

1 Introduction

Since the first studies on Bronze Age armour the number of helmets, greaves and cuirasses has increased significantly. This monograph provides for the first time an overview of all metal body armour from the European Bronze Age and aims to achieve a holistic view, not only from a typo-chronological perspective but also in focusing on the manufacture and usage of such armour. This was enabled through the re-evaluation of central and eastern European finds in particular and their material analyses. The monograph is divided in three main chapters, dealing with helmets, greaves and cuirasses respectively. In each chapter the research history, distribution and chronology, as well as manufacture and use of the different classes of armour is discussed. Only shields are not discussed in the following, since M. Uckelmann recently published them in an extensive study.¹

Details of the development, manufacture and use of Bronze Age metal body armour has remained unclear for large parts of Europe, even after more than a century of research. The focus of previous studies was usually on typo-chronological aspects, while other topics such as manufacturing techniques, actual use and technological observations were rarely included in the studies or even considered as chronologically relevant. The study of Bronze Age warfare, be it theoretical or derived from a more practical, experimental approach, has become rather fashionable during the last decades, resulting in many publications and a wide variety of interpretations of how weaponry was used and how warfare took place. Compared to arms, studies of the use of armour have remained rather traditional, focusing on typology and cultural interactions with only a few significant exceptions. Among these are the work on shields by M. Uckelmann, which also incorporated a range of metallurgical analysis, the application of radiocarbon analyses to their dating, as well as use-wear analysis and experiments, and of B. Molloy, which also used use-wear analysis and experiments.²

Studies concentrating on Bronze Age cuirasses, greaves and helmets, especially where aspects of manufacture and use are concerned, nevertheless remain scarce, and usually focus on finds from the same find spot³ or single finds.⁴ Metallurgical analysis or the study of chemical composition of armour is even scarcer: only a handful of objects had been analysed previously and the few studies undertaken are to be found spread over single papers and rarely referencing each other.⁵ C. Clausen, who studied greaves, is the only one to use as the basis of their typological classification the different methods of production and aspects of their technological design, such as the way that the greaves fix on the leg.⁶ So far, only H. Hencken saw, documented and described the majority of Bronze Age and Early Iron Age helmets in detail, though following the classification of G. v. Merhart.⁷ He also identified and described evidence of use-wear, such as damage from weapon impacts, and thus his study is seminal in this tradition for Bronze Age armour. For cuirasses, only a recent study by the author includes any metallurgical

¹ Uckelmann 2012.

² Molloy 2004; Uckelmann 2011; Uckelmann 2012; Molloy 2013.

³ E.g. Schauer 1982d; Mottier 1988.

⁴ E.g. Born – Hansen 1992; Born – Hansen 2001; Clausen 2005; Molloy 2013.

⁵ E.g. Born – Hansen 1992; Born – Hansen 2001; Lehoërf 2008; Taratori et al. 2008; Lippert 2011.

⁶ Clausen 2002.

⁷ v. Merhart 1941; Hencken 1971.

study and use-wear analysis, alongside a complete overview of this class of Bronze Age body armour.⁸

Despite the fact that the experimental manufacture of Bronze Age weapons has a long history of research,⁹ similar studies concerning armour, especially body armour, are rare to non-existent. Experimental studies have so far only been carried out on shields¹⁰ and the Dendra panoply.¹¹ The shields have been studied in terms of both manufacture and use, whereas the Dendra panoply has only been studied in respect of its use. The major reason for the lack of further experiments certainly lies in the scarcity of skills required to reproduce bronze sheet objects with replica Bronze Age tools and in particular a lack of understanding concerning material characterisation, such as chemical composition and microstructure, of the original Bronze Age finds. Combining the results of material characterisation and identifiable manufacture- and use-wear traces, a good understanding of how the object was produced can be achieved, as we hope to demonstrate in this volume. Only with this evidential base can the reproduction of such armour be successfully achieved with the technologies identified and for tests of its usability and efficacy to have archaeological relevance.

To interpret warfare, combat and the actual use or efficacy of armour, it is important not only to understand the archaeological evidence but also the material characteristics of the bronze armour and social environments in which they were used. This is one of the gaps, which the author aims to close with this publication. Thus, this volume aims not only to be an extensive corpus of Bronze Age body armour, including the archaeological information, literature and depictions of the armour, but also one concerned with the application of metallurgical perspectives, incorporating both previous and newly carried out analyses of this armour. This publication focuses on both traditional artefact studies and metallurgical studies, including also the reconstruction of the manufacture of the armour, technological developments and innovation as well as use-wear analyses.

Unfortunately, many of the armour known today to archaeologists derives from illegal excavations, has no known find spot and context, and is currently in private collections (at least 17 helmets and some greaves are known to the author). Despite their doubtful provenance, they were sold and re-sold through different auction houses, and usually cannot be studied in detail. This publication includes also these 'new' finds, even though the publication of these finds might run the risk of raising their monetary value. Certain institutions, such as the German Archaeological Institute (DAI), prohibit the academic publication of finds without firm provenances, or of dubious acquisition, from private collections. This is laudable. However, there is also a need for academics to be aware of finds, especially those of forms poorly attested through archaeological recovery or in public collections, such as our metal armour. The inclusion of these finds here does not in any way infer that the illegal acquisition of archaeological materials is supported, or the collecting of finds for private collections. Also, the inclusion of such finds in genuine academic publications is not to be believed to encourage in any way their illegal collection or curation. This is in accordance also with the recent statement of the 'Committee on the Illicit Trade in Cultural Material' of the European Association of Archaeologists.¹² It is, nevertheless, important to bring to light such important finds for the benefit of research and to present them alongside already known examples of their class, to at least slightly increase the small material framework that survives to us of this rare category of Bronze Age equipment.

The author documented, studied and analysed all accessible helmets, greaves and cuirasses in eastern Europe and some of the armour from western Europe, which significantly increased the number of armour studied and analysed in detail. The importance of carrying out studies

⁸ Mödinger 2014b.

⁹ Mödinger et al. 2011.

¹⁰ Coles 1962; Coles 1977; Molloy 2004; Molloy 2007; Uckelmann 2012.

¹¹ Molloy 2013.

¹² Mödinger et al. 2016.

directly on the object cannot be emphasised enough: only in this way is it possible to confidently identify armour fragments as such, for example, distinguishing fragments formerly interpreted as parts of a helmet of Type Paks as being parts of decorated flat discs.¹³ Moreover, such direct study of the objects allows for the documentation of otherwise unrecognised traces of manufacture and use not only on the outside, but also on the inside and backside of the armour, dimensions that only rarely appear in published studies.

Since the distribution of Bronze Age body armour ranges from Iberia in the west to Cyprus in the east and from Sicily in the south to Sweden in the north, as well as in the Near East, it covers a wide geographical study area. Such a large area inevitably comes afflicted with numerous regional chronological systems, with differing phases and horizons, which have to be aligned in order to enable the visualisation of chronological development and to pinpoint the appearance and trade of specific types. As it is the scheme most widely used, we will follow the chronological classification of P. Reinecke, as updated by H. Müller-Karpe, despite ranging beyond the territory for which it was devised, as a supra-regional scheme. The numbered phases of this scheme have therefore been prefixed with regionally relevant phase names, primarily derived from characteristic metalwork deposits. Thus, these phases provide still the most useful descriptive tool for the discussion of chronology. The recent work of J. Sperber suggested new absolute dates for these phases, representing formerly so-called ‘high’ dates.¹⁴ The validity of his dates and the compatibility with the phases of Müller-Karpe is still debated.¹⁵ Similarly ‘high’ dates have also been suggested for the British Bronze Age,¹⁶ which are applicable to the western European or Atlantic Bronze Age.

The chronological classification used in the following is based on the dendro-chronological dates from the lake-shore settlements northwest of the Alps, which provide precise dating evidence for the 11th–9th centuries BC (Fig. 1.1).¹⁷ This chronological scheme was developed mainly for the western part of the Urnfield Culture but is also valid for wide parts of the eastern part of the Urnfield Culture and compatible with its various horizons of associated deposits (*Depotfundstufen*).

The different classes of armour have rather wide distribution patterns, which span over different geographical areas and time periods (Fig. 1.2). It is our aim to discover the reasons for this pattern and the background of exchange – its frequency and direction, the benefits accrued, the bonds made or the antagonisms created – that resulted in it.¹⁸ The definition *exchange* includes any transfer or displacement of material goods or people between individuals or groups in a spatial or temporal sense. With such displacement, a shift in value and perception of the object or person might be accompanied, which might also result in different depositional practices (see e.g. the cuirass from Saint-Germain-du-Plain). Distribution patterns of Bronze Age armour and any other object type depend on several factors, which influenced the archaeological record:¹⁹

1. Armour was circulated between regions but, as a result of the differing life-cycles (e.g. recycling, deposition) of individual objects or regions, much armour never or only scarcely entered the archaeological record.
2. Specific classes and types of armour were not available to groups in certain areas, be it for socio-cultural reasons (taboos) or simple economic unavailability (consumption) – perhaps due to loss, recycling or deposition – before reaching such regions.

¹³ Mödlinger 2013a.

¹⁴ Sperber 2011.

¹⁵ Cf. Gerloff 2007.

¹⁶ Needham et al. 1997.

¹⁷ Pare 2008; Sperber 2011. Unlike previous studies (e.g. Sperber 1987), in his 2011 scheme Sperber names his Stufe IIIa1 ‘jüngeres Ha B1’ and the Stufe IIc ‘älteres Ha B1’; SB IIIa2 is equivalent with Ha B2 only.

¹⁸ Needham 1993, 162.

¹⁹ Adapted after Needham 1993, 166.

	Iberia		France		United Kingdom	Central Europe	Italy (BM & BR Northern Italy; BF Tarquinia/Veii)			
	Hoard	General	NW / Atlantic	Central / East						
1500	Isla de Cheta	Bronze tardío	Bronze moyen I (Trébol)	Bronze moyen	Arreton	Bz B2	Middle Bronze Age	Bronzo Medio IIA		
1450					Acton 2	Bz C1		Bronzo Medio IIB		
1400					Taunton	Bz C2		Bronzo Medio IIC		
1350						Bz D1		Bronzo Recente I		
1300						Bz D2				
1250		Huerta de Arriba	Bronze final I (Rosnoën)	Bronze final I	Appleby					
1200					Grañón	Bronze final IIA	Penard	Ha A1	Bronzo Recente II	
1150		Alhama de Aragón	Bronze final	Bronze final II (St.-Brieuc-des-Iffs)	Bronze final IIB	Limehouse	Ha A2		Bronzo Finale I	
1100						Hío	Wilburton	Ha B1a		Bronzo Finale II
1050						Huelva	Bronze final IIIa	Blackmoor	Ha B1b	
1000	Ha B2		Bronzo Finale IIIb transition Prima Ferro IA							
950	Monte Sa Idda	Plainseau (Boughton-Venat group)	Bronze final IIIb	Ewart Park	Ha B3a		Prima Ferro IB1 / IB			
900					Ha B3b		Prima Ferro IB2 / IC			
850										
800		Hierro antiguo	Court-St-Etienne/Gündlingen	Hallstatt ancien	Iron Age	Iron Age	Iron Age	Prima Ferro IIA / IIA-B		

Fig. 1.1 Synchronised version of the relevant chronological systems mentioned in the text (1500–800 BC). Iberia (including Monte Sa Idda, Sardinia): Roberts et al. 2013; France: Milcent 2012; Roberts et al. 2013; United Kingdom: Matthews forthcoming; central Europe: Pare 2008; Sperber 2011; Italy: de Marinis 1999; Iaia 2005; Pare 2008.

	Croatia	Hungary	Romania	Aegean			
				Mainland (high)	Crete (high)	Mainland (trad.)	Crete (trad.)
1500				LH IIA	LM IB	LH IIA	LM IIA
1450				LH IIB	LM II	LH IIB	LM IIB
1400				LH / LM IIIA1		LH IIIA1	LM IIIA1
1350		Forró		LH / LM IIIA2		LH IIIA2	LM IIIA2
1300	I	Opály	Uriu	LH / LM IIIB		LH IIIB	LM IIIB
1250							
1200		Aranyos	Domaneşti				
1150	II	Kurd	Cincu-Suseni	LH / LM IIIC		LH IIIC	LH IIIC
1100		Gyermely	Turia-Jupalnic				
1050	III			sub-mycenaean	subminoan	submycenaean	subminoan
1000		Hajdú-böszörmény	Moigrad-Tăuteu				
950				protogeometric			
900	IV			early geometric			
850		Románd	Fizeşu Gherlii-Sîngeorgiu de Pădure	middle geometric			
800	V	Bükk-szentlászló	Şomartin-Vetiş				

Fig. 1.1 continued.

Croatia: Vinski-Gasparini 1973; Hungary: Mozsolics 2000; Romania: Petrescu-Dîmboviţa 1978; Aegean: Manning 2010; Uckelmann 2012.

	1500	1475	1450	1425	1400	1375	1350	1325	1300	1275	1250	1225	1200	1175	1150	1125	1100	1075	1050	1025	1000	975	950	925	900	875	850	825	800	775	Type
HELMETS	Eastern Europe, Italy and Greece																											Type Oranienburg			
	Western Europe																											Type Paks Type Nagytényi Type Piskolt			
	Italy (<i>Bronzo finale</i> and <i>Prima Ferro</i>)																											Type Mombellet Type Mantes Type Lueg Type Biebesheim Type Bernières-d'Ally Italian cap helmets Italian pottery helmets Italian crested helmets			
GREAVES	Eastern Europe																											Type Desmonia Type Lengyelóti Type Kufim			
	Southern Europe																											Type Kallithea Type Grammichele Type Ilijak			
	Miniatures																											Miniatures Italy Miniatures Eastern Europe			
CUIRASSES	Greece, Eastern and Western Europe																											Greek cuirasses (Dendra) Greek cuirasses (Thebes) Carpathian cuirasses Western European cuirasses			

Fig. 1.2 Typo-chronological distribution of Bronze Age body armour.

3. People were simply not interested in the specific class or type of armour for various reasons (e.g. another type of armour was considered 'better', being more effective or simply matching better the aesthetic or cultural expectations).

In truth, these distribution maps are in fact 'recovery maps', and need not necessarily represent original patterns of circulation or frequency accurately, and at best give only a vague idea of it. As such, it is necessary to rethink for instance the generalisation of western European helmets deposited in rivers and eastern European helmets deposited in associated deposits.²⁰ These different deposition practices involving cuirasses, greaves and helmets will be discussed in their corresponding chapters.

Moreover, one has to take into account that it is not possible to completely reconstruct the spatial, temporal and social distance between the original production site and the ultimate find location, nor postulate the means of transmission or the significance or value attached to the objects as received by the recipients.²¹ The armour producing workshop does not necessarily need to be in the centre of a distribution of a specific class or type of armour but could just as likely be located somewhere else (as shown e.g. by the finds of socketed axes Type Målar in Scandinavia and the workshops producing them in the Baltic). Thus, the documentation and publication of casting moulds and related casting evidence relating to the manufacture of Bronze Age armour is of significant importance, technologically and in relation to its spatial and chronological aspects. Once such production centres or areas are located, it is possible to reconstruct the technological and social constraints placed on production, its local imitations, as well as degree of receptiveness to stylistic or technological influences or the exploitation of local resources in a more reliable manner.

S. P. Needham²² is correct in his observation on the degree to which our archaeological distributions, as maps of archaeological recovery, do not accurately reflect past scales of circulation. However, archaeological 'distribution maps' must also be understood to be maps of what are specifically archaeological types, delineated as valid entities from the extant recovery record. Therefore, when discussing the spatial occurrence of such types, they have valid distributional value, as they contain the finds upon which these types have been identified. Here, then we use the term 'distribution' specifically to denote such archaeologically identified types.

In order to avoid a protracted discussion of whether or not finds deposited together belong to a specific category of deposit, such as 'hoard' (meaning it was deposited for the purpose of safe keeping until recovery), 'scrap hoard' (again only temporarily deposited and intended for recycling), or 'votive deposit' (as in a sacrificial offering), the neutral expression 'associated deposit' is used. There exists a wide and varied literature on the matter, which has been perhaps best addressed by R. Bradley, whilst S. P. Needham has attempted to construct a classification system for such deposits.²³ Our various categories of bronze armour derive from a number of such instances, and we have here adopted the neutral term 'associated deposit' to describe such agglomerations of finds. Given the scope of our research, both spatially and temporally, these associated deposits inevitably vary in form and purpose. Therefore, where such purpose is clear and unambiguous we have identified them as such, as in the case of the votive deposits from Piller Sattel or Škocjan.

The distribution area of metal body armour in the European Bronze Age varies widely and rarely overlaps. From the United Kingdom and Ireland only shields are known. The Iberian Peninsula has produced only a few fragments of crested helmets, though the depiction of likely Type Herzsprung shields on local stelae may also suggest their use in this region. Helmets and greaves but no cuirasses or shields have been found in Italy. Despite the cuirasses of Dendra and Thebes, only a small number of greaves and helmets, and no metal shields, are known from

²⁰ Hansen 1994, 19; see also the detailed discussion on p. 25.

²¹ Needham 1993, 166–168.

²² Needham 1993.

²³ Bradley 1990; Needham 1990, 137–140.

Greece. From France, helmets, greaves and cuirasses are known (the latter two only in central and eastern France), but no shields. In Germany, the distribution area of (organic) shields and helmets overlap, whilst only two greaves and one potential cuirass are known. In the central Alps, a small number of greaves, helmets and a miniature cuirass were found. From Poland and the Ukraine, three single helmets are known – all of different types. It is only in the Carpathian Basin that all four types of armour can be found. Nonetheless, there is only the associated deposit of Nadap, Hungary, where fragments from all types of armour were found together: one almost complete helmet of Type Oranienburg, fragments of helmet(s) of Type Paks, four greaves of Type Lengyeltóti and Desmontà, and one fragment each of a cuirass and a shield. The second almost complete assemblage of armour is reported from Grave 12 at Dendra, Greece, which contained a greave, the unique panoply, and a boar tusk helmet with bronze cheek plates, whilst the body was probably also covered by a wooden shield.

Apart from the Greek armour and the Čaka find (the case of Volders/Tyrol is not secure yet), the different classes of armour appear to have generally been deposited as parts of associated deposits or as single finds, often in wet locations. In central Europe, this appears to coincide with the disappearance of sword graves, which amongst the eastern Urnfield Culture had already occurred by Bronze D2,²⁴ and followed by the western Urnfield Culture shortly after. In the eastern Urnfield Culture, the number of graves generally increases from the early Hallstatt B1 to Hallstatt B3,²⁵ but with swords no longer included as grave goods, this being common as of Hallstatt A2 in the western area of the eastern Urnfield Culture and in the eastern area already since Bz D2.²⁶ Comparing the total number of swords and spearheads in graves up to these periods with that for contemporary armour, it is perhaps not surprising that just one grave find from the eastern Urnfield Culture (Čaka) is known so far. In the western Urnfield Culture, swords were no longer buried with the deceased from Ha B1b on, with only a few more recent graves occurring (e.g. Weinheim). Graves with swords reappear only later, from Ha B3 onwards, c. 950 BC, whilst the use of cemeteries is no longer common,²⁷ indicating differing sepulchral traditions. During the same period, river depositions, as in those from the upper Rhine increase, indicating a shift in burial traditions from graves to rivers. Thus, there is no certain indication that armour was excluded from (whichever type of) sepulchral practice, and we might assume similar depositional practices for both arms and armour for the wider Urnfield Culture.

The combination of material value and work invested in the production of armour certainly suggests a high status and prestigious object, which were used and worn by economical and socially potent persons. But did such bronze body armour serve in combat? And if so, how were the different elements of armour combined?

With the exception of the Dendra grave, which contained a probable complete set of armour, no further sets of armour, comprising cuirass, greaves and helmet, are known. Therefore, all reconstructions, assemblages or combinations of such armour must ultimately be hypothetical.²⁸ It is also likely that a combination of metal and organic body armour was used, of which the latter rarely survives. Whilst the overlapping distribution and chronological contemporaneity of types might be useful indicators for reconstructing sets of armour, different types of the same class were clearly used at the same time (e.g. the fragments of different helmet types in the associated deposit of Nadap), which may reflect different selection processes for specific purposes, as for instance with the different types of armour seen on the Sardinian bronze figurines.

It is extremely unlikely that bronze armour was worn as a plain metal protection alone: greaves were worn over or sewn on to an organic wrapping; helmets had an organic inlay or

²⁴ Hereafter Bz D2. Similar also for Bronze C (Bz C), Bronze D (Bz D), and so on.

²⁵ Hereafter Ha B1 and B3. Similar also for Hallstatt A (Ha A), Hallstatt B (Ha B), and so on.

²⁶ In detail, see: Sperber 2011, 34–35.

²⁷ Sperber 2011, 31.

²⁸ For example, as depicted in Marzatico – Gleirscher 2004, fig. 11b; Milcent 2012, title page.

were worn above an organic cap; the cuirasses were worn over a leather, woollen, felt or textile jerkin, which may have been fixed inside the cuirass, as on the Carpathian and western European cuirasses, while the organic lining was attached directly onto the metal on the Greek examples.

Consequently, bronze armour cannot be considered as less effective than organic armour. Instead, the combination of organic inlay or organic protection worn underneath the bronze armour would have offered an effective, additional layer of protection, with the combined effect considered as far functional as purely organic armour alone. Repairs and traces of use on all classes of armour, as well as the fact that there can be no symbolic object without the reality of what it signifies, indicate that not only weapons but bronze armour were used in combat, be it in a violent melee, in individual sparing or even ritual combat. Thus, it can be concluded that bronze armour did not serve just as a high-status ceremonial version of more effective organic protection but guaranteed instead a higher level of protection and was certainly used as such. This, of course, does not indicate that the armour was used exclusively for fighting for it fulfilled the equally important function as a symbol of wealth, social status or power of its owner or society to which its wearer belonged.

Finally, this volume aims to achieve a more holistic study of European Bronze Age body armour, its manufacture and its use. It is the wish of the author that it may serve also as a base for further experimental studies in both production and utility of helmets, cuirasses and greaves, which would undoubtedly provide further important insights into Bronze Age life, and how armour was part of it: be it in respect of its practical and utilitarian use or aspects of its important ceremonial and symbolic functions.

