# MANUFACTURE OF BRONZE AGE DEFENSIVE ARMOUR IN EASTERN EUROPE

After more than a century of research into Bronze Age defensive armour throughout Europe, development and chronology remains still unclear in wide parts. This is particularly true concerning manufacture techniques and usage of helmets, greaves and cuirasses – only a small number of objects was analysed so far. Despite Uckelmann 2012, Born – Hansen 2001 and partly Lippert 2011, who included some analyses, all studies focused on typology and distribution only. The most well studied objects so far are shields (Uckelmann 2012) and helmets (v. Merhart 1941, Hencken 1971, Clausing 2003; 2005). C. Clausing also studied typological aspects of greaves (2002).

During a three year long project, funded by the Austrian Science Fund (FWF) and Marie-Curie-Actions (FP7), mainly technological aspects of Bronze Age defensive armour are currently studied. Portable XRF, SEM-EDXS-EBSD, η-Raman and metallography are used to characterise composition, microstructure and corrosion features in order to reconstruct alloys used and thermomechanical treatments applied. Additionally, non-invasive analyses as PGAA, PIXE and ToF-ND were carried out on Hungarian defensive armour. Characterising corrosion products of the finds involved, museums and conservators will benefit from the results, knowing more about the effects of different methods of restoration carried out during the last decades and their influence on the current state of the object but also about the corrosion processes occurred during the last 3000 years to enhance restoration techniques. The armour was studied, documented and analysed in museums in the following countries: Bosnia-Herzegovina, Croatia, Czech Republic, Hungary, Romania, Serbia, Slovakia, Slovenia as well as Austria and Germany.

Opposite to weapons as sword or spearheads, finds of Bronze Age defensive armour in Europe are scarce. Around 120 helmets, 95 shields, 40 greaves and 30 to 35 cuirasses are known. Their distribution area differs significantly; i.e. from the United Kingdom we do not know any secure finds of bronze helmets, cuirasses, or greaves. From the Iberian Peninsula, only two helmets, but no greaves, shields or cuirasses

were found – though depictions of helmets and shields are known. Shields are generally lacking in France, the alpine region and Italy, but are common in Northern Europe and the United Kingdom. Full metal cuirasses are only known from France, the Carpathian Basin (Hungary, Slovakia) and Greece – and a miniature of such a cuirass from Austria (Brandgraben). Potential finds are known from Italy, the Czech Republic and Germany. The only overlapping distribution area of all types of armour is the Carpathian Basin and Moravia/Slovakia. Despite a few older finds (conical helmets, the finds from Dendra), metal armour appears first in the beginning of the Urnfield culture (ca. 1300 BC).

Roughly, we can distinguish European helmets in two main groups: in Western Europe, the conical cap is usually made of two halves, resulting in a central crest. In Austria, three cap helmets with round cap and different crests are known. Their chronological classification still is a matter of discussion (most recent: Lippert 2011). In Central and Eastern Europe, conical helmets, decorated cap helmets and bell helmets dominate.

All three types are made of one single metal sheet with a normally cast-on knob or socket at the top. Greaves were distinguished typological so far according to their decoration (most recent Hansen 1994) or their way of application on the feet (Clausing 2002). Bronze Age cuirasses are usually distinguished in an older, eastern-Carpathian group (decoration with engravings and ribs) and a younger, western-Alpine group (decoration with pellets, bosses and ribs).

Interpreting metal arms and armour as a symbol of high status and power, we must also consider that they were most likely used during warfare, melees or (even ritual) combat. Repairs and traces of usage as well as the fact that ‘there can be no rituals or symbols without the reality of what they signify’ (Kristiansen 1999, 188), indicate that not only weapons, but also defensive armour (in our case the studied helmets, greaves and cuirasses) was definitely used during whatever kind of combat. This, of course, does not indicate that the armour was used for fighting only, but includes also the additional function as a symbol of wealth, social status or power of its owner or the society. Nonetheless, metal arms and mainly armour are usually interpreted as non-functional and instead interpreted as for display or for ceremonial character. But what does this interpretation means for the concept of the ‘warrior’ and his role in society in such circumstances?

Documentation and first analyses carried out so far on the armour showed several traces of repair and usage. Also, alloy composition and material characteristics of the tin-bronzes used (6-13.5% tin) support the usability of the bronze objects to be worn effectively as armour. Also, the analyses carried out so far strengthen the typological order of i.e. greaves: greaves with wheel motive show a much wider range of alloy composition than greaves type Kurím. This observation is similar to helmets; also here, different types of helmets have a diverse range of alloys used. Concerning cuirasses, it is worth to note that the cuirasses from Čaka and Čierna nad Tisou have with over 11% of tin the highest tin-amount of all cuirasses – significantly more than other cuirasses analysed as the one from Marmesse and Kér and the potential cuirass from Winklsaß. As far as it can be said during this stage of the project, the alloy composition of the armour is not significantly depending on the main type of armour (means cuirass, greave or helmet), but on the time period.

To pass from the as-cast to the final shape of the object, several steps of cold deformation by hammering followed by recrystallization annealing treatments were applied. The microstructural and compositional features of the cross sections show usually a mostly homogenous solid solution with polygonal recrystallized crystals that suffered a last deformation process. Since intergranular corrosion shows the microstructure – usually recrystallized grains with slipping bands and mechanical twins crossing each other – on many samples, no metallographic etching was necessary. Additionally, this enables further studies on the corrosion products. An interesting aspect of this study was also the discovery of a so far unknown, tentacular type of corrosion (Mödlinger et al. 2012).

Forthcoming analyses within the project will show a clear picture of manufacturing techniques applied, the transfer of technology and the alloys used for the production of the armour, in order to provide a deep insight into this so far unexplored area of Bronze Age craftsmanship.

**Acknowledgments**
The author would like to thank the Austrian Science Fund (FWF) and the FP7/Marie Curie actions who were supporting the research with the Schrödinger-fellowship no. J 3109-G21. Also, the financial support by the access to research infrastructures of the Budapest Neutron Centre in the 7th Framework Programme of the EU (CHARISMA Grant Agreement n. 228330) is gratefully acknowledged. A lot of thanks also to everyone who was supporting and helping with information about and documentation of the armour in all museums concerned.

**Bibliography**
Born, H. – Hansen, S. 2001. Helme und Waffen Alteuropas. Sammlung Axel Guttmann 9 (Mainz).

Clausing, C. 2002. Geschnürte Beinschienen der späten Bronze- und älteren Eisenzeit. Jahrb. RGZM 49, 2002 (2003) 149–187.
Clausing, C. 2003. Spätbronze- und eisenzeitliche Helme mit einteiliger Kalotte. Jahrb. RGZM 48, 2001 (2003) 199–225.
Clausing, C. 2005. Zwei neue urnenfelderzeitliche Bronzehelme mit Scheitelknauf. Archäologisches Korrespondenzblatt 35, 31–38.
Egg, M. – Tomedi, G. 2002. Ein Bronzehelm aus dem mittelbronzezeitlichen Depotfund vom Piller, Gemeinde Fliess, in Nordtirol. Archäologisches Korrespondenzblatt 32, 543–560.
Hansen, S. 1994. Studien zu den Metalldeponierungen während der älteren Urnenfelderzeit zwischen Rhônetal und Karpatenbecken, Universitätsforschungen zur prähistorischen Archäologie 21 (Bonn).
Hencken, H. 1971. The earliest European helmets. Bronze Age and Early Iron Age. Am. School Prehist. Research, Bull. 28 (Cambridge/ Mass.).
Kristiansen, K. 1999. The Emergence of Warrior Aristocracies in Later European Prehistory and Their Long-Term History, in: J. Carman – A. Harding (eds.), Ancient Warfare (Stroud), 175–189.
Lippert, A. 2011. Die zweischaligen ostalpinen Kammhelme und verwandte Helmformen der späten Bronze- und frühen Eisenzeit. Archäologie in Salzburg 6 (Salzburg).
V. Merhart, G. 1941. Zu den ersten Metallhelmen Europas. Bericht der Römisch-Germanischen Kommission 30, 4–42.


e-mail: marianne.moedlinger@univie.ac.at

This article should be cited like this: M. Mödlinger, Manufacture of Bronze Age Defensive Armour in Eastern Europe, Forum Archaeologiae 65/XII/2012 (http://farch.net).