a, 346) pointed out.

HISTORY OF RESEARCH

The first comprehensive study of Bronze Age cuirasses was published by von Merhart (1954). He classified cuirasses into two main groups: the Western-Alpine group (with three sub-groups) and the Eastern-Alpine group. The cuirasses from Naples, Grenoble (Graye-et-Charnay or Véria A and B, as they are now known) and the cuirass, which today is kept in Hamburg, form the first sub-group of the Western-Alpine cuirasses, dated to the 8th century BC. The second sub-group (also dated to the 8th century BC) consists of the cuirasses from Fillinges, Marmesse, and the two cuirasses of unknown provenance in the Metropolitan Museum of Art (New York) and another potential cuirass from the former »Reiling-collection« in Mainz (see p. 29). The third sub-group is formed by only one cuirass from Saint-Germain-du-Plain, which was dated by von Merhart to the 7th century BC (the cuirasses which have been classified as »Eastern European« were not

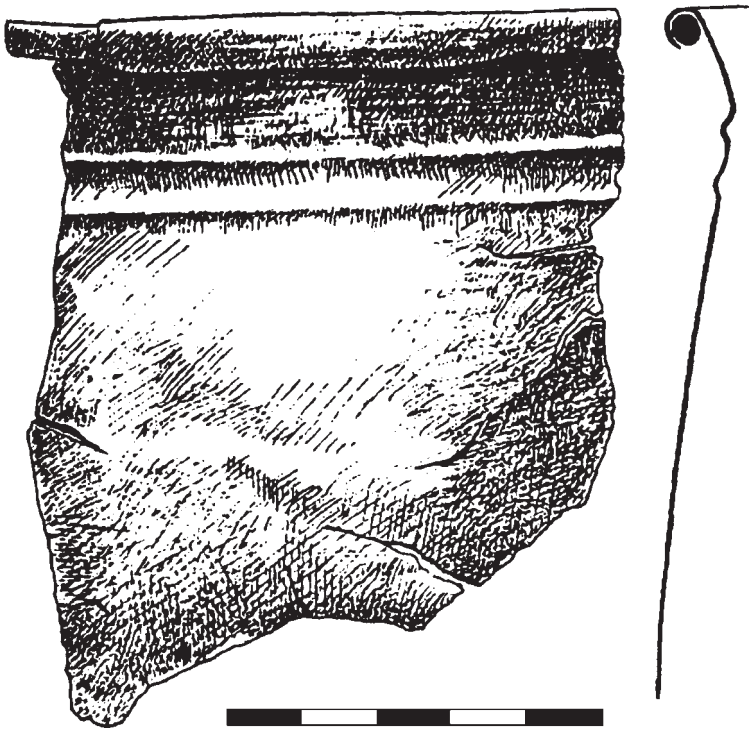

Fig. 8 Nadap (Kom. Fejér/H). – (After Makkay 2006, pl. VI, 12).

known at that time). The Eastern-Alpine group consists of the younger, 7th century BC cuirasses from Kleinklein (Bez. Leibnitz/A) and Stična-Vrhpolje (občina Grosuplje/SLO). Von Merhart put forward the same origin for all the European cuirasses, indicating they also influenced or initiated Greek cuirasses (von Merhart 1954, 55). Only a few years later, the new finds from Dendra and the thought-to-be cuirass fragments from Kallithea (periféria Attikis/GR) disproved his theory and strengthened the theory that Bronze Age defensive armour had an Aegean origin, as discussed in detail by Hermann Müller-Karpe (1962). Nevertheless, Jozef Paulík still argued that the cuirasses which formed the Eastern-Carpathian group (at that time cuirasses from Čaka, Čierna nad Tisou and Ducové were known) had been produced in Danubian workshops which then influenced the Aegean workshops, and not the other way round (Paulík 1968). Referring to the idol from Kličevac (okr. Braničevo/SRB) (Vršac-Žuto-Brdo Group), he assumed that the ancestors of the Carpathian metal cuirasses were leather jerkins with bronze applications (Paulík 1963, 135).

However, Müller-Karpe's theory of an Aegean origin could not be disproved until today (Schauer 1982a, 115 note 80) – though authors as i. e. Schauer tried to disprove it. He assumed that the Dendra cuirass was not connected with the later Bronze Age cuirasses in Eastern and Western Europe (Schauer 1975, 307), since it was used mainly by Mycenaeans in a carriage. Due to its bronze neck protection, Schauer linked the Dendra-corselet with the depiction of scale armour in the Ken-Amun-grave of Thebes (Schauer 1982a, 121 fig. 8). He stated that all cuirasses might have had the same ancestor, which he located in the Near East (Schauer 1982a). As we know today, the European cuirasses are the oldest full metal cuirasses; no previous examples are known from the Near East or Egypt.

According to Nikolaos M. Verdelis, the cuirasses developed from organic jerkins, protected by single metal sheets, followed by panoplies of the Dendra type, lasting until the end of the 13th century BC. At the beginning of the 12th century BC, the type of armour changed due to various influences connected with the »catastrophe« around 1200 BC (Drews 1993). Paulík posited that the Eastern-Alpine/Carpathian cuirasses also

Fig. 9 Saint-Germain-du-Plain (dép. Saône-et-Loire/F). – (Photo M. Uckelmann). – without scale.

influenced or initiated the production of the Western European cuirasses, produced in two centres (Paulík 1968, 61), while Schauer strengthened the idea of local organic predecessors (Schauer 1982a, 129), and for the later Early Iron Age cuirasses from Austria and Slovenia he suggested a direct influence from Greece. In contrast to the importance and the high value the cuirasses most certainly had in the Bronze Age, interest in this topic of research has been rather low over the last 35 years, especially in relation to the Carpathian cuirasses. Most recently the cuirasses from Fillinges have been discussed by Yvette Mottier (1988), while a detailed study on the cuirasses from Marmesse is in preparation by Anne Lehoërff. An overview on all Greek Bronze Age cuirasses is given in the most recent study on these objects of rare, valuable defensive armour by Andrikou (2007).

DEPICTIONS

Depictions of cuirasses are even rarer than the cuirasses themselves. Greek depictions might include metal cuirasses, but could also depict organic cuirasses, or cuirasses with combined materials (for a detailed discussion about the depiction of cuirasses in the Linear-B tablets see Catling 1977, 107-118). In the Linear B archives from the palaces of Knossos (140 tablets, category SC; LH IIIA) and Pylos (12 tablets, category Sh; LH IIIB2) several armour-ideograms have been identified. The Knossos ideograms exhibit common characteristics, such as a trapezoidal shape, curved lines indicating the shoulder pieces, and a varying number of horizontal lines within the trapezoid. The latter most likely indicates reinforcement bands or belts of segmented armour. The armour-ideograms from Pylos, however, significantly resemble the Dendra corselet, though the following number of 30 or more »accessories« (*o-pa-wo-ta*) seems to be far too high for a metal panoply, and shoulder guards are not mentioned, even though the »accessories« also include parts of the well-depicted helmets (d'Amato/Salimbeti 2009, 32 f.). The Knossos Linear B tablets mention cuirasses together with chariots, which is supported by the two cuirass finds from Thebes, as these are the only ones found with arms/war related objects in store rooms or annexes of a settlement or palace, and not inside a warrior's grave.

The most significant depictions are noted below (for further depictions of metal cuirasses see Verdelis 1967, 23-29):

1. Thisbe (periféria Stereas Elladas/GR) (LH II/c. 1500 BC), seal-stone. The standing warrior appears to be wearing a cuirass with a single, large right shoulder guard, as found in Dendra (Grave 8).
2. Tiryns (periféria Peloponnisou/GR) (LH IIIC). The lower edge of a bell-shaped cuirass is visible as well as a potential waist belt. The armour is worn by a man who is accompanied by another in a chariot (Verdelis 1967, 25 pl. 34, 1).
3. Lefkandi (periféria Stereas Elladas/GR) (LH IIIC), crater. A warrior with large body armour and enlarged shoulder guards is depicted.
4. Cyprus (15th-14th centuries BC), Achaean-Cypriote seal. Two warriors in a chariot.
5. Chania/Gortyn (periféria Kritis/GR) (c. 1400-1450 BC), figurine. A potential representation of a cuirass, the rims of which are strengthened with rivets on jagged bronze sheets (as those examples from Čaka and Pázmándfalu [Kom. Györ-Moson-Sopron/H]), might be worn by the statuette. It looks like a bell-shaped cuirasses or jerkin with a lower, trimmed edge.
6. Sardinia (I) (11th-10th centuries BC?), bronzetti. The cuirasses seem to consist mainly of organic material, though some figurines also wear what may be metallic neck guards (see Lilliu 1966; Demontis 2005, no. 14; 18; 20, b; 21; 29; 36).

7. Kličevac (13th/12th century BC), figurine. According to the star-motif, as on the cuirasses from Čaka and Ducové, the figurine from Kličevac was supposed to wear a cuirass as well (Paulík 1963, 135). However, the star motif appears on the figurine on the chest and chin, which indicates a more decorative character.

From Greece and Austria, although they are not really depictions, small, simplified miniatures of cuirasses have been noted. The miniatures served different purposes from vessels to pendants. In a tomb at Knossos (Museum Heraklion, inv. no. 2408; Verdelis 1967, 22 suppl. 23, 1) a 5.6 cm tall miniature of a cuirass, made of stone, was found. This would have served as a miniature vessel. It was discovered before the excavation of the same area and should be dated to LM IIIA1 (according to Catling 1977, 85 to LH IIB/IIIA1). Another miniature cuirass comes from Praisos (periféria Kritis/GR) (Heraklion Archaeological Museum inv. no. 840) but dates to a later period (Yalouris 1960, 53; Snodgrass 1964, 74). Further examples of miniature corselets from Praisos and Bassae (periféria Peloponnisou/GR) are known, but in less detail (Snodgrass 1964, 74). The 3.3 cm × 1.4 cm miniature from Brandgraben (Kammerhofmuseum Bad Aussee, find no. 83; Windholz-Konrad 2008, 48-57. 137 fig. 53-55) was made of high-tin bronze; in opposition to the original cuirasses (see **tab. 2**). The hoard consists of 234 objects and dates generally to Bz D/Ha A. However, the oldest objects date to the 14th/13th century BC (Windholz-Konrad 2008, 50). The Brandgraben-miniature depicts a waisted cuirass with an accented chest and a concave rib, which follows the spine. The lower edge is massive and decorated with alveoli. On the neck, a loop is visible, allowing for the miniature to be used as a pendant. In the middle of the spine and on the neck on the back, two holes are visible (caused by casting defects). The miniature is hollow inside and was cast in a bi-valve mould, as the casting seam residues indicate. The pectoral muscles are clearly visible. Typologically, this miniature exhibits similarities with both Western and Carpathian cuirasses, as indicated by the concave rib on the back and accented breasts. The waisted shape is similar to the complete Carpathian cuirasses and the cuirasses from Marmesse. Since the waisted shape of the cuirasses from Čaka and Ducové is just a reconstruction based on assumption due to the lack of the according fragments, we cannot consider them for comparison.

DISTRIBUTION AND DEPOSITION

Cuirasses are the least occurring of all metal defensive armour. The distribution area (**fig. 10**) includes the chronology and different decoration styles of the three main groups of cuirasses: Greek, Carpathian and Western European.

The earliest cuirasses from Greece (Dendra and Thebes) come from around the Corinthian Gulf, within a distance of less than 100 km. Further fragments of potential cuirasses have also been found in Nichoria. The panoply from Dendra was discovered in a grave, as was the slightly older shoulder protection from grave 8. The cuirasses from Thebes, however, come from a settlement area: one from an annex of the palace, the Municipal Conference Centre, the other from the Arsenal (**fig. 11**). So far, these two cuirasses are the only ones, which have been found in a settlement context.

Chronologically the closest group to the Greek cuirasses is originated in the north-western Carpathian Basin and documented by one find from a deposit from Brno (okr. Brno-město/CZ) (**fig. 12**) and a complete cuirass from the Saône near Saint-Germain-du-Plain. The core group of the Carpathian cuirasses consists of six specimens from Čierna nad Tisou, Čaka, Ducové and a complete cuirass from the Danube, as well as fragments from Pázmándfalu and Nadap. Due to local depositional practice, all but one were destroyed before the deposition, and only a few fragments of the cuirasses were deposited within the hoard (*pars pro toto*). The same practice can be noted in relation to the cuirass from Brno and a possible cuirass' fragment from Winkl-

Fig. 10 Distribution area of cuirasses: **1-2** Dendra/GR. – **3-4** Thebes/GR. – **5** Čierna nad Tisou/SK. – **6** Čaka/SK. – **7** Ducové/SK. – **8** St. Germain-du-Plain/F. – **9** Pázmándfalu/H. – **10** Nadap/H. – **11** Brno-Řečkovice/CZ. – **12** Danube/H. – **13-14** unknown. – **15-16** Graye-et-Charnay or Véria/F (former Grenoble and Naples). – **17-23** Fillinges/F. – **24-30** Marmesse/F.

Fig. 11 Thebes (periféria Stereas Elladas/GR), Arsenal. – The cist grave in which the parts of the cuirass collapsed. In the front, two wash basins. – (After Platon/Stassinopulou-Touloupa 1965, fig. 8).

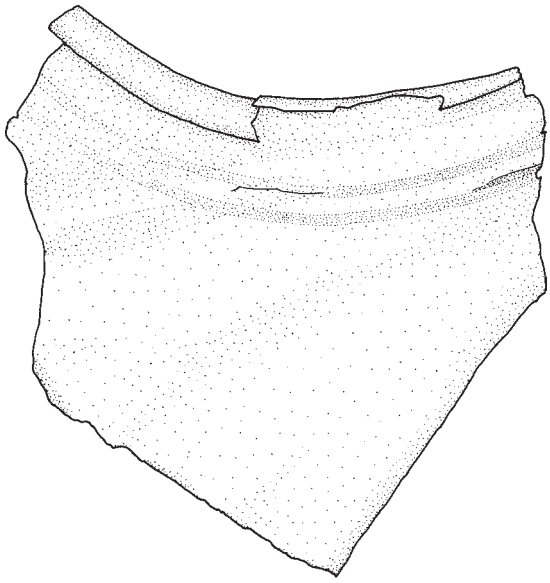

Fig. 12 Brno-Řečkovice (okr. Brno-město/CZ). – (Drawing M. Mödlinger).

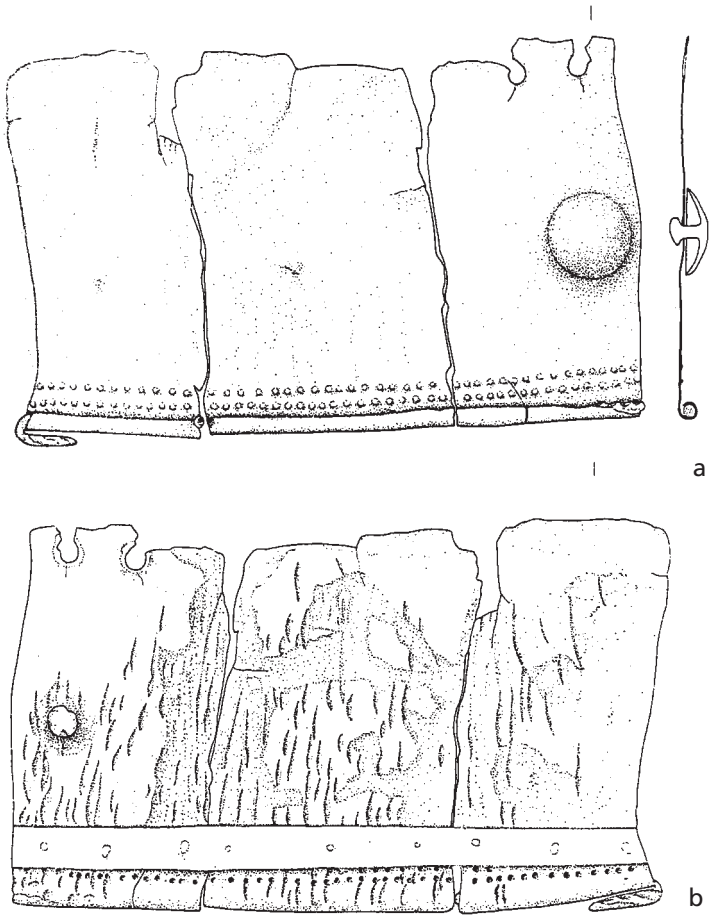

Fig. 13 Potential cuirass fragment from Winklsaß (Lkr. Landshut/D): **a** front. – **b** back with recent soldering on of a brass sheet. – (After Weiss 1998, 537 fig. 2). – Scale 1:2.

saß (**fig. 13**) (see also Gerloff 2010, 298 f. concerning the east-west transfer of bronze sheet objects). The cuirass from Čaka was found in a grave – as was the Dendra panoply. However, due to burial traditions, the cuirass participated in the cremation process and thus is not preserved completely, but heavily fragmented. The other finds from the hoard exhibit visible eastern traits (e. g. the rib-decorated socketed axe, usually found in Slovakia, Hungary and Romania, or the sickle fragments type Uioara, a fibula of type Röschitz), and thus we have to consider the possible cuirass fragment from Winklsaß not as the »missing link« between the Carpathian and Western cuirasses, but more as an eastern product which arrived in the west. This hypothesis is even clearer, when we note the cuirass from Saint-Germain-du-Plain (Paulík 1968, 56. 60; Schauer 1982a, 125; Weiss 1998, 543). This cuirass and the one found in the Danube are the only completely preserved Carpathian specimens. They were dedicated and sunk (undamaged) in the Saône at Saint-Germain-du-Plain and the Danube (a publication is in preparation by Éva Petres, Tibor Kovács and Katalin Jankovits).

Most interesting is the point that Saint-Germain-du-Plain is close to the small distribution area of the Western cuirasses from Marmesse (7), Fillinges (7), and Graye-et-Charnay or Véria (2). All 16 cuirasses were found within an area of 230 km. Another cuirass, now stored in the Metropolitan Museum of Art, resembles the cuirasses from Fillinges (**fig. 14**) so closely that an origin close to the site of Fillinges may be assumed. However, find spot and circumstances are unknown. One more cuirass, now stored in the Museum für Kunst und Gewerbe Hamburg (**fig. 15**), is also part of the group of Western cuirasses. Its find spot and circumstances are also unknown. The cuirasses from Fillinges were found together with a unique bronze wand, in an ash layer, but without any significant sign of fire exposure. The breast- and backplates were placed inside each other as we can also see on the specimens from Marmesse (**fig. 16-18**). They were deposited in the shape of a triangle, resembling the deposition of the three helmets from Bernières-d'Ailly (dép. Calvados/F), which

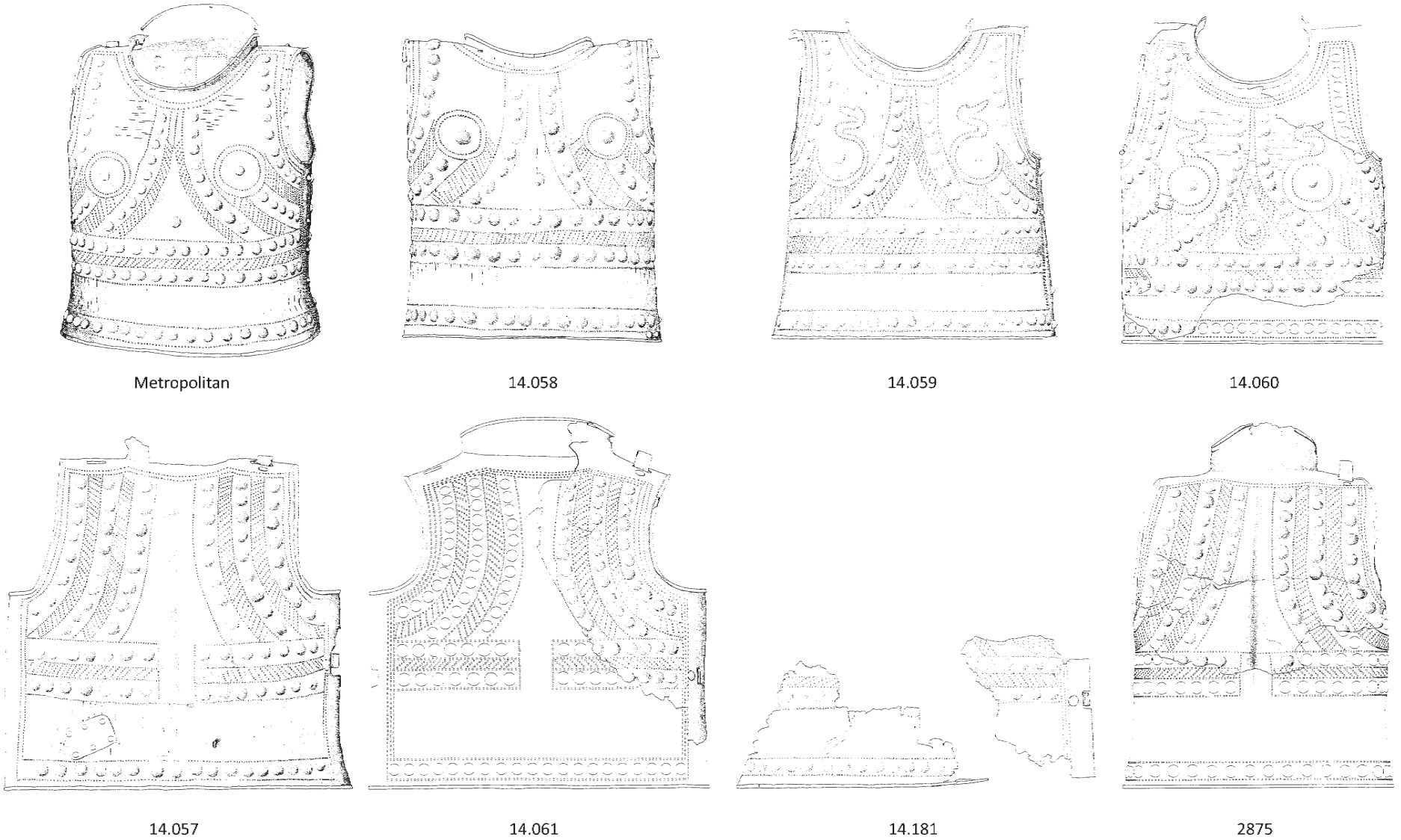

Fig. 14 Fillinges (dép. Haute-Savoie/F). – Also the cuirass now in the Metropolitan Museum is depicted here (upper left). – (After Mottier 1988).

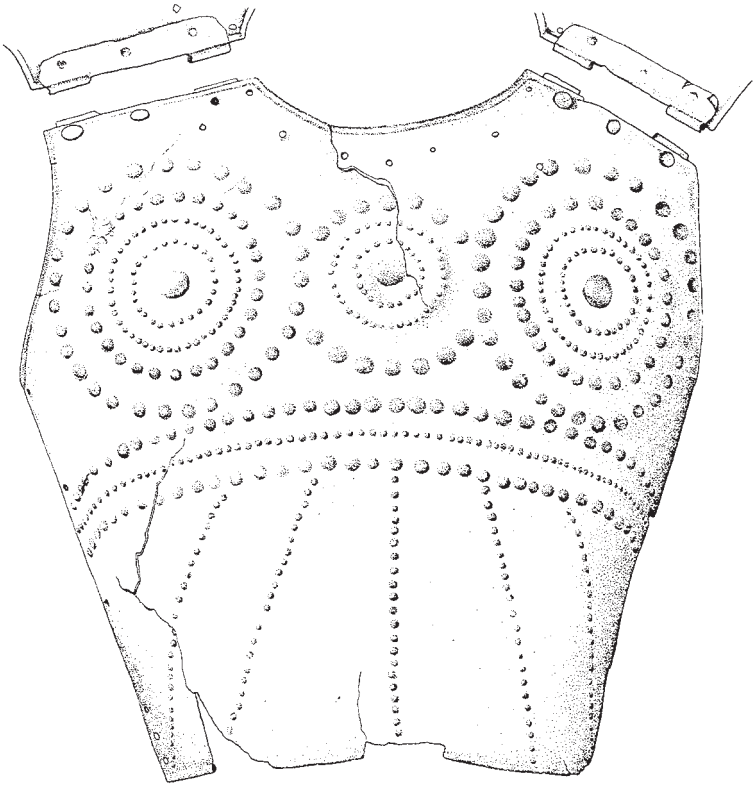

Fig. 15 Unknown findspot, today in Hamburg. – (After Mottier 1988, 139 fig. 34).

Fig. 16 Three of the Marmesse (dép. Haute-Marne/F) cuirasses inside each other. – (Photo A. Chauvet/C2RMF; by courtesy of the Musée d'Archéologie nationale, Saint-Germain-en-Laye [MAN]).

were also deposited inside each other in the shape of a triangle. Close to Marmesse, two other cuirasses were deposited at Graye-et-Charnay or Véria (previously assumed to have originated from Grenoble and Naples) (**fig. 19**); no associated finds are known (Descamps 2005, 100).

The distribution area of European metal defensive armour is specific. While helmets (in total approx. 120) are widely distributed in the Carpathian Basin, Central and Western Europe, rather infrequent in Southern

Fig. 17 Marmesse (dép. Haute-Marne/F): **a** inv. no. 83.753. – **b** inv. no. 83.755. – **c** inv. no. 83.756. – (Photos A. Chauvet/C2RMF; by courtesy of the MAN).

Europe and, except for two helmets, non-existent in Northern Europe, the distribution area of shields is even more restricted to the British Isles, southern Scandinavia, Germany, Czech Republic and the Carpathian Basin. Greaves spread from the western side of the Danube westward to France and the Po-Basin, and southward to Croatia. The even smaller distribution area of cuirasses and its centralisation in rather small areas might lead to the assumption that (if we do not want to take into account different deposition hab-

Fig. 18 Marmesse (dép. Haute-Marne/F): **a** inv. no. FZ 32.691. – **b** inv. no. 83.754. – **c** inv. no. unknown. – (a photos M. Uckelmann; b photos A. Chauvet/C2RMF; by courtesy of the MAN; c photos M. Mödlinger).

its), in other regions, organic protection (the need for adequate protection for the body has to be taken for granted when we consider the highly developed weapons) was preferred instead of metal cuirasses. These may not have been used due to various reasons, or a combination of them: for example, tradition, religion, lack of specialised workshops or financial reasons.

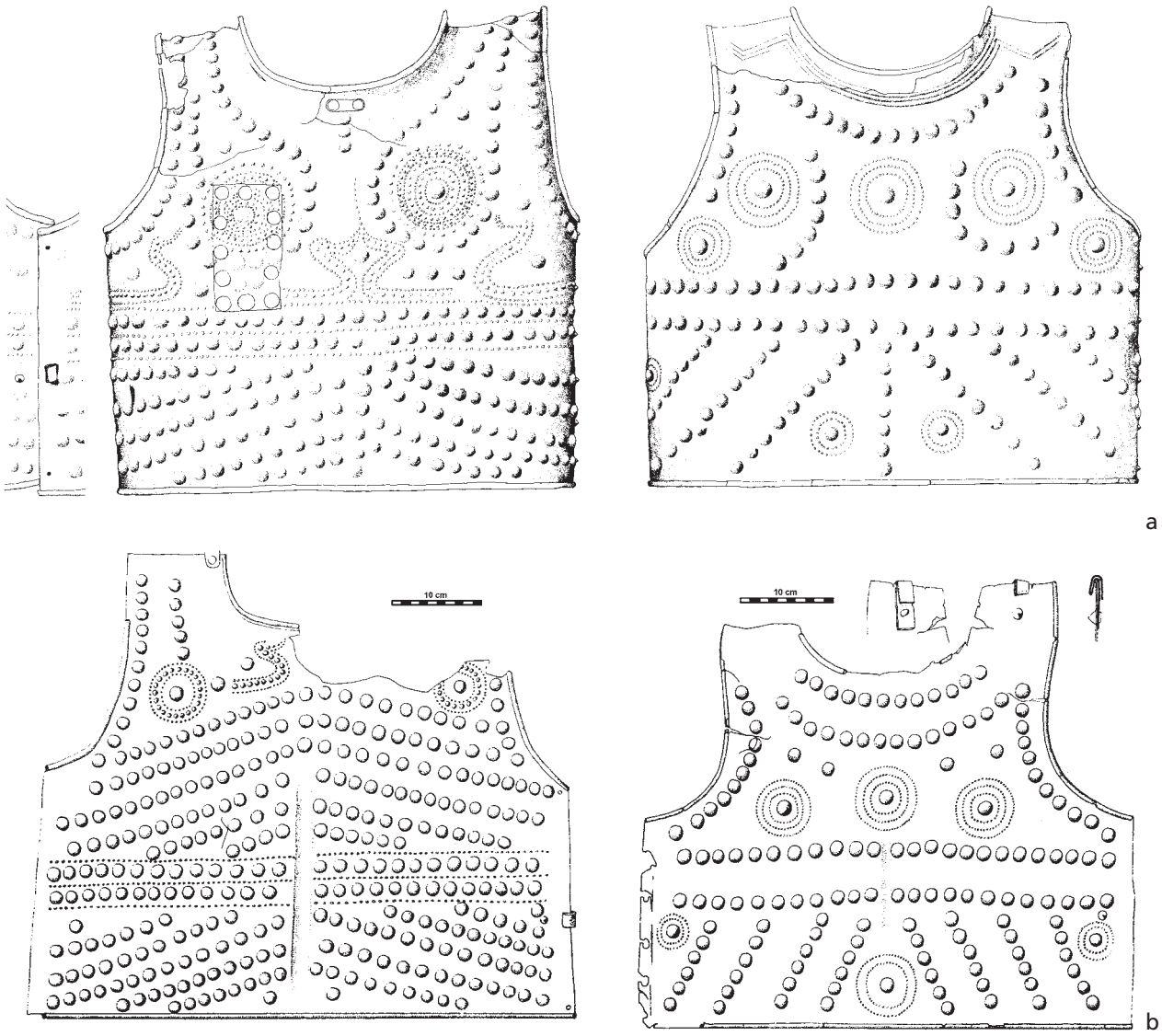

Fig. 19 Graye-et-Charnay or Véria A and B (dép. Jura/F): **a** former Naples. – **b** former Grenoble. – (a after Schauer 1982a, 126 fig. 10; Michel/Mohen 1970, 69 fig. 8; b after Schauer 1982a, 127 fig. 11; Michel/Mohen 1970, 68 fig. 7).

CHRONOLOGY AND TYPOLOGY

From LH II to LH III, defensive armour changed significantly in the Aegean. The tower and figure-of-eight shields were exchanged for the small round shield, and thus, in order to provide adequate protection, the body had to be protected with additional armour. The rapid development from the protection of single parts of the body in battle, to a complete protection of the whole body, is demonstrated by the two armaments found in Dendra (Graves 8 and 12).

The earliest European metal defensive armour is a bronze protective sheet for the right shoulder, found in Grave 8 at Dendra (LH II; see **fig. 20**). It is considered to be slightly older than the famous panoply from Grave 12 (Andrikou 2007, 402; Verdelis 1967, 21f.), which is usually dated to LBII/IIB. The potential fragment of a cuirass from Phaistos can be considered contemporary with the Dendra cuirass (Grave 12). The panoplies or cuirasses from Thebes have been dated to LH IIIA2/B1 and thus are slightly younger (Andrikou

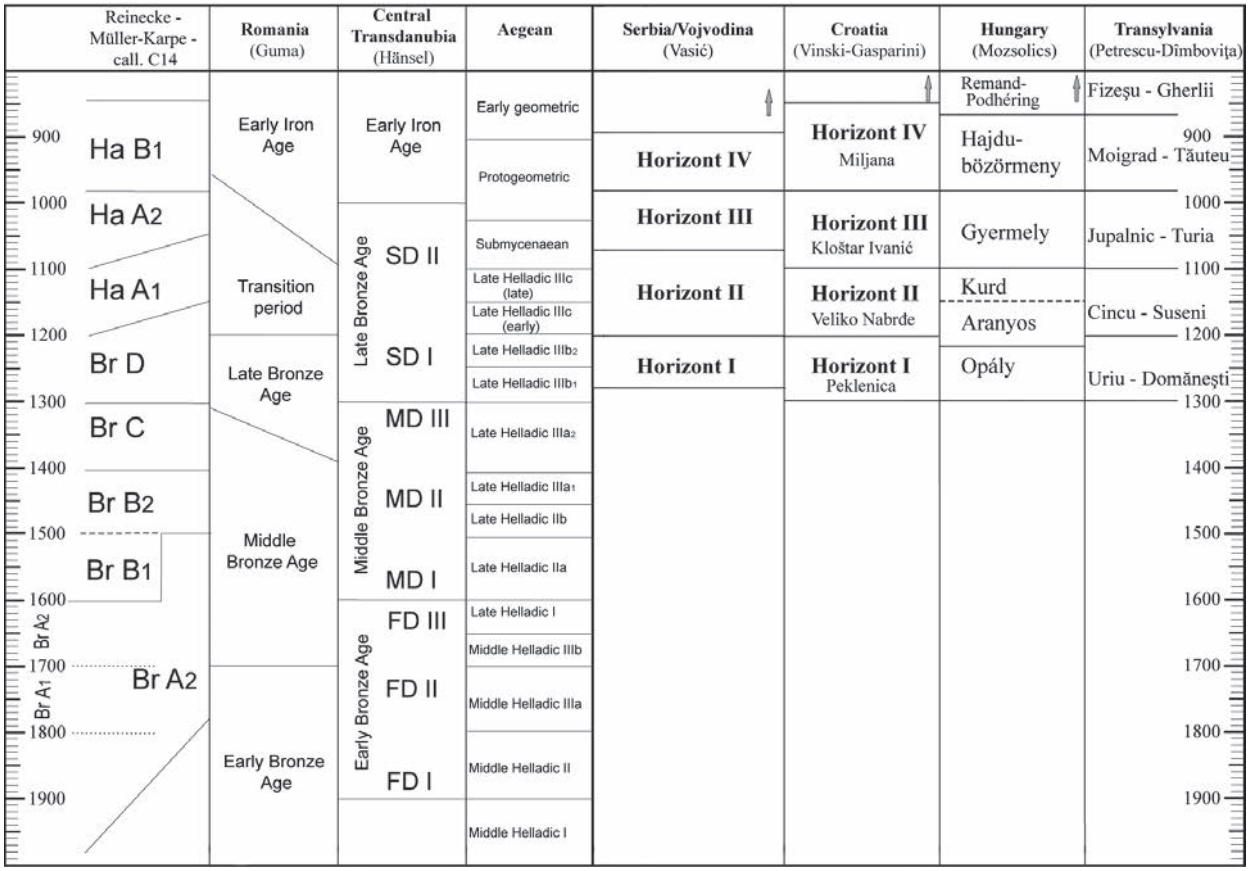

Fig. 20 Parallelisation of the European Bronze Age Chronology (selected areas). – (After Jovanović 2010).

2007; Verdelis 1967, 21 f.). Anthony Snodgrass dated the first one found to »somewhat earlier« than the destruction of the building in 1300 BC (Verdelis 1967, 22 note 58). The chronological gap between the Mycenaean cuirasses and the next cuirass from Argos (8th century BC) might be connected to deposition practice, the decrease of chariots and the state of research, but certainly not to the general lack of metal armour or the decrease of activities from the 11th century BC onwards, since metalwork continued to be practised (Andrikou 2007, 40).

Due to the depositional practice, Carpathian cuirasses are, in contrast to the Western cuirasses, easier to date. The generally accepted date of the hoards from Nadap and Brandgraben is from Bz D/Ha A1 (most recently Uckelmann 2012; Windholz-Konrad 2008). Grave 2 and the cuirass from Čaka date to Bz D, at the latest to the beginning of Ha A1 (Hansen 1994, 12; Paulík 1968). According to the associated finds, the hoard from Ducové dates to Bz D, at the latest to the transition horizon Bz D/Ha A1 (Paulík 1968, 46; Hansen 1994, 12), while the hoard from Winklsaß dates to Ha A1 (Weiss 1998). Also, the hoard from Pázmándfalu has been dated to Ha A1 on the basis of the deposited objects (Szabó 2013, 811). Due to the lack of adequate associated finds, the cuirass from Čierna nad Tisou has to be dated according to the other Carpathian cuirasses, to Bz D-Ha A1. As early as 1966, Bohuslav Novotný (1966, 31) excluded a close connection between Carpathian and Early Hallstatt cuirasses on the basis of the rivetting of the two halves on the left side, which is actually closer to that on the cuirass of Saint-Germain-du-Plain. Being single river finds, the deposition date of the cuirasses from the Danube and Saint-Germain-du-Plain is unclear, although the close connection to the Carpathian cuirasses in terms of decoration applied, physiognomy and construction

suggest a deposition date of Bz D/Ha A1 (the cuirass from the Danube is supposed to be published soon by Petres, Kovács and Jankovits).
However, von Merhart connected the cuirass from Saint-Germain-du-Plain with the Eastern Alpine Hallstatt cuirasses (von Merhart 1954, 52). Today, it is usually interpreted as an Eastern piece deposited in the West of Europe (Paulík 1968, 56. 60; Schauer 1982a, 125; Weiss 1998, 543). Though Louis Bonnamour and Claude Mordant date the cuirass to Ha A2-B1 (Bonnamour/Mordant 1988, 367), and Lothar Sperber even suggests a date at the beginning of Ha B (2011, 24f.), as does Schauer (1982a, 336 fig. 1). We will see in the following analysis that a date of Bz D/Ha A1 (as suggested by Hansen 1994, 12) is far more reasonable.
All Western cuirasses lack datable associations. Nevertheless, according to their decorative elements, they have been frequently dated to Ha B1, which corresponds to the Atlantic Wilburton/Brécy/Hio phase or later. Heiko Steuer, for example, dated the cuirasses from Marmesse to the 9th/8th century BC and assumed that due to their decoration they must be chronologically placed between the cuirass from Saint-Germain-du-Plain and the cuirasses from Fillinges (Steuer 2001, 336f.). Jean-Pierre Mohen assumed that the cuirasses from Marmesse should be dated to the end of the Bronze Age (Mohen 1987). Schauer saw in the chest/nipple decoration of the cuirasses from Fillinges an abstraction of *phalerae*, which are generally dated to Ha B3/C, though some slightly more recent ones are also known. Not concerned by this contradiction, he dated the cuirasses to the late Ha B1, and the deposition date to Ha B2 (Schauer 1982a, 114). This date might be supported by decorative elements on the cuirass from Graye-et-Charnay or Véria A – ribs as well as pellets and bosses potentially indicate a later dating, to the very end of the Urnfield period (*Leisten-Buckel-System* after Jockenhövel 1974, 39).
The cuirasses of Fillinges were first dated by Waldemar Deonna to the 9th-7th centuries BC or 7th-5th centuries BC (Deonna 1934, 93-143). Von Merhart dated the cuirasses, on the basis of the characteristic ornamentation with points-and-studs decoration and waterbird depictions, to a later period of the younger eastern Urnfield period (Ha B1/B2) (von Merhart 1954, 149-171), followed by Müller-Karpe (1962, 255-287). Mottier also followed von Merhart but tended to date the cuirasses to Ha B2 (Mottier 1988, 143). However, as Albrecht Jockenhövel mentioned (1974, 39 note 90), point and stud decoration follows the decoration with bosses/points of equal size, which started in Bz D/Ha A1. In Ha B1, point and stud decoration appeared, in tangent with bird depictions (see e.g. cups type Kirkendrup/Jenišovice, vessels type Hajdúböszörmény and greaves type Kuřim). The fact that only three of the 18 Western cuirasses bear bird depictions might indicate less importance being placed on the bird motif on the cuirasses, or a slightly earlier date (or both).
However, if we have a look at the broader context of the distribution of arms, armour and sheet-metal work and the material exchange in Bz D/Ha A1 compared to Ha B1, we can note an interesting exchange between west and east concerning arms and armour or bronze sheet objects in general. Although the Atlantic Bronze Age is notable for its local production of arms such as swords, the presence of bronze sheet products such as armour, vessels and cauldrons indicate more complex relations and mutual influences between east and west in the 13th and 12th centuries BC. The distribution and chronological development of shields was discussed recently by Marion Uckelmann (2012), vessels and cauldrons by Sabine Gerloff (2010, 106-114) and greaves by Christoph Clausing (2002). Distribution maps and hoard associations certainly demonstrate the usage of a Central or Eastern European/North-Western European trade route, which is more likely than a West Mediterranean/Iberian trade route, as pointed out in detail by Colin Burgess (1991). The only indications for metal armour on the Iberian Peninsula in the Bronze Age and Early Iron Age are fragments of two helmets from the river Huelva, one of a crested helmet, dated to the Ewart Park/Vénat/Monte Sa Idda phase, the other one is of Eastern type, indicating connections with the Eastern Mediterranean in the 7th century BC (Brandherm 2007, 81), as well as depictions of shields (type Herzsprung) on stele (Uckelmann 2012, 62. 166). Moreover, fragments of further crested helmets are known from the hoards of Grañón

(prov. La Rioja/E) and Monte Crasto (distrito Braga/P) (Brandherm 2011, 40). This points, in contrast to weapons such as swords, to a limited armour exchange during Bz D/Ha A1 with the Atlantic Bronze Age. This limited exchange certainly did not improve much during the following centuries.

The Western cuirasses have been found only on the periphery of the Atlantic zone, in the north of the Western Alps, in today's Haute-Savoie and Haute-Marne within a distance of less than 230 km. This key region, as emphasised by other rich hoards such as the one from Blanot (dép. Côte-d'or/F) (Thevenot 1991), was the meeting point of two main trade routes (from west to east) of arms, such as swords type Arco, Monza or Rixheim, and armour such as greaves (Clausing 2002) passing through northern Italy/the Po-Basin or the North Alpine regions. While the trading routes which passed through the North Alpine regions continued overland to the Carpathian Basin and further south-east to the Aegean (as recently noted in relation to cauldrons: Gerloff 2010, 114), the southern trade routes through northern Italy/the Po-Basin could have passed overland to the Carpathian Basin (i. e. greaves) or continue through the Mediterranean (i. e. swords). Cuirasses are rarely found in northern Italy and the northern Alpine region, but were certainly known (see the cuirass miniature from Bad Aussee [Bez. Liezen/A] and the potential cuirass fragment from Winklsaß).

The development of armour is usually associated with the rise of the early *Griffzungenschwerter*, but these show no overlapping distribution area with the Western cuirass finds. Therefore, the connection of certain rod-tanged Bz D/Ha A1 swords, such as type Pépinville, Arco-Terontola, Grigny and St. Ouen, with the Western cuirasses does not seem obvious, but their similar distribution area suggests otherwise. These rod-tanged swords, which were formerly considered to be of alpine origin, are spread exactly in the distribution area of the French cuirasses. Moreover, these swords show now much higher numbers from France, which indicates far more likely an Atlantic development (Matthews forthcoming). However, it is interesting to note that some arms, such as swords type Rosnoën, Arco-Terentola and Pépinville travelled eastwards, even as far as El Kantara (gov. al-Isma'iliyya/ET) (type Pépinville/type Monza after Gerloff 2010, 114; Burgess 1991, 29). Another sword, a hybrid of an Arco-Terentola hilt and eastern blade, was found in Ugarit. It also bears a cartouche of Pharaoh Merneptah (1212-1202 BC) (Burgess 1991, 30). Since these swords are usually found south of the Alps and in northern Italy (associated with other Italian beginning Late Bronze Age bronzes – such as Peschiera daggers or violin bow fibulae), we can hypothesise that trading routes to the eastern Mediterranean via the Mediterranean (Adria?) are more likely. The way of transport – raiders, commerce, mercenaries, invaders or other – might be discussed elsewhere in detail.

In contrast to these swords, armour and sheet metal work (in general) expanded from the Aegean to the Carpathian basin and from there to Western Europe, with the most prominent examples being the cuirass from Saint-Germain-du-Plain, the greaves from Cannes-Écluse II (dép. Seine-et-Marne/F) (Gaucher-Robert 1967) and the earliest Western cauldrons (Gerloff 2010). This is also supported by the lack of armour in pure Atlantic hoards of this period. In the same way as shields (Uckelmann 2012), helmets and early cauldrons (Gerloff 2010), cuirasses might also have been locally produced in Western Europe. This hypothesis is also supported by the close vicinity of find spots of Western cuirasses with the clearly Carpathian cuirass from Saint-Germain-du-Plain in the centre, and the lack of similar cuirasses in the east. According to the similar distribution of certain rod-tanged sword types and cuirasses, it may be that the same trading routes were used to bring the swords east, and the cuirasses (such as the one from Saint-Germain-du-Plain) to the west, resulting in a fast, but locally restricted adaptation of this type of defensive armour. Therefore, it seems likely that French cuirasses are the result of the noted east-west and west-east trading connections and their production should be dated slightly earlier, to Ha A2. This would place them chronologically in closer vicinity to the early metal shields, the greaves from Cannes-Écluse II (Gaucher-Robert 1967, 210) and the Carpathian cuirasses, thus creating a much sounder and well-rounded picture of the arms and armour exchange between east and west.

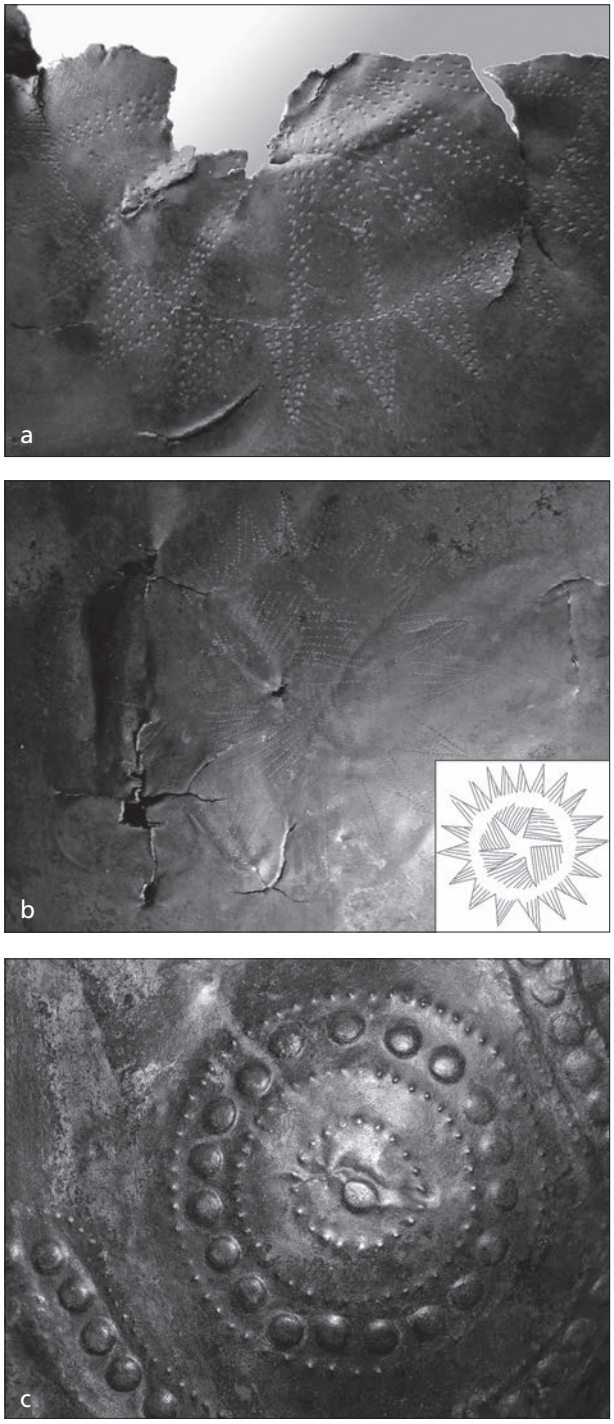

Fig. 21 Chest decoration: **a** Ducové (okr. Piešťany/SK). – **b** Saint-Germain-du-Plain (dép. Saône-et-Loire/F). – **c** Marmesse (dép. Haute-Marne/F). – (a photo M. Mödlinger; b photo M. Uckelmann, by courtesy of the MAN; c photo A. Chauvet/C2RMF, by courtesy of the MAN).

DECORATION

The preserved Greek cuirasses are all undecorated, while depictions of cuirasses (see p. 12 on depictions and mainly Verdelis 1967, 23-29) seem to also indicate applied decoration, combined materials or pure organic jerkins.

The breastplates of Carpathian cuirasses are moderately decorated with convex plastic ribs and fine, dotted concave punched lines (circles, chevrons, chevrons arranged as stars) on the breastplate alone (fig. 21). The ribs increased as *Sicken* (beads) also the stability of the bronze sheet respectively the cuirass. The backplate of the cuirass was widely undecorated. Also the shoulders, as far as we can tell from the level of preservation, are not accentuated. On the backplate the only decoration is usually a pair of plastic, embossed ribs or lines of pellets parallel to the base of the cuirass and the arm opening. The ribs can also be combined with chevrons, as on the cuirass from Saint-Germain-du-Plain (the sole example): a rib following the edges of the breastplate is doubled on the lower rim. At the centre of the lower end, the two ribs form a semi-circle and the area in between is filled with chevrons. Further chevrons are visible in between the ribs under the slightly convex breast, and an upwards-bent semi-circle right beneath it. Directly under the neck, the rib forms a semi-circle again, equivalent to the one at the lower end of the rim of the cuirass. Beneath, engraved chevrons were applied.

On the chest of the cuirasses from Ducové and Saint-Germain-du-Plain, two stars formed by dotted, punched lines of chevrons are visible (fig. 21). Stars could also have been separately attached as round, jagged discs, as on the cuirass from Čaka. Each point of the star-disc from Čaka was rivetted onto the cuirass separately, as on the younger cuirasses from Kleinklein and Stična-Vrhpolje. Furthermore, dotted, punched lines of chevrons are also found on the more recent cuirasses from Kleinklein and Stična-Vrhpolje or on the cuirass from the former »Sammlung Axel Guttmann« (AG 1124; Born/Hansen 2001, pl. VII). The centres of the chevron-stars of the Carpathian cuirasses are always empty. Each of the 12 points/chevrons of the star from Ducové is made of 3-4 slightly dotted lines. The points are surrounded by one big circle which acts as a base for a further 24

chevrons with hatching (the total diameter of the decoration is approximately 5.5 cm). On the side of the fragment, close to the opening for the arm, two convex ribs, which are very close to each other, are visible. They are decorated with a line of dots in the middle of each rib, while on the Čaka fragment pellets are visible between the ribs (Schauer 1982b, fig. 4). The fragment broke on its lower end as well as in the central part of the breastplate. The fact that the breakage was in the shape of a semi-circle indicates an application of a semi-circular décoration. Comparing the Čaka cuirass with the one from Saint-Germain-du-Plain, a decorated (double) rib that followed the outline of the chest seems probable. An additional circle or round decoration, as suggested by Paulík (1968, 48), does not have any parallels on Carpathian cuirasses; however, it is visible on the cuirass from Graye-et-Charnay or Véria A (former Grenoble). Generally, the pectoral muscles of Carpathian cuirasses are outlined with plastic ribs, which connect above the *sternum*. The cuirass from Saint-Germain-du-Plain also exhibits a decorative combination, which includes chevrons.

Paulík, in 1963, added stylised abdominal muscles to his reconstruction of the cuirass of Čaka in order to strengthen its connection with the Dorian cuirasses, which were not considered in earlier publications (Paulík 1963, 324 fig. 43, 1). The edges of the cuirass were not bent around a wire (as for Saint-Germain-du-Plain, Čierna nad Tisou, Brno, Winklsaß, Nadap) but the rim was strengthened with decorative, rivetted on jagged bronze sheets (as also for Pázmándfalu).

In comparison to the Carpathian cuirasses, the Western cuirasses are extensively decorated with lines and circles of positive bosses and studs on both breast- and backplate. Three cuirasses (Graye-et-Charnay or Véria B, Fillinges inv. nos 14.059 and 14.060) are additionally decorated with heads of waterbirds. On the basis of decoration, we can distinguish three sub-groups of Western cuirasses:

1. Fillinges and the cuirass in the Metropolitan Museum
2. Marmesse
3. Graye-et-Charnay or Véria and the cuirass in Hamburg

Lines and circles of different-sized bosses, as found on the Western cuirasses, are also common decorative elements on cups (type Kirkendrup/Jeníšovice), vessels (type Hajdúböszörmény) and amphorae (type Mariesminde) (Jockenhövel 1974; Wirth 2006a). However, the bird heads are arranged differently, most noticeably on the two cuirasses from Fillinges; the double embossed lines abstracting the chest are not completely closed, but open on the upper sides towards the armpits. The bird heads are either a prolongation of the circles and located on top of them (inv. no. 14.059) or »sitting« at the top of the outer circle (inv. no. 14.060). These birds are not connected with each other and, moreover, are separated from the motifs, which they usually accompany: suns, wheels, embossed rings (*Ringbuckel*) and boats. Schauer did not note any parallels for these »strange« bird depictions of the two cuirasses from Fillinges (Schauer 1982a, 110). However, further examples of isolated, but severely abstracted bird heads have been found on greaves from Desmontà (prov. Verona/I), Malpensa (prov. Varese/I) or Poljanci I (Brodsko-posavska županija/HR) (Bz D/Ha A1; see Clausing 2002). Similar bird decorations, like those found on the cuirass from Graye-et-Charnay or Véria B, are well-known from the crested helmets from the Cave of Flies in Škocjan (občina Divača/SLO) (Hencken 1971, fig. 92). Here, the bird heads are also an elongation of the decorative band, without further motifs such as suns, boats, embossed rings (*Ringbuckel*) or wheels. Nevertheless, the two central birds facing each other have a bigger boss in between them, as can be noted on the bronze bucket from Nyírlugos (Kom. Szabolcs-Szatmár-Bereg/H) or the Vienna situla (Wirth 2006b).

All cuirasses from Fillinges and their fragments, as well as the cuirass from the Metropolitan Museum, bear the same type of decoration: above the lower rim of the cuirass, a parallel line of bigger bosses is surrounded below and above by a line of small points. About 10 cm above, two horizontal lines of small points are visible, embracing two horizontal lines with bigger bosses, in between a band with diagonal lines, and confined by one horizontal line above and below. From these horizontal lines, vertical bundles of lines (al-

ternating lines of bigger bosses and bands with diagonal lines) spread upwards in the direction of the neck. Some of them are stopped by the chest decoration: the nipples are indicated by two lines of embossed circles with little points, and in the centre of each is a bigger boss. On two cuirasses (inv. nos 14.059 and 14.060) the circles are open and end in duck heads. A central boss above a bundle of horizontal lines indicates the navel. The backplate is decorated in a similar way to the breastplate, but the negative embossed spine passes in between the bundle of horizontal lines, dividing it into two (the decoration is discussed in detail by Schauer 1982a, 103-112).

All cuirasses from Marmesse are waisted. On both plates, the points and stud decoration follows the rim of the two plates, and there are doubled decoration lines on the lower end. The slightly convex chest is marked with two circles and a bigger boss in the middle of each circle. Under the chest, two semi-circles with dotted lines are parallel to the chest circles, in between which bigger bosses are applied. The only differences between the cuirasses are short vertical and horizontal lines underneath the semi-circles under the chest and in the centre of the cuirass: all but one have one horizontal line with three bosses and a parallel lower line with five bosses (inv. no. 83.756 has an additional line). Four cuirasses (inv. no. 83.753-56) have two short vertical lines under the semi-circles, consisting of three bosses each.

In contrast to the breastplates, the backplates exhibit small, but important, differences: the number of lines pointing upwards from the opening of the arm to the negative impressed spine is different. The cuirasses, inv. nos 83.753-83.755, have four thin embossed lines above one »massive« line on the bottom, with bigger bosses. The cuirass inv. no. 83.756 has one more line and (as on the breastplate) a third central horizontal line consisting of seven bosses. Cuirass FZ 32.691, however, exhibits three massive ribs with big bosses and, instead of just the small central horizontal lines of bosses, it also has a line of big bosses all along the backplate.

Though obviously found together, the decoration of the two cuirasses from Graye-et-Charnay or Véria differs considerably. There are, aside from the horizontal bands of small and large bosses around the waist, and circles abstracting the chest and nipples, no further similarities with the cuirasses from Marmesse or Fillinges. The cuirass from Graye-et-Charnay B is decorated in *horror vacui*: below the horizontal decoration at the waist, both breast- and backplate are covered extensively with vertical lines of bigger bosses. On the backplate, these lines can also be found almost up to the neck. Right under the neck, two heads of waterbirds, which are turned towards the centre of the backplate and look at each other, are visible. Each of the waterbirds has a circle with a central boss behind them, similar to the chest of the cuirasses from Marmesse. In comparison, the circles on the breastplate of the cuirass from Graye-et-Charnay B each consist of eight lines of small (or tiny) bosses with a central bigger boss. These circles are surrounded by a loop-shaped line, which spreads from the shoulder. Below the two chest circles, four heads of waterbirds are visible, facing each other; the inner two birds are touching each other with the peak. In between the birds, bigger bosses were placed. The breastplate from the cuirass from Graye-et-Charnay A is accented with nine circles, two of them above the chest of the warrior, each one on the two sides, and one between them – each with three pointed lines and a bigger central boss. Two smaller circles (two pointed lines and a bigger central boss) can be seen in the centre of the lower area of the breastplate, and two further circles of the same size under the two waistlines of bigger bosses. Similar circles (with or without the central bigger boss) are visible on the Carpathian cuirasses and other defensive armour such as helmets (type Pass Lueg), demonstrating the close connection between different types of armour. On each side, three vertical lines of bigger bosses can be seen under the two waistlines. The pectoral muscles are heavily abstracted by a line of bigger bosses; circles, which indicate the chest/nipples, are surrounded by a semi-circle. The rim of the cuirass on the upper half is decorated with a parallel row of bigger bosses. The backplate is decorated in a similar way to the breastplate, but has only three circles above the two waistlines of bigger bosses, and only one central, double-circle at the bottom of the backplate.

The cuirass with an unknown find spot, now held at the Museum für Kunst und Gewerbe Hamburg, is unique: not only the different shape (it is severely waisted, without becoming wider at the base), but also the decoration is different. Three horizontal lines around the waist separate the lower part, decorated with four vertical lines of little bosses and one central horizontal line of little bosses, from the upper part. The upper part is decorated with three circles, of which the outer ones consist of four lines (two outer lines with bigger bosses, two inner lines with smaller bosses) and the central inner circle consists of three lines (the outer line with bigger bosses, the inner lines with smaller bosses). All three circles have a central, bigger boss.
Mottier assumed there must have been at least three workshop traditions (Mottier 1988, 142 f.). The first produced the cuirasses from the Metropolitan Museum and Fillinges, maybe also the type Hajdúböszörmény-Unterglauheim vessels and similar types with bird depictions, and used points-and-stud-techniques. The second workshop may have produced the cuirasses from Graye-et-Charnay or Véria and Hamburg. Mottier locates the production site in eastern France, towards the western Alps (in opposition to Michel and Mohen, who argued that the production site should be close to Naples on the basis of decoration, a conclusion which resulted because to the false find spot, Naples; see Michel/Mohen 1970). However, this type of decoration is not really typical for Italy, and, as recently discovered, the cuirass thought to originate in Naples was actually found in Graye-et-Charnay or Véria (Descamps 2005, 100 no. 92). The third production site is supposed to be located at Marmesse, or close to it (Mottier 1988, 143).

OTHER POTENTIAL CUIRASSES

During the excavations in a tholos tomb at Nichoria 117 fragment of bronze plates dated to around LH IIIA-LH IIIB2 (c. 1370-1250 BC) were found (McDonald/Wilkie 1992). These fragments might belong to segmental armour. Some fragments have rolled edges and small, punched holes of 1-2 mm diameter and are spaced 1.5 cm away from each other along the rim (in order to attach an organic lining). Other fragments have slightly larger holes further away from the rim. Heavy bronze wires found in the grave might have been used as loops to join together the breast- and backplate. Four staples from the grave's floor may also belong to the armour. Three staples contain bronze sheets (each approx. 4.5 cm × 3 cm) of the same thickness as the body armour. The bronze sheets are plain, concave or convex; another fragment – a throat guard, perhaps – has a rolled edge. Most of the fragments have small holes for the application of an organic lining, while some have larger holes for attaching the plates to each other. Four fragments are still attached to the staples. Chamber Tomb 15 from Mycenae, dated to LH IIIA/B1 (1350-1300 BC), provided two fragments of bronze sheets (6-8 cm length). Along the rim they have a row of small holes, most likely for fixing the organic lining. According to Verdelis, it is likely that they belong to the lower parts of a panoply similar to that from Dendra (Verdelis 1967, 22). The late Mycenaean chamber tomb »Tomb A« was discovered by a farmer in Kallithea in 1953. The finds are now preserved in the Archaeological Museum of Patras. The bones of a (presumably) male person were reburied in a small pit in the back of the tomb. The second burial, another male, was buried in the shaft grave, which originally belonged to the first burial. The main finds are ceramics, mainly oinochoe, a Naue II sword, a spearhead and fragments of two greaves, which were lying on the legs of the second burial. Some bronze sheet fragments were also found. These are flat, but on the edges they have convex ribs. They are all without any original edge or rivet holes. All the fragments are slightly bent in a longitudinal direction. Most of them consist of a sheet with two ribs (or perhaps more) on each side. In the middle, nails were driven through, almost to the point of touching each other. The nails still seem to be straight and unbent (Yalouris 1960, suppl. 29 figs 1-2). In the same way as the fragments from Kallithea, the

Fig. 22 The fragments from the hoard of Szentgáloskér (Kom. Somogy/H), which are usually interpreted as belonging to a cuirass. – (Photos M. Mödlinger).

fragments from Lakkithra (periféria Ionion nision/GR) (Grave Δ) and, perhaps, the cuirass-fragments from Tiryns, were interpreted as parts of bronze or organic cuirasses (Paulík 1968, 54 fig. 8, 1; Schauer 1982a, 126 f.). Hector William Catling interpreted the fragments from Kallithea as a precursor of the Fillinges cuirasses (Schauer 1982c, 344), while Clausing doubted this, and noted that there are no parallels between these fragments (Clausing 1996, 429 note 31). In general, the Central European finds have been used as a base for the interpretation of the fragments as parts of a leather cuirass. These were then reinterpreted as parts of a leather cuirass in accordance with the finds from Kallithea (cf. Hansen 1994, 12) – a fatally circular argument. With more recent finds, the discussion of the potential fragments of a cuirass from Kallithea can finally come to an end. The fragments preserved are strips (24/27/17 cm × 2.2/3 cm), which are decorated with double ridges on either edge. These fragments, however, do not resemble any known type of cuirass, but they are similar to the bronze band fragments and bosses from Lakkithra Cephalonia, which have been interpreted as remnants of a mostly organic tiara-like helmet, on which metal bands and nails would have been applied. A more illustrative example of a similar helmet is the one found in the tholos-grave at Praisos-Foutoula, which is dated to c. 1200 BC (Deger-Jalkotzy 2006, 714). The bucket-shaped, cylindrical helmet is decorated with alternating single, horizontal ribs of rows and ornamental rivets. Another, similar helmet was found in a grave in Portes-Kephalovryson (district Limassol/CY) and was dated to around 1200-1100 BC (Moschos 2009, figs 1-2). The 16 cm high helmet has a cylindrical shape with an oval section and straight sides. It is decorated with bronze strips, consisting of horizontal ribs alternating with horizontal lines of ornamental rivets. Both ends of the helmet bear wider bronze bands with relief ridges at the edges. The 16 strips and the rivets were fixed on an inside headgear made of tightly knitted straw (Kolonas 2001, 260; Papadopoulos 1999, pl. LIXb). The Kallithea fragments are very similar to these tiara-like helmets, and thus we can exclude their interpretation of cuirass fragments.

Four small, rather thin bronze sheets of 0.2 mm thickness, from the deposit of Szentgáloskér (Kom. Somogy/H) have generally been interpreted as fragments of a cuirass (i. e. Moszolics 1985, 195; Paulík 1968, 50) (**fig. 22**). On one side, the bigger fragment has a small, thin bronze band, which is decorated along the edge with a row of small, embossed pellets that have been attached onto the main sheet with tiny, delicate, round headed rivets. It is possible to note that on the back of the fragment the bronze band is not rivetted onto the fragment all the way along, but overlaps with the straight-edged fragment, forming a bow. We might question, which other bronze sheet it would have been rivetted on in this area. Unlike the bronze band, the fragment has an embossed rib (width: 7 mm), which is parallel to the edge of the fragment on which the bronze band was rivetted. This embossed rib, together with the narrow width and the bronze band, which

was not completely rivetted, are the main arguments why this fragment, most likely, does not belong to a cuirass. If the fragment belonged to a cuirass, this rib (in drawings it is never visible, but is clearly identifiable in Mozsolics 1985, pl. 115, 6. 9) would be found placed vertically above the collarbone or, assuming the fragment is from the neck, horizontally above the collarbone. Both interpretations do not seem likely. Furthermore, bronze bands rivetted on other Carpathian cuirasses are significantly thicker, the rivets are much larger and the bronze band is pointed on the inner side as well as being attached parallel to the cuirass' rim. In the summer of 1911, foresters cutting trees found more than 100 single pieces of bronze in the forest around 1300 m north of Winklsaß. The deposit was stored 30-40 cm deep in the earth and covered with 35 bronze ingots. The hoard contained pins, necklaces, arm-rings, foot-rings, belt-hooks, parts of fibulae, a piece of a sword blade, four fragments of spearheads, seven fragments of axes, one complete sickle and 36 sickle fragments, a razor, fragments of knives and daggers, one ingot and ten bronze sheets belonging to a cauldron or bucket (Gerloff 2010, 193). The person who discovered the hoard was certain that he had found pure gold (a good indication for the low amount of patina on the bronzes) and sold it to the *Historischer Verein für Niederbayern*, who finally sold it on to the museum in Landshut. The bronze sheet, which possibly belongs to a cuirass, was folded twice, and unfolded during the restoration process (Weiss 1998, 537 f. fig. 2), during which it broke into three pieces (**fig. 13**). The lower end is bent around a bronze wire, which is 3 mm thick and partially heavily notched to prevent a firmer grip. On the right side, a big, convex decorative rivet is visible. Above the rivet, two torn-out rivet holes at the same height are visible (probably the residue of antique restoration: see Weiss 1998, 538). On the inside of the sheet, several vertical traces from the peen/hammer are visible. During the first restoration, which was obviously quite crude, the three pieces were rivetted on a modern brass or bronze sheet, and the separate parts were hammered flat. Usually, this fragment has been interpreted as a part of a bigger vessel (Holste 1936, 2. 14); Müller-Karpe was doubtful, but did not make any alternative suggestion (Müller-Karpe 1959, 285). Schauer noted that it might be a fragment of a cuirass, but did not mention it in any further publications or distribution maps of Bronze Age cuirasses (Schauer 1982b, 134). However, the wire at the lower end, which is surrounded by the metal sheet, and the thickness of the latter strengthen its classification as a cuirass. Also, the two lines of pellets exhibit parallels with the Carpathian cuirasses. According to Rainer-Maria Weiss, the decoration and composition of the cuirass and greave are so close to each other that it seems reasonable to assume they were part of the same set of armour (Weiss 1998, 545, note 82). In that case, the three spearheads as well as the fragment of the sword blade might also have been part of the armament. However, if we also include the other finds from the deposit, there is a correspondence with the equipment of the Čaka-grave. This also provides evidence for the reason behind the deposition – a scrap-metal deposition by a merchant is not completely convincing. A ritual deposition of the possessions of one high-ranked person seems to be more likely, according to *pars pro toto* and the choice of equipment, which is more reminiscent of burial objects (for more details about the so-called grave deposits, see Schütz-Tillmann 1997, 21-25 and Rittershofer 1983, 343 note 1058). Von Merhart noted that he had seen a complete cuirass once, while visiting the antiques shop David Reiling in Mainz in 1928 (von Merhart 1969, 153 note 4). It could not have been the cuirass kept at the Metropolitan Museum because this was bought by the museum 19 years before. However, it appears to be very similar to the finds from Fillinges; von Merhart assumed it might belong to the same ensemble. Also, Schauer was not always clear either. He mentioned a fragment of a possible cuirass from the deposit of Cannes-Écluse (Schauer 1982a, fig. 1, 7; Schauer 1982b, 122. 133) but did not describe it explicitly or refer to a drawing of the fragment he was discussing (it is likely that he meant the fragments described by Gerloff 2010, no. 28). Furthermore, he noted, along with Michael Rind, 16 possible fragments with rivets from Abensberg (Lkr. Kelheim/D), which might belong to cuirasses (Rind/Schauer 1997, 118 fig. 64, 1-16). However, the find circumstances are insecure (illegal find with metal detector) as are other finds which may

have been used for comparison, e. g. from Welzelach (Bez. Lienz/A) or Challans (dép. Vendée/F) as noted by the authors. Two bent, deformed and probably fire-exposed bronze sheet fragments, found in the grave from Farkasgyepű (Kom. Veszprém/H) (Veszprémi Bakonyi Múzeum, inv. no. 1955.117.8-9), were described by Katalin Jankovits as fragments of a cuirass (Jankovits 1999/2000, 195; 1992, 37. 70 f. fig. 30). On one side, the sheets have rivet holes parallel to the edge. Beneath the rivet holes, another small bronze sheet was attached with three rivets. However, their form and thin cross-section of 0.1-0.2 mm alone do not support their classification as fragments of a cuirass.

Three fragments from the Ha B1-deposit from Pfeffingen (Zollernalbkeis/D) are decorated with ribs and bosses and one side is bent around a bronze or copper wire. These have also been interpreted as parts of a cuirass (Sperber 2011, 24; Stein 1979, 118 f. pl. 94, 6; Seidl 1995, 108). However, two holes right above the bent rim seem to be quite unusual for a cuirass.

Novotný noted the discovery of a possible cuirass fragment from Šulekovo (okr. Hlohovec/SK), which was found along with a bronze sword and other objects in a grave before 1880 (Novotný 1966, 33). The finds cannot be located in the museum today (as noted by Novotný in 1966).

When the hoards from Podcrkavlje (Brodsko-posavska županija/HR) (found in 1962 at »Dvorišta«) and Slavonski Brod (Brodsko-posavska županija/HR) (found at »Biliš«) were brought to the Archaeological Museum of Zagreb in 1868, they were probably mixed together. The hoard consists of 277 objects, as well as a fragment of a cuirass or shield (inv. no. 3729; 3730; Holste 1951, 6 pl. 8, 29): arm rings, buttons, discs, pins, fibulae, bronze sheets, fittings, pendants, wire, fragments of swords (type Brodski Varoš), spearheads, daggers, socketed axes, knives, razors, saws, sickles and raw bronze (Vinski-Gasparini 1973, 217 pl. 66-68). The hoard is dated to Period II after Vinski-Gasparini (1973, 217).

The 7.3 kg deposit from Pila del Brancón (prov. Verona/I) was found during agricultural work 1.5 km to the south of the Middle Bronze Age cemetery of Olmo in 1993, and is now stored by the Sopraintendenza di Verona; the deposit was first published by Luciano Salzani (1994; 1998). It may be possible that the deposit has not yet been completely recorded. Currently, it consists of 51 spearheads and fragments, 12 swords and fragments (type Allerona, Cetona und Arco), two daggers (type Santa Agata and Pertosa), one fragment of a winged axe, 73 bronze sheet fragments (thinner fragments thought to belong to defensive armour and thicker fragments of vessels type Kurd) and nails. All objects were intentionally destroyed, bent or broken and exposed to fire (Jankovits 1999/2000, 189). The objects in the deposit date to the phases Bronzo Medio, Recente and Finale; Jankovits suggested a date of Bz D-Ha A1 obviously to connect the deposit with the find from Čaka (Jankovits 1999/2000, 189). Furthermore, she reconstructed a bell corselet with the bronze sheets (mainly inv.no. IG VR 266.650 and IG VR 26.603); in the author's opinion, the evidence is too poor to go that far and the fragments are too inhomogeneous. Also, the rivets are too long for the metal sheets alone, and thus they must have been fixed onto an organic backing on the inside as well.

In the debris cone in front of the cave Plérimond (dép. Var/F) the fragment of a cuirass (according to Schauer), a pair of greaves, a third single greave, a horse harness, *phalerae*, spear-heads, a Certosa-fibula and more artefacts were found (Schauer 1982a, 130 note 122). The fragment from the Heunischenburg, which was thought to be a fragment of another cuirass (Weiss 1998, 545 fig. 7, 1), might be a fragment from a vessel – the French cuirasses do not usually have three parallel lines of big bosses, but rather two. If there are three lines, they are separated from each other by decoration such as a line of pellets – and the lines are further away from each other.

Schauer noted a further potential fragment of a cuirass from Grésine (dép. Savoie/F) (Schauer 1982a, 129 fig. 13; after Deonna 1934). However, since no cuirass with similar decoration is known, with the so-called *Ringbuckel* and the semicircular bent bands of points and bosses, this fragment might belong to a vessel or another object.

Fig. 23 Detail of the panoply from Dendra (periféria Peloponnisou / GR). – Note the still preserved leather bands. – (Photo A. Salimbeti / R. d'Amato, by courtesy of the Nauplion Museum).

CONSTRUCTION OF CUIRASSES

The diverse principles of construction and assemblage (**figs 23-26**) of the different parts of the panoplies or cuirasses are consistent with the varying distribution, chronology and decoration of the main groups of cuirasses: Greek, Carpathian, and Western European. The construction principles of the different cuirasses will now be described briefly. Due to the state of preservation, their primary presence as fragment(s) and publication restrictions (e. g. the cuirass from the Danube; see forthcoming publication by Petres, Kovács and Jankovits) only the Carpathian cuirasses from Saint-Germain-du-Plain and Čierna nad Tisou can be discussed.

The construction of the Dendra panoply was already described in detail by Verdelis (1967, 8-18) and does not need to be repeated in detail again. The panoply consists of 15 bronze pieces:

1. One breastplate and one backplate,
2. two shoulder protectors which both have an additional metal sheet to protect the upper arm,
3. two triangular metal sheets placed over the breastplate to protect the chest,
4. the neck guard,
5. each of the three bronze bands of the front and back is attached to the breast- respectively backplate at the lower end.

Every metal sheet has small holes of approx. 2 mm diameter every 2-2.5 cm all along the rim; these were used to attach leather lining, as threads within the holes and remnants of leather inside the breast- and backplates indicate (Verdelis 1967, 8) (**fig. 23**). The leather lining was bent around the metal edge and fixed on both the outside and the inside. Additionally, the edge of the metal sheets was partly protected by an 8 mm wide metal band, when the edges were not bent outside.

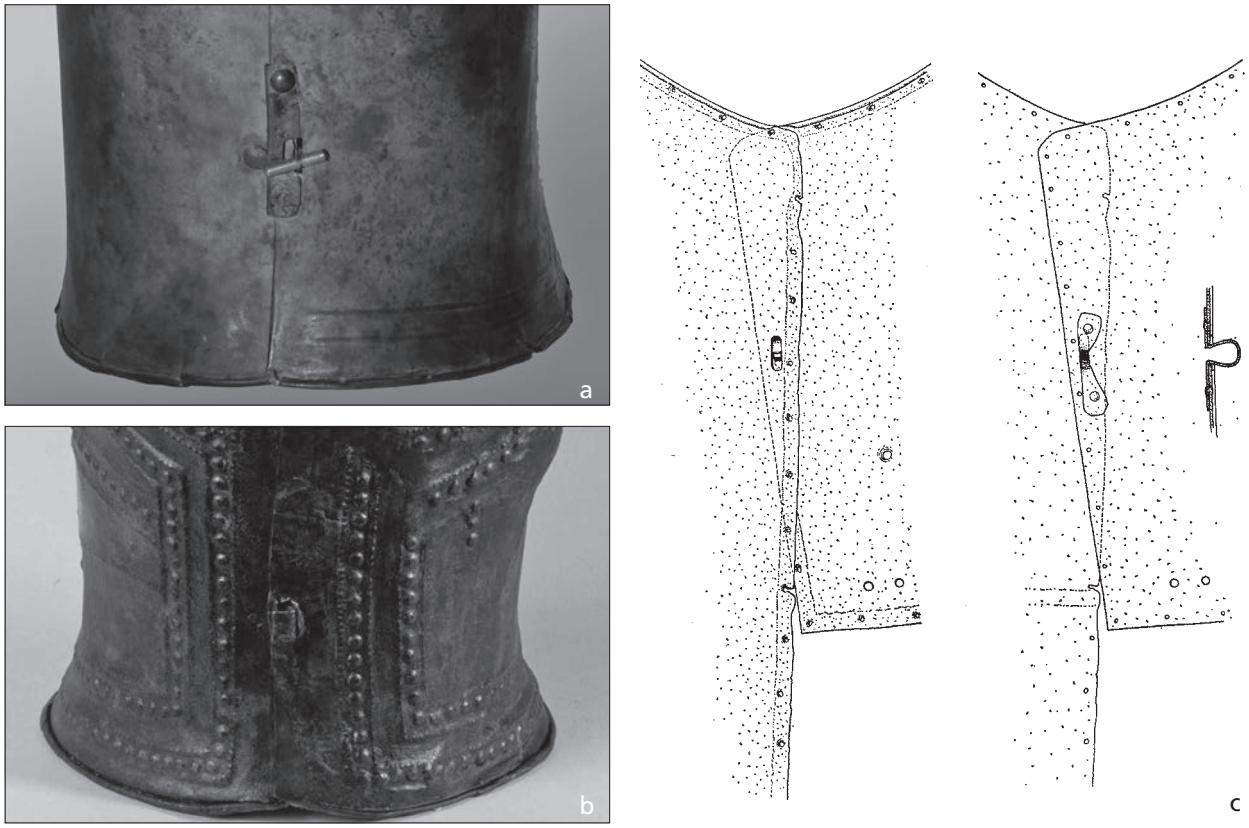

Fig. 24 Different ways of fixing the breast- and backplate together on the right side: **a** Saint-Germain-du-Plain (dép. Saône-et-Loire/F). – **b** Marmesse (dép. Haute-Marne/F). – **c** Dendra (periféria Peloponnisou/GR). – (a photo M. Uckelmann, by courtesy of the MAN; b photo A. Chauvet/C2RMF, by courtesy of the MAN; c after Verdelis 1967, fig. 4).

The breastplate (41 cm high, 46 cm wide) and the longer backplate (52 cm high, 55 cm wide) are joined together at the shoulder by a loop rivetted on the breastplate, which passed through a rectangular hole on the backplate and was then fixed in place by passing a nail through the loop (**fig. 25**). At the sides, the backplate overlaps the breastplate by at least 3 cm to ease the fastening. On the left side a metal bar fixed on the backplate, which reaches from the armpits to the pelvis, holds the plates together. It is possible to insert the bar into a range of three rings, which are attached on the breastplate (Verdelis 1967, fig. 5). Therefore, the cuirass was flexible on the left side and could be closed on the right side, using the same system as on the shoulders (one loop passed through a hole on the backplate and was then fixed with a nail).

The shoulder plates are slightly bent outwards from the body of the warrior; where the protective bands for the upper arm were fixed, the edges of the shoulder plates remained straight. A metal ring, of 1.2 cm diameter, is rivetted onto the top of the right shoulder plate. It might have served to fasten a strap for a sword or shield. It seems as if the shoulder plates were fixed on the breastplate only, since bigger holes are missing on the backplate. The armplates (54 cm × 8 cm [right side] and 47.5 cm × 8 cm [left side]) were attached to the shoulderplates with threads, which would have passed through five holes on each side. They widen in the centre and at the end in a rather pointed shape. The rim near to the arms is bent outwards, while the rim towards the shoulder plates is straight. The two triangular breastplates (9 cm × 18 cm) were attached to the shoulder plates by rings passing through three pairs of holes on each plate (Verdelis 1967, 16). The neck protector (height 8-15 cm; diameter at the top 28.5 cm; base diameter 21 cm × 24 cm) is formed by

a bronze band, the ends of which were rivetted together. The upper and lower end of the protector is bent outside in order to reduce the risk of slitting the neck and increase the mobility of the head. It seems as if it was not fixed with leather strips to the breast- and backplate since suitable holes are not present; obviously it was clipped over the bent rims of the two plates. The upper bronze sheet bands were attached to the breast- and backplates with threads or strips, since they do not always match perfectly on both sides. These would pass through three pairs of holes with diameters of about 4 mm on the lower part of the breast- and backplates on the left, the right and in the middle. In a similar way, the bands are joined together. A remnant of a leather band or strip, which held the bronze sheet bands together is still preserved (**fig. 23**). The sheet bands measure between 64-76.5 cm × 15-17.3 cm with the wider bands placed towards the bottom of the panoply.

The cuirass from the Arsenal at Thebes consists of similar elements as the Dendra panoply (Verdelis 1967, 21 f.), but the breast- and backplate are of equal length. Also, the edges of the corselet, shoulder guards and arm guards are plain, not rolled. Aside from the corselet, the cuirass or smaller panoply consists of: two shoulder pieces (13.6 cm × 21.5 cm and 14 cm × 19.5 cm), two triangular breastplates (length 27.7 cm) and two arm plates (length 40 cm). The shoulder plates are slightly smaller than the ones from the Dendra panoply and do not have the wide »wings« which cover the Dendra cuirass at the chest and back. The two breastplates have a series of small holes (approx. 2 mm in diameter) all along the edges. This might indicate that they were parts of organic armour, which was reinforced with bronze plates. The two upper arm protectors were attached to the shoulder guards. Also, these parts bear a row of small holes along the edges, for fixing organic parts onto the bronze sheets. Additionally, they have bigger holes of 3-4 mm diameter for joining the bronze plates together. A further 44 fragments of several band sheets, all with a row of 2 mm-holes along the edge, are preserved as well. These band sheets are significantly smaller than the ones from the Dendra panoply. The larger fragments also have bigger holes, as on the two upper arm plates. These fragments most likely belong to belts fastened on the cuirass, which would have protected the lower parts of the body (Andrikou 2007, 402). We have to consider the possibility that all these fragments do not necessarily belong to one panoply, but might also be different parts of more than one panoply.

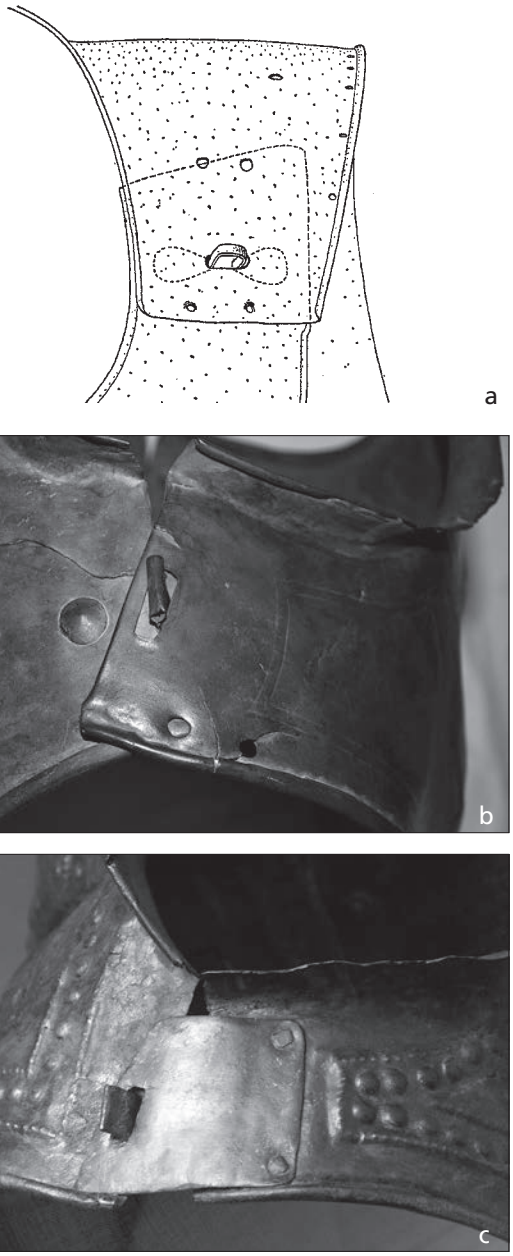

Fig. 25 Different ways of joining breast- and backplate on the right shoulder: **a** Dendra (periféria Peloponnisou/GR). – **b** Saint-Germain-du-Plain (dép. Saône-et-Loire/F). – **c** Marmesse (dép. Haute-Marne/F). – (a after Verdelis 1967, fig. 3; b photo M. Uckelmann, by courtesy of the MAN; c Photo A. Chauvet/C2RMF, by courtesy of the MAN).

Fig. 26 Inside view of the left side of two cuirasses: **a** Marmesse (dép. Haute-Marne/F) inv. no. 83.757. – **b** Čierna nad Tisou (okr. Trebišov/SK). – Note the lining discs used for both cuirasses. – (a Photo A. Chauvet/C2RMF, by courtesy of the MAN; b Photo M. Mödlinger).

The cuirass from the Municipal Conference Centre plot in Thebes is constructed in a similar way to the Dendra panoply: the breast and longer backplate are fastened by two double-headed nails on the left side, while on the right side there is a rivetted loop on the breastplate, which would have been passed through an elongated hole in the backplate; thus the two plates would have been fixed together once the corselet was on. All along the edges of the corselet are small holes, indicating the attachment of an organic lining, and bigger holes in pairs or triads along the lower edge for attaching the bronze sheet bands below the corselet. The fragment of a shoulder guard and one (triangular?) breastplate strengthens its close connection to the Dendra panoply, even though the edges of the corselet are not rolled (Andrikou 2007, 402).

The two plates of the cuirass from Saint-Germain-du-Plain were joined together by four conical headed rivets on the left side (one of them is missing), and one rivet on the left shoulder, which is also missing. The rivet holes were punched through from the outside to the inside. On the right shoulder, the breastplate has a rectangular hole to allow the wearer to grab the upwards-bent metal sheet, which is attached to the inside of the backplate, with a conical headed rivet. In this way, the two plates could be joined together (**fig. 25**). On the right side, a metal sheet was rivetted centrally, at the edge of the breastplate, with two conical headed rivets, one of which is lost today. In the centre of this sheet (in the same manner as the breastplate) a rectangular hole was made. A bronze sheet formed as a loop passed through the hole in order to fix the two halves together with passing a dowel through the loop (**fig. 24**). The bronze loop made of

a bronze sheet band was rivetted onto the backplate with a slightly conical headed rivet. The inside rim at the side and shoulder of the back part was also folded on the right side. There is an additional rivet hole on the breastplate right under the armpit, the function of which is not yet clear; it might have been used for a cord which fixed the dowel in place. It has no equivalent on the other side. Inside the neck and the body of the cuirass, vertical hammering traces are visible. The metal also has several vertical cracks, most likely a result of the hammering process.

The decoration of the cuirass was applied with repoussé (ribs) and chasing (chevrons) on the breastplate. The backplate remained undecorated. The ribs were marked out and their edges accented with a chisel on the front side of the breastplate. The rim around the arms, neck and base of the two plates was bent over a wire made of rolled bronze or copper sheet.

The backplate of the cuirass from Čierna nad Tisou was fastened onto the breastplate with four conical headed rivets on the left side. Aside from a few fragments around the rivets, nothing of the breastplate remains. We can note one complete lining disc and remnants of other rectangular lining discs attached on the inside of the cuirass, improving the quality of the rivetting (**fig. 26**). Since no original edge of this exemplar is preserved, it remains unclear if the rim was rolled, bent or reinforced with rivetted metal bands. However, as the cross-section indicates, a rolled rim seems most likely. On the inside of the backplate, hammering traces can be found on the left side and in the centre. Slight vertical hammering traces can also be found on the outside of the cuirass. The decoration of this example consists of just two ribs parallel to the base and the armpits. The approx. 4 mm wide ribs were applied from the back (repoussé) and their outline defined with a chisel (chasing).

Due to the high level of fragmentation, the construction of most of the Carpathian cuirasses cannot be reconstructed, nor was it possible to detect specific traces of manufacture. The fragment from the cuirass from Nadap was bent around a bronze or copper wire, while the fragment from the cuirass from Brno was rolled around a wire with a much wider diameter; however, no wire remained. The decoration of both fragments consists of two ribs parallel to the rolled edge. The decoration was applied using the repoussé technique on both samples, and only the fragment from Brno has a defined outline of the decoration, which was applied with a chisel on the outside of the cuirass (as on the cuirass from Saint-Germain-du-Plain). On the outside of the fragment, vertical polishing traces are visible, while on the inside, horizontal hammering traces can be noted.

It is not possible to examine the construction of the cuirass from Ducové in great detail; however, the decoration on the chest was applied with the edge of a chisel on the outside of the breastplate while the two ribs were applied from the inside (repoussé) and their outline defined with a chisel (chasing). Additionally, small pellet decoration was applied from the back inside the ribs.

The fragments from Čaka allow for the reconstruction of edge reinforcement: the application of rivetted bronze bands with a serrated edge, the points directed to the centre of the cuirass. It should be noted that on all fragments with edge reinforcement, no indications of fixing the breast- and backplates together are visible (rivet holes, opening for the bronze loop on the right side, etc.). However, the bronze bands are additionally decorated with lines of little pellets, which were applied from the inner side of the cuirass. Two star-like, serrated discs were rivetted onto the breastplate above the nipples. The rivets were attached at every point, but not in the centre (Jockenhövel 1971, pl. 60, 48). Parallel to the armpit, two ribs were applied using the repoussé technique. An interesting observation is that the rim of the fragments with the decorative bronze band is straight; in comparison, on the fragments with one parallel rib the rim is rolled outwards. Since one of the rim fragments with the decorative band is from the edge of the bronze plate, it seems rather unlikely that the edge was suddenly bent outwards. The fragment with the rib is straight and unbent, and thus it cannot derive from the opening for the arms (for a comparison see also the fragments

from Pázmándfalu: the rim of the plates around the arms was decorated with a serrated bronze sheet). Therefore, it seems rather unlikely that the three fragments with the rib belong to the same object. Also, the rib on these fragments is bigger than the ribs on the breastplate, while on the cuirass from Saint-Germain-du-Plain all ribs are the same size. Compared with the fragments from Pázmándfalu, we can note that the serrated, bronze sheet decoration is not found on the left side, where breast- and backplate were joined together. It therefore seems reasonable to assume that the rectangular fragment with the decorative bronze band derives either from the right lower edge of the breastplate (on the backplate the decoration would not be visible, since the backplate was usually fixed underneath the breastplate) or from the shoulder/neck area of the breastplate.

The line of little holes all along the edge of the fragments with rolled rim and parallel rib do not derive from fixing the decorative band with a serrated edge; otherwise, there would be another line of holes above. It seems more likely that the holes served for attaching an inner lining (as we know it from the Greek cuirasses), if these fragments were ever part of the cuirass.

The fragments of the most recent cuirass find from Pázmándfalu resemble the Čaka find (Szabó in press). In comparison to the Čaka find, however, the decorative band with serrated side was attached with one line of rivets only. Unfortunately no central parts remain apart from fragments from the rim of the breast- and backplates. These have two ribs parallel to the armpits and the base of the cuirass, which were applied with repoussé and chasing. Breast and backplate were fastened together with slightly conical headed rivets; the rivet holes were punched through from the inside to the outside. The reinforced metal sheet bands with a serrated edge were rivetted on the breastplate (and perhaps the backplate?). Two different sizes of these sheets can be noted: the bigger sheets were most likely applied on the base of the cuirass, while the thinner bands served as reinforcement at the armpits and eventually on the shoulders, as the rectangular fragment with a rivetted decorative band indicates.

The construction and assembly of the cuirasses of Fillinges was already described in detail by Mottier (1988) and Schauer (1978). In order to avoid too much repetition, only a short summary is given here. The breast- and backplates are with 0.7-0.8 mm thickness thinner in the centre (chest area, spine) than on the edge, which is approx. 1-1.1 mm thick (Schauer 1982a, 112). The edges of both plates are bent around wires with a round cross-section 2-2.5 mm in diameter. Breast and backplate were joined together on the left side, with five to six conical headed rivets each. The backplate was placed under the breastplate. The edge of the backplate was bent over the breastplate's edge near the arm pit. On the left shoulder, the two parts were joined together either by rivets (14.058; 14.059; Metropolitan Museum) or by bronze sheet bands which were rivetted onto the backplate and passed through a rectangular hole on the breastplate, as on the right shoulder (14.057; 14.061; Metropolitan Museum). The breastplate copies the structure of the muscles with decoration. On the opposite side, the backbone is indicated on the backplate by a massive, convex rib, which would also have increased the stability of the bronze sheet. On most plates, vertical traces of hammering are visible also on the outside; however, on the cuirass from the Metropolitan Museum horizontal hammering traces dominate. On no other cuirasses a comparable amount of hammering traces is visible (when found, these are usually on the inside). The construction of the cuirass from the Metropolitan Museum is the same as those from Fillinges, aside from a row of small, punched through holes all along the armpits, which most likely served for the application of an inner organic lining. The decoration of both the cuirasses from Fillinges and the one from the Metropolitan Museum was applied with different-sized punches from the inside (repoussé). Around some of the bosses, the imprint of a ring is visible, indicating the usage of a die (ring). Before the decoration was applied, the sketch of the decoration structure was marked out with thin scratches on the inside of the cuirasses. These sketches are also known on the inside of Bronze Age greaves (Clausing 2002).

The breast- and backplates of the cuirass from Graye-et-Charnay or Véria B (former Naples) were joined together on the left shoulder by two rivets, which are visible on the breastplate. The backplate lies under the breastplate and is not completely preserved, as well as the right shoulder. The fastening on the left side of the cuirass was made by six conical headed rivets, while on the right side of the cuirass, in the centre of the breastplate, a rectangular hole was used to fix a metal band which was rivetted to the backplate. Further holes at the top and bottom of the right side of the plates (two holes on each plate) were most likely for additional fixing of the plates, e. g. leather bands. The decoration was applied from the inside with four different-sized round punches (repoussé).

The cuirass from Graye-et-Charnay or Véria A (former Grenoble) differs in terms of ornamental style but does not differ significantly in its construction from the second cuirass from the same find spot (former Naples). This cuirass is attached by conical headed rivets on the left side (five in total). At the centre of the right side of the breastplate, a rectangular hole was used to fix a metal band, which was rivetted onto the backplate. The hole, today, is ripped open. The left shoulder is not preserved, so not much can be said about the fastening. On the right shoulder, only parts of the backplate remained. In the centre of it is a bronze band, which was attached with a conical headed rivet. The band was bent around the edge, forming a flat loop, and bent backwards towards the inside of the backplate. The edges of the plates (arms, neck, base) are rolled around a bronze or copper wire. Two punched-through holes within the rib decoration right under the neck on the breastplate seem to have been made during restoration. The cuirass obviously suffered severely during excavation, since the rivet holes on the left side are all torn out, but the rivets are still present on the breastplate. The decorative elements on the cuirass from Graye-et-Charnay or Véria A (former Grenoble) were applied with repoussé and chasing, using three different-sized, round punches, while the third punch was used to form the ribs – most likely with the help of a die. Hammer traces are not visible inside the cuirass due to the high level of corrosion.

The construction of the cuirass from an unknown find spot, which is now stored in Hamburg, differs from the other Western cuirasses significantly – the breast and the backplate are fastened onto the shoulders by two hinges. A bronze sheet with the hinges attached was rivetted onto the rim of the breastplate and onto each shoulder with three conical headed rivets. Seven other rivet holes along the neckline indicate the attachment of decorative elements; the three central rivet holes exhibit different corrosion products (in a circular shape), which might be the result of formerly rivetted organic or metal discs. Once the cuirass was placed over the shoulders of the warrior, it would then have been fixed with organic (i. e. leather) strips on both sides. The strips would have passed through six holes on each side of the plate. The edges of the plates are bent inwards. The presence of a bronze or copper wire is not secure. On the cuirass from Hamburg the decorative elements were applied with two different-sized round punches from the inside.

The construction of the Marmesse cuirasses is very similar to those from Fillinges: breast- and backplate were joined together permanently by four to five conical headed rivets on the left side of the cuirasses, with the help of lining discs. On the left shoulder, another conical headed rivet reinforced the fastening of the two plates. On the right shoulder of the breastplate, a central rectangular hole was used to fix a metal band, which was rivetted onto the backplate. The rims of the cuirasses are bent outside around a bronze or copper wire on the neck, base, side and openings for the arms. On the inside of the cuirasses, traces of the straight peen hammer are still visible: on the lower parts – vertical – and in the upper parts between the shoulders – horizontal. The measurements of the hammering traces vary between 0.3 mm and 8 mm in length. The decoration was applied using the repoussé technique with two different-sized round punches. On most of the cuirasses the pellet decoration was at least partially applied within slightly convex ribs – this is clearly visible from the inside of the cuirasses (as on the fragment from Ducové). The radiographs carried out on the Marmesse cuirass (inv. no. 83.755; Puniet/Balcar 2000) revealed vertical hammering traces on

Method	Findspot	typ/no. sample	location	inv. no.
SEM-EDXS	Brandgraben, Austria	drilling sample	body	Fdnr. 83
SEM-EDXS	Čierna nad Tisou, Slovakia	sheet	back plate	15/40
SEM-EDXS	Čaka, Slovakia	sheet	back plate	I 8. 22025
SEM*	Marmesse, France	P1	back plate	86.197
SEM*	Marmesse, France	P2	breast plate	86.197
SEM*	Marmesse, France	P3	breast plate	86.197
SEM*	Marmesse, France	P10	back plate	83.753
SEM*	Marmesse, France	P8	back plate	83.754
SEM*	Marmesse, France	P8bis	back plate	83.754
SEM*	Marmesse, France	P5	breast plate	83.756
SEM*	Marmesse, France	P6	back plate	83.756
SEM*	Marmesse, France	P7	breast plate	83.756
SEM*	Marmesse, France	P9	back plate	83.757
SEM*	Marmesse, France	P4	back plate	83.758
unknown**	Graye-et-Charnay or Véria (former Grenoble)	sheet	–	B 4
unknown**		–	rivet	
unknown**		–	wire	
unknown**	Graye-et-Charnay or Véria (former Naples)	sheet	–	Br 1132
unknown**		–	rivet	
handheld XRF***	Dendra, grave 12	sheet bands (media of 5)		
handheld XRF***		sheet band no. 5		
handheld XRF***		sheet band no. 6		
handheld XRF***		cuirass (thorax)		
handheld XRF***		shoulder protection (right)		
handheld XRF***		shoulder protection (left)		
handheld XRF***		neck guard		
handheld XRF***		triangular breast protection		

Tab. 2 Results of all analyses on the alloy composition carried out on Bronze Age cuirasses so far, including the newly achieved SEM-EDXS data. – * see Lehoërff 2008 (the analyses were carried out with SEM »couple à un systeme d'analyse«). – ** see Michel/Mohen 1970. – *** see Taratori/Moschona-Katsarou/Karydas 2008.

the inside of the cuirass, as well as several cracks which formed as a result of the too-high tension of the metal during the working process.

ANALYSES

So far, only parts of the elemental and metallographic analyses of the Marmesse cuirasses (Lehoërff 2008), the two cuirasses from Graye-et-Charnay or Véria (Michel/Mohen 1970, 70f.) and the Dendra panoply (Sofou/Katsarou-Moschona 2006; Taratori/Moschona-Katsarou/Karydas 2008) as well as the elemental analyses from the potential cuirass fragment from Winklsaß have been published (Weiss 1998). In the following section, the alloy composition of all analysed cuirasses, the microstructural features of the sampled

Cu	Sn	As	Ag	Ni	Sb	Pb	S	Fe	Co	Zn	Se
79,2	18,7	0,9	0,2	0,4	0,1	0,2	0,2	0,3	tr.		
87,6	11,5	0,3	0,1	0,2		0,2	0,1	tr.	tr.	tr.	
88,8	10,5	0,2		0,5	0,1	0,2	tr.	tr.			
± 91	± 8,5					4	± 0,2				
89	10,8						± 0,2				
88-89	10-11						± 0,2				
± 91	± 8					3	± 0,2				
90-91	9-10										
90	10		± 0,90	± 0,10							
92	7,5						0,25-0,3				
± 91	± 8,5						0,3-0,5				
± 92	8						0,2-0,25				
± 90	± 10						± 0,2				
93	7										
91,7	8,3	tr.	tr.	< 0,22	< 0,22			tr.			
98,7	1,3										
95,5	2,6			1,4				0,6			
92,3	6,5	tr.	tr.	0,2	1,0			tr.		tr.	
97,4	1,5	0,1	tr.	0,1	0,9	tr.		tr.		tr.	
89,5	10,5 ± 0,5		tr.					tr.			tr.
88,7	11,2 ± 0,6		tr.					tr.			tr.
88,9	11,1 ± 0,6		tr.					tr.			tr.
89,7	10,0 ± 0,5		tr.					tr.			tr.
87,8	12,0 ± 0,6		tr.					tr.			tr.
88,9	11,0 ± 0,6		tr.					tr.			tr.
89,9	9,9 ± 0,5		tr.					tr.			tr.
87,1	12,0 ± 0,6		tr.					tr.			tr.

cuirasses from Čierna nad Tisou, Čaka and the cuirass miniature from Brandgraben are discussed. In order to present an overview of all analyses of cuirasses, the previously published analyses are presented together with the newly acquired SEM-EDXS results in **table 2**.

SEM-EDXS

The two samples from the cuirasses from Čierna nad Tisou and Čaka were mounted in epoxy resin for metallography and polished with up to 0.25 µm diameter paste. The samples were studied with the SEM-EDXS and light optical microscope, both bright field and dark field. The alloy composition was characterised by Energy Dispersive X-Ray Spectroscopy (using a PENTAFET® EDXS detector sensitive to light elements, Z>5) connected to a Scanning Electron Microscope (SEM) Evo40 Zeiss. The operating conditions were: accelerat-

ing voltage of 20 kV, P<10^{-5} barr and acquisition time of 60 seconds with 2000 channels of 5 eV each. The cobalt calibration was applied with ZAF 5 correction. For quantitative analyses, real standards were used. The compositions reported are normalised and quoted in per cent by weight. They correspond to the mathematical average of 10-14 spectra with suitable fit index per sample.

The alloy composition of the cuirasses which have been analysed and published is presented in **table 2**. The material is usually a binary alloy of copper and tin, while in two cases, 3-4 wt% lead was also found (Marmesse, backplates from inv. nos 86.197 and 83.753). Only the cuirasses from Marmesse could be sampled on both breast- and backplate – despite the Pb, they do not differ significantly in their composition. The bronze used to produce the Bronze Age cuirasses has a Sn content of 6.5-11 %, and when the Dendra panoply is included this percentage rises to 12.6 %. Only in the case of Graye-et-Charnay or Véria rivets and wire could be sampled. Here, the amount of Sn is 1.3-2.6 % (much lower than in the bronze sheets of the cuirass). According to the analytical method used, trace elements such as As, Ag, Ni, Sb, Pb, S and Fe were detected. In some cases, traces of Zn and Co were also detected. These elements can be connected to the copper ore used for the production of the cuirasses. According to the material characteristics, the major usage of a tin-bronze between 8-11 % is the most suitable for bronze sheet production and the material demands needed for effective armour. It is not very surprising, especially when compared with other contemporary bronze sheet objects that four of the five analysed cuirasses and parts of cuirasses are made of this alloy.

Qualitative analyses were carried out on the Dendra panoply on the surface of corroded areas (Taratori/Moschona-Katsarou/Karydas 2008, tab. 2) with a handheld XRF (X-ray fluorescence) analyser. Copper chlorides (atacamite, nantocite and paratacamite), copper carbonates (azurite, malachite), tin oxides (cassiterite) and calcite (most likely due to the soil) were detected. Furthermore, quantitative analyses were carried out, again with a handheld XRF. The corrosion was removed, so the metal could be analysed directly. The Dendra panoply was made of a binary CuSn alloy. The amount of Sn was 9.4-12.6 wt%, which fits well with the composition of European Bronze Age sheet metal objects, though the Western European cuirasses in general have lower amounts of Sn. The cuirass and the neck guard from the Dendra panoply seem to be made of the same alloy, as were the left shoulder protection and the triangular chest protection. The right shoulder protection and the sheet bands no. 5 and 6 also seem to be made out of the same alloy. We can note that the different pieces of the panoply were made of very similar alloys, and some parts were even made of the same alloy. This most likely indicates a production at the same time and place, which contradicts the documented practice of providing additional parts of armour for different well-equipped warriors, as the Linear-B tablets mention (Andrikou 2007, 406). Thus, we have to assume the panoply was produced in one go, and was worn by a wealthy person of high status.

One micro-sample each could be taken from the backplates of the cuirasses from Čierna nad Tisou and Čaka. The samples were studied with an optical microscope, bright field and dark field, as well as the SEM-EDXS for the elemental analyses. The density of inter-crystalline corrosion products outlined and visualised the matrix clearly, and thus no etching was necessary. The fragment from the cuirass from Čaka was severely corroded (**fig. 27**, above). Nevertheless, the alloy composition could be measured by analysing single grains. Due to the cremation process, the fragment of the Čaka cuirass is perfectly homogenised and consists of big grains, which are now mostly completely corroded, or just a small metal core is existent. Thus, the last step of production, whether it was annealing, hammering or quenching, cannot be detected anymore. The temperature of annealing for the cuirass from Čierna nad Tisou was below the solidus curve of the alpha-phase in the equilibrium diagram Cu-Sn, but high enough to homogenise the solid solution. Only a few inclusions of Pb are distributed in the metallic matrix, indicating a mild final deformation of the matrix, which is also evidenced by the presence of slip lines and slightly deformed grains (**fig. 27**, below right).

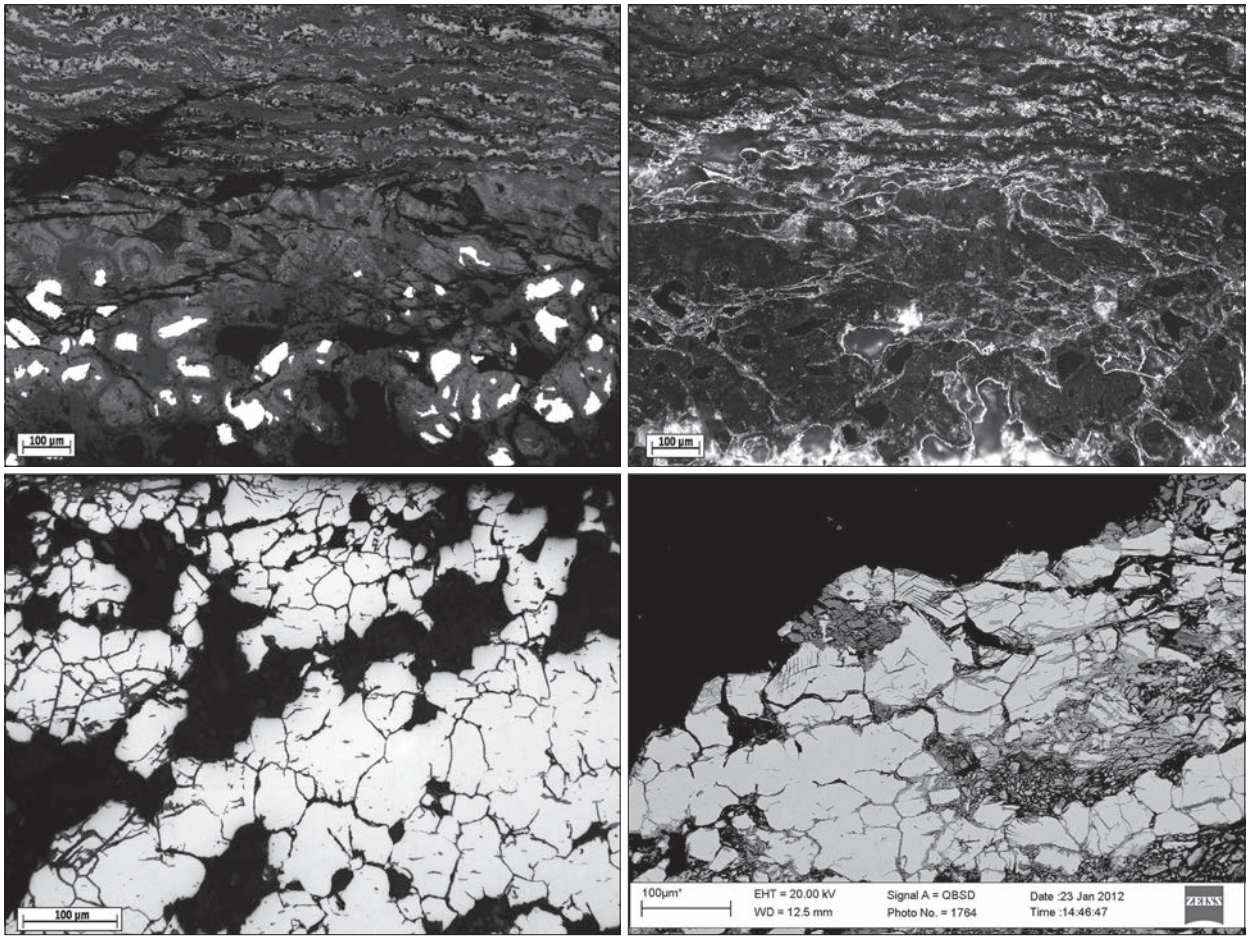

Fig. 27 Microstructure of the cuirasses from (above) Čaka (okr. Levice/SK) and (below) Čierna nad Tisou (okr. Trebišov/SK). – The fragment of the Čaka cuirass is almost completely corroded, while the corrosion on the sample from Čierna nad Tisou outlined the microstructure. – (Photos M. Mödlinger).

From the deformation of the $Cu_{2-x}Fe_xS$-inclusions (Mödlinger/Piccardo 2012), we can estimate the total biaxial deformation, from the as cast to the finished cuirass plate from Čierna nad Tisou, at around 77 %. The thickness of the cuirass is 0.8 mm in the sampled area. The calculated minimum thickness of the original as-cast disc from which the backplate was made, was a minimum of 3.6 mm. This value cannot take into account all material losses, which may have occurring during shaping, such as flaking off of copper oxides, polishing and grinding, as well as usage. Since no $Cu_{2-x}Fe_xS$-inclusions can be clearly identified in the severely burnt and corroded fragment from Čaka, the amount of deformation as well as the minimum thickness of the as-cast disc cannot be calculated.

The location of sampling on the cuirasses from Graye-et-Charnay or Véria is not indicated (Michel/Mohen 1970). However, the texture reveals a recrystallised grain structure of α-phase, not fully homogenised, with deformation twins. Unfortunately, the pictures do not allow for the identification of slip lines and $Cu_{2-x}Fe_xS$-inclusions (Michel/Mohen 1970, fig. 11, d for cuirass A and fig. 12, b-c for cuirass B), thus the total amount of deformation could not be calculated. Six of the cuirasses from Marmesse were sampled, analysed and published by Lehoërff (2008, 95-106 fig. 3, including the location of sampling). The $Cu_{2-x}Fe_xS$-inclusions are deformed by up to 90 %. The cuirasses from Marmesse that were analysed (86.197, 83.753-54, 83.756-58) contain between 9-10 % tin (Lehoërff 2008, fig. 7). The publication of further analyses on the Marmesse cuirasses as well as the cuirass from Saint-Germain-du-Plain is in preparation by Lehoërff.

USAGE

The usage of the Dendra panoply as armour is not in doubt, though the context of usage is still a matter of debate. Nevertheless, there has never been a significant discussion as to whether it might have served a ritual purpose alone, or was just an object of display and prestige. It seems a little strange that this is so commonly posited in relation to most Central European defensive armour, in particular shields (for an overview see Uckelmann 2012, 175 f.). Several arguments (objects of prestige, symbolic armour, too precious to be used) were used to avoid the interpretation of these masterpieces as what they are: armour. These arguments did not take into account that these were affordable (for high-status warriors at least) and useable, and would have protected the warrior in combat. Also, the efficiency of the bronze corselet at protecting the warrior from sword blows, especially in comparison to leather jerkins, has been questioned. This does not seem to be valid, since the bronze corselet was strengthened with a leather or cloth lining or worn over an organic jerkin (see above), thus gaining efficiency. Besides, the utilitarian character does not contradict the fact that bronze corselets belonged to the members of an elite, and added to the prestige and authority of the warriors wearing them. Aside from practical improvements which can be noted from the Mycenaean cuirasses to the Western European cuirasses, traces of usage and several repairs on both Carpathian and Western cuirasses will be described, supporting the usage of the armour as such.

Whether the warrior wearing the Dendra panoply fought only from a chariot (Bouzek 1981, 26-28) or if he only used it to reach the battlefield and then fought on foot (most recently Andrikou 2007, 407) is still a matter of discussion. The theory that the panoply was only used by a warrior on a chariot, however, leaves the question open as to why the warrior was also protected by greaves, since the front of his lower leg would already have been protected by the chariot. Fighting on foot seems to be likely, at least in later warfare. It is certain that the warrior did not only use his spear, as the (potential) sword in the grave indicates. A reconstruction of the Dendra panoply demonstrated that fighting with a sword is possible, but the usage of bow or spear is much less practical, since the shoulder protectors get in the way, thus supporting the theory that a warrior wore it while fighting on the ground. Also, the gap for the right arm is 2 cm wider than the one for the left arm, leaving the fighter more space to use his weapons with his right arm (Verdelis 1967, 10). The often depicted final stroke in man-to-man combat with swords (e. g. Shardana on the Medinet Habu relief from the »Sea battle« and the seal from the shaft-grave III from Mycenae) hits the neck and would have caused the immediate death of the opponent; thus, the high neck guard of the panoply (which is also depicted on the linear-B ideogram panoplies or cuirasses) seems to be reasonable protection in sword combat. Another argument in favour of the usage of the sword is the little bronze ring attached to the top of the right shoulder guard, which was most likely used to hold the strap for either a sword or shield. The presence of greaves and a singular guard for the right arm, which was found lying on the panoply (Verdelis 1967, 40 f. fig. 9 pl. 18), further supports the theory that the Dendra armour was also used for fighting on ground level, and not just for a parade or for charioteers. The main disadvantage of the panoply, however, is its estimated weight of about 30 kg. The wood and leather remnants found between arm guard and panoply in the grave, spread over an area of 42 cm × 35 cm (Verdelis 1967, 6), might indicate the presence of a shield, although a tower or figure-of-eight shield would have covered a much wider area. In summary, taking into account the high value of the armour, we might assume that the warrior arrived by chariot on the battlefield, most likely as a leader, and then fought together with his foot soldiers.

Due to the heavily fragmented nature of most of the Carpathian cuirasses, no traces of usage can be noted on the fragments. Also, the cuirass from Saint-Germain-du-Plain does not bear any clear traces of usage or repairs. Battle traces, as found on the Danube cuirass will be discussed elsewhere (see forthcoming publication by Petres, Kovács and Jankovits).

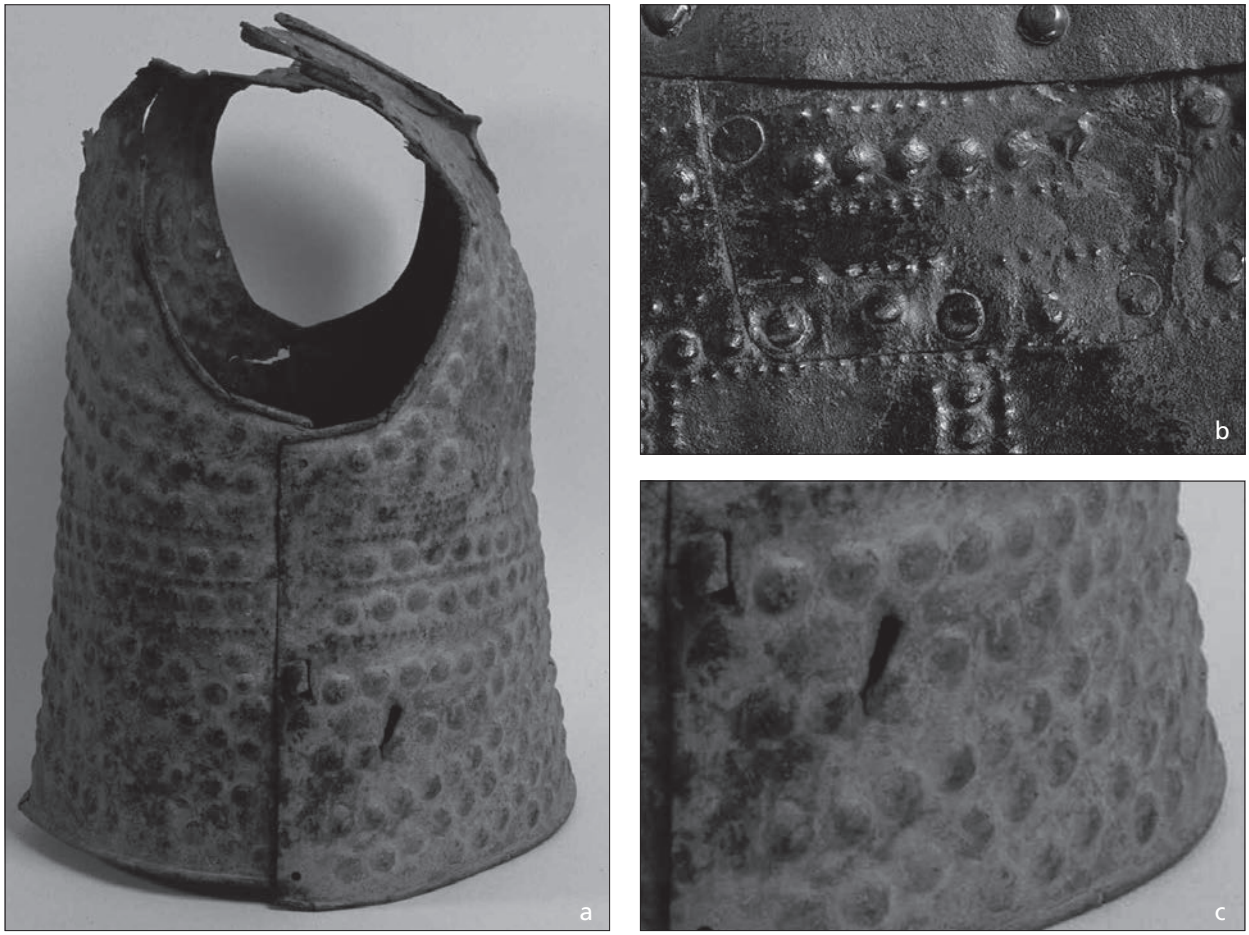

Fig. 28 Traces of usage on cuirasses. Both examples illustrate different types of use-wear as weapon impact and restoration and are not the only traces of use-wear of both types documented on Bronze Age cuirasses. – The cuirass (**a. c** [detail]) from Graye-et-Charnay or Véria (dép. Jura/F) shows the impact of a sword or spearhead in the area of the liver. The cuirasses (**b**) from Marmesse instead show traces of repair only. – (Photos A. Chauvet/C2RMF, by courtesy of the MAN).

In contrast, the Western cuirasses are rich in terms of evidence of repairs, which were the result of either injuries during combat or manufacturing mistakes. The three breastplates from Fillinges clearly exhibit impact damage from combat, or at least an action which damaged the cuirasses: as described in detail by Schauer (1978, 101), they have small holes at the neck, with outward bent edges, most likely as a result of weapon perforation. If we do not want to consider a frontal attack, when the spearhead passed partly through or beside the neck, we might also consider these traces as a result of ritual or cultic action. Schauer hypothesised that the owner of the cuirasses might have been sacrificed during the funeral festivities close to the pyre (Schauer 1982a, 101).

The cuirasses from Fillinges were certainly used as armour, as the reparations on one breastplate (inv. no. 14.060) and one backplate (inv. no. 14.057) indicate. On cuirass inv. no. 14.060, the left shoulder and a bigger part of the rim below are missing. The breastplate was repaired twice. Under the right nipple, a new piece of bronze sheet (3.1 cm × 2.2 cm) was fixed with four rivets (Mottier 1988, 121 fig. 10-12). On the right side of the breastplate, another bronze sheet was attached (3 cm × 2.1 cm) with four rivets, in order to cover a crack, which does not seem to have been caused by weapon impact, but was more likely caused by material stress. On cuirass inv. no. 14.057 (on the left side) the upper part around the neck, the middle of the back and parts of the lower rim are missing. However, on the remaining parts two repairs can be noted.

Close to the liver, the cuirass was repaired with a squared sheet (7.7 cm × 4.5 cm), which was attached with six rivets. More damage of the cuirass, to the right of the repaired area, is visible and was perhaps caused by an arrowhead, at least according to Schauer (1978, 107 pl. 41, 1). One of the fragments (inv. no. 16.932) has two little bronze sheets rivetted partly above each other on the outside of the cuirass (Mottier 1988, 127 fig. 21).

The cuirass from Graye-et-Charnay or Véria B (former Naples) exhibits damage in the form of a long, thin perforation from the outside (with inward-bent edges), as can be caused by swords, at the lower area of the liver, which was not repaired (**fig. 28**). Similar battle traces are also known from shields (cf. Uckelmann 2011, fig. 4). Additionally, there are repairs in the form of rivetted bronze sheets on the right side of chest and neck. On the rivetted rectangular bronze sheet on the right side of the chest, the decoration was applied as it was on the cuirasses from Fillinges. The sheet was applied above a rectangular, cut out void in the breastplate.

As the cuirasses from Fillinges and the one from Graye-et-Charnay or Véria B, the cuirasses from Marmesse have also been repaired. The most significant repairs are on cuirass inv. no. 32.691, on the left side of the backplate and on the left side of the breastplate of cuirass inv. no. 83.757 (**fig. 28**). Steuer assumes without questioning the repairs were made during manufacture and not after combat (Steuer 2001, 337). It seems as if the slightly different decoration on the back of the Marmesse cuirasses was important for identifying the person wearing the cuirass, while the front view provided opponents with a uniform view of the warriors. The different number and thickness of lines might also indicate the status or rank of the warrior. The backplates from Fillinges do not exhibit any significant difference, in comparison to the backplates of the Marmesse cuirasses.

CONCLUSIONS

As discussed in detail, the different principles of construction and assemblage of the different parts of the panoplies or cuirasses are consistent with the distribution areas, chronology and decoration of the main groups of cuirasses: Greek, Carpathian, and Western European. The group of undecorated panoplies and cuirasses from Greece is limited to two find spots, Dendra (graves) and Thebes (settlement), and dates from LH II-IIIA2/B1. Carpathian cuirasses were found mainly heavily fragmented in hoards in Hungary, Czech Republic and Slovakia, and date from Bz D-Ha A1. Two complete cuirasses have been identified, which were deposited in the Danube and, as an export, also in the Sâone. Carpathian cuirasses have decorative elements, such as ribs, punched decoration and sometimes also decorative, rivetted metal bands on the rim. The river find from the Sâone has a close geographical proximity with the more recent, contemporary or slightly younger, Western European cuirasses. These cuirasses were found in three deposits in the area around Dijon within a maximum distance of 230 km. The find spot(s) of two further cuirasses is unknown. The Western European cuirasses are decorated all over with different-sized bosses, lines, waterbirds and circles. The further development of cuirasses in Central Europe and Greece towards the plastic integration of anatomical features, additional to the evolution of the bell-shape, indicates not just random contact or exchange; rather, a profound exchange of decorative and technological aspects of the production of metal armour between Greece, the Carpathian basin and Western Europe from the 15th century BC onwards is likely, in order to improve effectiveness and adapt to changing fighting techniques.

Not only do the technological aspects, the distribution and the chronology demonstrate close contact, the usage and practical improvement of the armour itself also follows a clear line of development. The most

complete Bronze Age set of armour also contains the oldest, complete bronze cuirass: the panoply of Dendra, which was combined with a boar tusk helmet with bronze cheekplates, greave(s) and (potentially) also a wooden shield. The cuirass was made of a breast- and backplate, on which other bronze sheets were attached in order to improve the protection for the throat and neck, shoulders, chest, pelvis and upper legs. On each bronze sheet, an inner lining was attached. The finds from Thebes indicate the level of variation possible when combining these elements with the base cuirass. The combination may have been connected to the warrior's status, rank or financial limitations. Also we have to take into account that the palatial authority, as the Linear B tablets inform us, provided selected persons with corselets, who paid back the value of the corselet through compliance and sustaining the system.

We should also consider faster and more flexible warriors, who might have been armed with breast- and backplate only, without any additional fixed-on bronze sheet protection. Since the Thebes cuirasses and the panoply were not worn as pure metal on the skin or above clothes but, as indicated by the small holes all along the edge, with additional, inside applied lining. We thus might suggest an early substitution of the additional metal parts of the panoply with organic elements. This development is also clearly visible on the Carpathian cuirasses. These cuirasses are much lighter and allow for easier and quicker movement. No small holes along the metal sheets for the attachment of inner lining are present, which indicates the usage of a separate organic protection (similar to the *gambeson*), which most likely was reinforced on the shoulders and the pelvis. Also, we might assume that the inner lining was fixed onto the cuirass with rivets, as on the contemporary, decorated cap helmets (Mödlinger 2013) or the later bell helmets (Mödlinger 2014). We have to assume that cuirasses were generally made for individuals, even though in Thebes the palatial authority could also have provided the armour. A cuirass is, more so than any other piece of armour, an object which needs to fit properly and which does not fit every man, as it is indicated by the different sizes of the cuirasses from Marmesse, the different height of the neck guard and the slightly different decoration, which could also potentially indicate rank, or have allowed the identification of the warrior from the back. Due to the decrease in metal thickness from the Greek to the Carpathian and Western European cuirasses, the latter must have been reinforced through the application of decoration (ribs, bosses) and the bending of the rim around a bronze or copper wire or by strengthening the rim by rivetting on additional bronze sheets. These developments, changes and improvements in the usage of the armour were also connected to a change in fighting techniques towards a faster, less static, closer method of combat.

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ZUSAMMENFASSUNG / ABSTRACT / RÉSUMÉ

Europäische bronzezeitliche Panzer. Aspekte der Chronologie, Typologie, Herstellung und Verwendung

Panzer gehören zur seltensten Gruppe bronzezeitlicher Defensivbewaffnung. Die rund 30 heute bekannten Panzer werden entsprechend ihrer Verbreitung, Chronologie und Verzierung in drei Gruppen unterteilt: eine westeuropäische, eine osteuropäische und eine griechische Gruppe. In diesem Artikel werden nicht nur Verbreitung, Datierung und Neufunde, sondern auch Herstellung, Konstruktionsprinzipien und Verwendung der Panzer diskutiert.

European Bronze Age cuirasses. Aspects of chronology, typology, manufacture and usage

Bronze Age metal cuirasses are the rarest type of defensive armour in Europe. The total number of 30 cuirasses is, according to their chronology, distribution and decoration, divided into three groups: a Western European, an Eastern Carpathian and a Greek group. Within this article, chronology, distribution, new finds, as well as construction principles, manufacturing techniques and usage of the cuirasses are discussed.

Cuirasses européennes de l'âge du Bronze. Aspects chronologiques, typologiques, techniques et fonctionnels

Les cuirasses métalliques de l'âge du Bronze représentent le type d'arme défensive le plus rare en Europe. La totalité des 30 cuirasses se répartit en trois groupes: Europe occidentale, Carpates orientales et Grèce. Cet article aborde la chronologie, la distribution, les nouvelles trouvailles ainsi que les principes d'assemblage, les techniques de fabrication et l'usage des cuirasses.

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