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The Metalworker and his tools / Le métallurgiste et ses outils

23-26 Jun 2016

Belfast

United Kingdom

Table of contents

Conference Programme	3
Tools and technology	8
Analyse fonctionnelle des supports de frappe métalliques de l'âge du Bronze, Maxence Pieters	9
Defining early technological traditions in Iberia, Mercedes Murillo Barroso	10
Impact of the mould material during casting of copper-based alloys artefacts: the non-equilibrium conditions, Justine Vernet [et al.]	11
Lithic metalworking tools from the chalcolithic hilltop settlement of Outeiro Redondo (Central Portugal), João Luis Cardoso [et al.]	12
Minimum Tools Required: A system for organising the metalsmith's workshop, Elpidia Fregni	13
Soufflets et chalumeaux de l'âge du Bronze en Europe occidentale, Thibault Lachenal	14
Stones in the metallurgical chaîne opératoire: an integrative functional assessment, Selina Delgado Raack	15
The Axe of Ahneby or How to cheat a Customer who wants to buy a precious foreign Object, Mechtild Freudenberg [et al.]	17
The changing face of the metalworker's toolkit: a survey of the evidence from Bronze Age Scotland, Trevor Cowie	18
Tracing Multimetal Craftsmanship through Metallurgical debris – Open air workshops and multimetallity in Late Iron Age Scandinavia, Andreas Svensson	19

Tracing a Balkan metalsmith: tools, marks and debris in the 5th millennium BC, Verena Leusch [et al.]	21
Tools and workshop	22
A stone to die for-evidence for early gold working from Hacketstown, Co. Waterford, Mary Cahill	23
Bragny-sur-Saône and Talant, two late Hallstatt metallurgical production sites in central Burgundy., Jean-Loup Flouest [et al.]	24
Fine metalworking tools and workshops in Western and Northern Europe – a diachronic consideration, Barbara Armbruster	25
Intentionel or accidental design? The tale of Minoan double axes and chisels, Maria Lowe Fri	26
Réflexions sur la structuration de la production métallurgique des sites du Bronze final en Ile-de-France, Paul Brunet [et al.]	27
The place and space of non-ferrous metalworking in Iron Age Britain and Ireland, Sophia Adams	28
Tools and Techniques-Hands On Experience, Brian Clarke	29
Tools, metal products and workshops in Early Iron Age : towards a first synthesis on metal craftsmen in West Hallstatt territories (630-425 BC)., Emilie Dubreucq	30
Un atelier de bronzier au milieu d'un habitat à Montélimar (France, Drôme) au Bronze final, Sylvie Cousseran-Néré [et al.]	31
Un atelier de travail du fer du (Hallstatt D-La Tène ancienne) en contexte d'habitat, le cas de Weyersheim Les Hauts de la Zorn (Bas-Rhin)., Matthieu Michler [et al.]	33
Tools; rituals and society	36
Artisans du métal laténiens et pratiques rituelles non funéraires : le cas de la Gaule du Ve av. J.-C. à la conquête romaine., Thibault Le Cozanet [et al.]	37
Hammers of the Gods: The role of metalworking tools in the interpretation of hoards in Late Bronze Age Britain, Elpidia Fregni	38
Life histories of Bronze Age moulds, Leo Webley	39

Sacred or profane? Some considerations of the purpose of hoarding metals in Bronze Age Western Europe, Davide Delfino	40
Tools in ritual contexts – Remarks on the social position of Bronze Age metal workers through the lens of their implements in hoards and graves, Bianka Nessel	41
Tools in tombs: an overview of Late Bronze Age funerary contexts in eastern France and Baden-Württemberg (14th-12th century BC), Rebecca Peake [et al.]	42
poster	43
Embossed ornaments on Gold objects of the Early Iron Age in South-West-Germany – tools and experimental work, Birgit Schorer	44
Experimental casting pit for bronze items, Alessandro Armigliato	45
First results of micrometallographic analysis of metalworking tools in graves of metallurgists in Moravia/Czech Rep., Jaroslav Peška [et al.]	46
Les outils lithiques liés à la déformation plastique des métaux du site de Cuciurpula (Corse, Bronze final/premier âge du Fer), Linda Boutoille [et al.]	47
Metallurgists and their craftwork in the archaeological record, Katja Martin . . .	48
Mines - Copper - Artisans in the steppe of the Late Bronze Age, Nikolai Shcherbakov [et al.]	49
The metalworking toolset found at Upton Lovell G2a, Wiltshire, England., Linda Boutoille	51
Author Index	51

Conference Programme

Thursday, June 23, 2016

14:00 pm to 18:00pm	Special lecture by Dr Barbara Armbruster “Gold during the Metal Ages” + refreshments - see website for details
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Friday, June 24, 2016

8:50 am to 9:10 am	Registration opens
9:20 am to 9:30 am	Welcome
	Session 1: tools and technology
9:30 am to 9:50 am	Stones in the metallurgical <i>chaîne opératoire</i>: an integrative functional assessment. <i>Selina Delgado Raack</i>
9:50 am to 10:10 am	Defining early technological traditions in Iberia. <i>Mercedes Murillo Barroso</i>
10:10 am to 10:30 am	Lithic metalworking tools from the chalcolithic hilltop settlement of Outeiro Redondo (Central Portugal). <i>João Luis Cardoso, Dirk Brandherm, Linda Bouteille</i>
10:30 am to 10:50 am	Discussion
10:50 am to 11:20 am	Refreshments
11:20 am to 11:40 am	The axe of Ahneby or how to cheat a customer who wants to buy a precious foreign object. <i>Mechtild Freudenberg, Leif Glaser</i>
11:40 am to 12:00 am	Tracing a Balkan metalsmith: tools, marks and debris in the 5th millennium BC. <i>Verena Leusch, Miljana Radivojević</i>
12:00 pm to 12:20 pm	Tracing multimetal craftsmanship through metallurgical debris – Open air workshops and multimetallurgy in Late Iron Age Scandinavia. <i>Andreas Svensson</i>
12:20 pm to 12:40 pm	Minimum tools required: a system for organizing the metalsmith’s workshop. <i>Elpidia Fregni</i>
12:40 pm to 13:00 pm	Discussion
13:00 pm to 14:00 pm	Lunch (not provided)
14:00 pm to 14:20 pm	The changing face of the metalworker’s toolkit: a survey of the evidence from Bronze Age Scotland <i>Trevor Cowie</i>

14:20 pm to 14:40 pm	Impact of the mould material during casting of copper-based alloys artefacts: the non-equilibrium conditions. <i>Justine Vernet, Paolo Piccardo</i>
14:40 pm to 15:00 pm	Soufflets et chalumeaux de l'âge du Bronze en Europe occidentale. <i>Thibault Lachenal</i>
15:00 pm to 15:20 pm	Discussion
15:20 pm to 15:40 pm	Refreshments
15:40 pm to 16:00 pm	Analyse fonctionnelle des supports de frappe de l'âge du Bronze. <i>Maxence Pieters</i>
16:00 pm to 16:20 pm	A stone to die for-evidence for early gold working from Hacketstown, Co. Waterford. <i>Mary Cahill</i>
16:20 pm to 16:40 pm	Discussion
16:40 pm to 17:00 pm	Posters session
17:00 pm to 18:00 pm	UISPP commission "Metal Ages in Europe"
18:00 pm to 19:30 pm	Wine reception sponsored by The Prehistoric Society and the Ulster Archaeological Society

Saturday, June 25, 2016

	Session 2 : tools and workshops
9:00 am to 9:20 am	Tools and Techniques-Hands on experience. <i>Brian Clark</i>
9:20 am to 9:40 am	Fine metalworking tools and workshops in Western and Northern Europe – a diachronic consideration <i>Barbara Armbruster</i>
9:40 am to 10:00 am	Intentional or accidental design? The tale of Minoan double axes and chisels. <i>Maria Lowe Fri</i>
10:00 am to 10:20 am	Un atelier de bronzier au milieu d'un habitat à Montélimar (Drôme, France). <i>Sylvie Cousseran-Néré, Eric Néré, Marilou Nordez</i>
10:20 am to 10:40 am	Discussion
10:40 am to 11:10 am	Refreshments
11:10 am to 11:30 am	Réflexions sur la structuration de la production métallurgique des sites du Bronze final en Ile-de-France. <i>Paul Brunet, Patrick Gouge, Muriel Melin, Eric Néré, Théophane Nicolas, Rebecca Peake, Daniel Simonin, Linda Boutolle</i>
11:30 am to 11:50 am	The place and space of non-ferrous metalworking in Iron Age Britain and Ireland.

11:50 am to 12:10 pm	<p><i>Sophia Adams</i></p> <p>Tools, metal products and workshops in Early Iron Age: towards a first synthesis on metal craftsmen in West Hallstatt territories (630-425 BC).</p> <p><i>Emilie Dubreucq</i></p>
12:10 pm to 12:30 pm	<p>Bragny-sur-Saône and Talant, two late Hallstatt metallurgical production sites in central Burgundy</p> <p><i>Jean-Loup Flouest, Régis Labeaune</i></p>
12:30 pm to 12:50 pm	Discussion
13:00 pm to 14:00 pm	Lunch (not provided)
14:00 pm to 14:20 pm	<p>Un atelier du travail du fer du Hallstatt D – La Tène ancienne en contexte d'habitat, le cas de Weyersheim « les Hauts de la Zorn » (Bas-Rhin, France).</p> <p><i>Matthieu Michler, Patrick Clerc, Forent Jodry, Marion Béranger, Luisella Cabboi</i></p>
	Session 3: tools, rituals and society
14:20 pm to 14:40 pm	<p>Life histories of Bronze Age moulds.</p> <p><i>Leo Webley</i></p>
14:40 pm to 15:00 pm	<p>Sacred or profane? Some considerations about use of hoarding metals in Bronze Age Western Europe.</p> <p><i>Davide Delfino</i></p>
15:00 pm to 15:20 pm	<p>Hammers of the Gods: the role of metalworking tools in the interpretation of hoards in Late Bronze Age Britain</p> <p><i>Elpidia Fregni</i></p>
15:20 pm to 15:40 pm	Discussion
15:40 pm to 16:10 pm	Refreshments
16:10 pm to 16:30 pm	<p>Tools in ritual contexts – Remarks on the social position of Bronze Age metal workers through the lens of their implements in hoards and graves.</p> <p><i>Bianka Nessel</i></p>
16:30 pm to 16:50 pm	<p>Tools in tombs: an overview of Late Bronze Age funerary contexts in eastern France and Baden-Wurttemberg (14th-12th century BC).</p> <p><i>Rebecca Peake, Claude Mordant, Mafalda Roscio, Stefan Wirth</i></p>
16:50 pm to 17:10 pm	<p>Artisans du métal laténiens et pratiques rituelles non funéraires: le cas de la Gaule du Ve av. J.-C. à la conquête romaine.</p> <p><i>Thibault Le Crozanet, Gérard Bataille</i></p>
17:10 pm to 17:50 pm	Discussion + Close

Sunday, June 26, 2016

9:00 am to 16:00 pm	Fieldtrip to the Navan Fort and Beaghmore stone circle – see website for details
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Posters

Embossed ornaments on gold objects of the Early Iron Age in South-West-Germany – tools and experimental work.

Birgit Schorer

Experimental casting pit for bronze items.

Alessandro Armigliato

Mines-Copper- Artisans in the steppe of the Late Bronze Age.

Nikolai Shcherbakov, Miljana Radivojević, Iia Shuteleva, Tatiana Leonova

Metallurgists and their craftwork in the archaeological record.

Katja Martin

First results of micrometallographic analysis of metalworking tools in graves of metallurgists in Moravia/Czech Rep.

Jaroslav Peška, Jindřich Štelcl

The metalworking toolset found at Upton Lovell G2a, Wiltshire, England.

Linda Bouteille

Les outils lithiques liés à la déformation plastique des métaux du Site de Cuciurpula (Corse, Bronze final/premier âge du Fer).

Kewin Peche-Quilichini, Linda Bouteille

Tools and technology

Analyse fonctionnelle des supports de frappe métalliques de l'âge du Bronze

Maxence Pieters * ¹

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Les supports de frappe métalliques de l'âge du Bronze recouvrent une remarquable variété d'outils, malgré la minceur du corpus connu (à peine plus d'une trentaine d'individus en Europe). L'analyse de la structure de chaque outil permet d'en déterminer les parties actives et d'identifier sa fonction. On peut ainsi distinguer des outils multifonctions (enclumes) et des outils spécialisés (tas, bigornes, matrices...). Derrière chaque support de frappe, ce sont ainsi des gestes techniques qui apparaissent, mettant en évidence, dès le Bronze final, une maîtrise des principales techniques de déformation plastique du métal utilisées jusqu'au XVIII^e siècle, à l'exception du corroyage, spécifique au fer.

À partir de ces gestes techniques, il est possible d'aborder les productions induites. Les enclumes, principaux supports de frappe répertoriés (70 %), sont conçues systématiquement comme des outils multifonctions. L'ensemble des opérations techniques autorisées par l'enclume permet de déterminer la nature de la production envisagée lors de la conception de l'outil. En complément, les assemblages d'outils contenant plusieurs supports de frappe offrent une vision de la diversité des opérations techniques réalisées dans un atelier. Intervient alors la notion de métier, qui s'avère différente de celle que nous connaissons à partir de la période romaine et jusqu'au XIX^e siècle.

Cette analyse technique des supports de frappe permet de mettre en évidence la conception originale de chaque outil, une même opération technique étant généralement déclinée en autant de solutions qu'il existe d'outils. Néanmoins, des points communs dans la conception générale des enclumes révèlent l'existence de traditions techniques qui évoluent dans le temps et l'espace, sans toujours se superposer aux aires culturelles définies à partir d'autres mobiliers.

Keywords: Support de frappe, technique, analyse fonctionnelle, métier, geste

*Speaker

Defining early technological traditions in Iberia

Mercedes Murillo Barroso * ¹

¹ UCL, Institute of Archaeology – United Kingdom

The study of different metallurgical and technological traditions can give us some clues on how the technological knowledge is transmitted, spread, adapted or modified by different societies.

This paper will present the study of one of the main metallurgical focus in Iberia during Copper and Bronze Ages. The technological tradition of SE Iberia is defined by archaeometallurgical analyses of three metallurgical workshops in an area of 30km. The whole metallurgical chaîne opératoire, from ore to objects, have been recovered in situ in these three workshops. Based on archaeometallurgical analyses the whole metallurgical process is reconstructed. Specific choices on crucible fabrics or blowing pipes will be addressed.

Keywords: Copper metallurgy, Archaeometry, Crucibles, Blowing pipes

*Speaker

Impact of the mould material during casting of copper-based alloys artefacts: the non-equilibrium conditions

Justine Vernet * ¹, Paolo Piccardo ¹

¹ Laboratorio di Metallurgia e Materiali, DCCI, Università degli Studi di Genova – Italy

Archaeological excavations on metallurgical sites or smith hoards from the Bronze Age and Iron Age brought to light a wide quantity of inorganic material fragments, like stone or clay, that might have been used as mould during early casting processes. Even for the recent period, mould typology is still used in order to classify the diverse casting processes.

From the material science point of view, the basic difference between those materials stays in the resulting cooling rate applied to the poured melt. Indeed, as each material is endowed with specific thermal properties, they do not get the same ability to remove the heat bought during the process and the as-cast artefacts do not solidify at the same rate. As a consequence, phase diagram, that provide for phase transformations in function of time for equilibrium conditions (extremely low transformation rate), could not be follow anymore and new cooling curves have to be investigated and design.

The study between archaeometric and experimental archeology proposes to test four classical mould materials, i.e. sand, clay, stone and metal, for copper-based alloys casting through a thermal monitoring in order to determine the real cooling range applied on the molten metal and compare the repercussion on the resulting artefact microstructures. A numerical casting simulation is also performed for comparison.

Keywords: Mould casting, cooling rate, microstructure, non, equilibrium state

*Speaker

Lithic metalworking tools from the chalcolithic hilltop settlement of Outeiro Redondo (Central Portugal)

João Luis Cardoso* ¹, Dirk Brandherm† ², Linda Bouteille ‡§ ²

¹ Centro de Estudos Arqueológicos de Oeiras – Portugal

² Queen’s University Belfast [Belfast], School of GAP – University Road Belfast, BT7 1NN, Northern Ireland, UK, United Kingdom

The fortified hilltop settlement of Outeiro Redondo (Sesimbra, Estremadura) has produced one of the more significant assemblages of lithic metalworking tools from the Chalcolithic and Early Bronze Age on Iberia’s Atlantic façade. In contrast to most similar implements known from 3rd millennium settlement contexts in western Iberia, at Outeiro Redondo the finds in question were retrieved from well-defined contexts in modern excavations. This paper discusses the functional characteristics of the tool assemblage from Outeiro Redondo and its archaeological context, with the ultimate aim of gaining insights into the *chaînes opératoires* of early metalwork production and the social division of labour in the Chalcolithic societies of south-western Europe.

Keywords: Chalcolithic, Early Bronze Age, Outeiro Redondo, Hilltop, lithic metalworking tools, Portugal

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Minimum Tools Required: A system for organising the metalsmith's workshop

Elpidia Fregni * ¹

¹ independent researcher – Italy

In Britain there is little evidence for actual metalworking from Bronze Age contexts and only a fraction of the tools necessary to make metal objects have been recovered.

In order to understand what would constitute a suite of materials and tools necessary for a Bronze Age metalworker's toolkit, an inventory was made of known metalworking tools from the archaeological record. This was cross-referenced with the tools and materials used in both modern workshops and ethnographic settings. This catalogue, along with an understanding of the chaîne opératoire for creating metal objects, provide the components for establishing a system that will yield a clearer image of the organisation of the metalsmith's workshop.

The resulting system provides a means to assess assemblages and interpret suites of tools. This knowledge could indicate specific metalworking tasks, such as casting or sheet metal work. In addition, this system, combined with experimental work, is useful for the recognition of the tools that are missing in the archaeological record, thus providing a more complete understanding of the organisation of the metalsmith's craft in antiquity.

Keywords: tools, workshop, chaîne opératoire, metalworking

*Speaker

Soufflets et chalumeaux de l'âge du Bronze en Europe occidentale

Thibault Lachenal * ¹

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Cette contribution s'intéressera aux objets coniques perforés en céramique que l'on retrouve généralement regroupés sous l'appellation de tuyère dans la littérature francophone. Leurs contextes de découvertes (sépultures de métallurgistes, ateliers de réduction), de même que les représentations figurant dans d'autres contextes culturels (Égypte ancienne, Amérique précolombienne) permettent de les associer à l'alimentation en air des foyers dans le cadre d'activités métallurgiques, au sens large du terme. Leurs caractéristiques morphologiques permettent néanmoins d'en dégager plusieurs types pouvant répondre à des différences fonctionnelles, avec au moins, d'une part, des objets correspondant à des extrémités de chalumeaux et, d'autre part, à des buses de soufflets. La répartition géographique et chronologique des différents types identifiés sera discutée pour l'âge du Bronze ancien et moyen en Europe occidentale. L'objectif est d'identifier des pôles d'innovation et d'éventuels axes de diffusion de ces objets pouvant révéler la présence de différentes traditions techniques de ventilation des foyers métallurgiques. Les objets du Néolithique, moins nombreux, et du Bronze final, dont la fonction est plus évidente, seront également évoqués afin de discuter de l'évolution de ces pratiques.

Keywords: Age du Bronze, Europe occidentale, tuyère, chalumeau, soufflets, techniques métallurgiques

*Speaker

Stones in the metallurgical chaîne opératoire: an integrative functional assessment

Selina Delgado Raack * ¹

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Starting with Semenov’s publications in the 1960s, functional studies on prehistoric artifacts developed as a genuinely archaeological methodology. Since then, important improvements have been made with the aid of experimental archaeology, ethnoarchaeology and material sciences. In this process, use-wear analyses has focused fundamentally on chipped and bone tools, but in the last decades significant progress has been achieved also with regard to other artifact remains, like macrolithic artifacts.

The relevance of stone tools in metal working process has been suspected for a long time, mainly on the basis of the presence of some of these tools in prehistoric burials. In recent times, a growing number of archaeologists from Eastern, Central as well as Western Europe, working generally independently from one another, have become concerned about these tools and their meaning in the archaeological contexts.

Our contribution to the study of this type of artifact has been directed to establish a research line aimed at recognizing and characterizing the lithic instruments involved in the production of metallic objects during European Bronze Age, that is to say, a context where the dawn of the first class societies happened on the continent.

Our presentation will continue and extend previous work and will be addressed to review some of the most relevant results achieved through a strategy which systematically integrates petrography, morphometry, functional analysis and mechanical properties of stones, as well as spatial analysis. This has allowed us:

- (a) to recognize the intervention of macrolithic artifacts in practically the complete metallurgical *chaîne opératoire*, ranging from the exploitation of ore to the finishing/maintaining of metal objects, through the casting and forging,
- (b) to redress old functional interpretations of certain lithic artifacts, for which some technological attributes were erroneously taken as diagnostic for metallurgical instruments,
- (c) to verify the participation of recent findings in the process of metallurgical production and to better specify their functionality through the use of new analytical techniques, regarding residue analysis in particular.

*Speaker

Keywords: Macrolithic artifacts, Petrography, Morphometry, Use, wear Analysis, Residues Analysis, Bronze Age

The Axe of Ahneby or How to cheat a Customer who wants to buy a precious foreign Object

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The British Isles axe found at Ahneby, Kr. Schleswig-Flensburg is the most spectacular bronze object found in Schleswig-Holstein from the late Neolithic period. Therefore, it was the first object we started to analyse when we began our cooperation between the Archäologische Landesmuseum in Schleswig and the Deutsche Elektronen-Synchrotron (DESY) in Hamburg. We wanted to find out as much as possible about how it was produced and how it was used. We also experimented with casting replicates and working with stone tools for metalworking. We used the facility of a 19th century foundry as well as replicated hearth and blow pipes or simple bellows for our casting experiments.

For a long time, available methods for investigations of the fabric of the objects were limited to sampling and the inspection of polished section. Fortunately that changed and investigation of texture and strain in historic axes was performed using neutron time of flight and neutron diffraction mainly in the last decade. We chose an approach which is slightly less accurate concerning the absolute strain measured in the sample, but as we will show, it helps to easily distinguish the three main states that copper and bronze axes may be in: cast, forged and tempered (after previous cold working). We compared the results of the measurements of the originals with the objects produced in our experiments. The scanning of the surface revealed problems of the casting process and the ways the craftsmen disguised them.

Measurements were done using high energy diffraction in transmission for structural information, X-ray diffraction at lower energies in reflection for surface analysis and X-ray fluorescence in reflection to gather information of the surface chemistry. The experiments were performed at the DORIS III Beamlines L, G3 and HARWI and the PETRA III HEMS Beamline P07 at the DESY.

Keywords: Experiments, forging, casting, strain measurement, X, ray diffraction, X, ray fluorescence

^{*}Speaker

The changing face of the metalworker's toolkit: a survey of the evidence from Bronze Age Scotland

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Kingdom

Scotland has an unusually rich inventory of finds of Early Bronze Age stone moulds, and a growing number of excavated sites with evidence of Late Bronze Age/Early Iron Age metalworking. This conference offers an opportunity to take stock of the metalworker's toolkit over the period as a whole, from the inception of copper- and gold-working around 2500BC to the transition to full ironworking around 800BC. The evidence is too uneven across this wide time span to distil a continuous narrative of metalworking practice; however by playing to its strengths at certain periods, the Scottish record can be used to explore a number of the themes of the meeting, ranging from specific issues such as mould technology through to wider concerns of workshop organisation and scales of production.

Keywords: Early Bronze Age, stone moulds, Scotland

*Speaker

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Tracing Multimetal Craftsmanship through Metallurgical debris – Open air workshops and multimetality in Late Iron Age Scandinavia

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Metallurgical debris is by far the most informative source-material for studying the metal craftsmanship of the past. In comparison to the finished objects, which has attracted far more attention in archaeological research, debris material are more or less confined to the original workshop sites and hence provide direct evidence as to production volume and quality, site organization, artisanal skill and operational sequences within the various crafts.

On many sites throughout the "Metal Ages" evidence of both iron smithing and the use of non-ferrous metals can be found. Traditionally, a clear division between these types of crafts has been enforced in site interpretation, separating sites into ferrous versus non-ferrous workshop sites chronologically or spatially. However, the presence of, for instance, smithing slag cakes with droplets of Cu-alloy within their matrix as well as casting debris of both metals and ceramic materials in forges and smithing hearths challenges this strict division.

The thesis project "*From Crucible and onto Anvil*" started in 2015 and focuses on sites housing remains of multimetal craftsmanship dating primarily from AD500-1000. Within the project a comprehensive survey of sites will be used to evaluate the presence of multimetal craftsmanship in the landscape based first and foremost on the metallurgical debris documented on or collected from them. Sites in selected target areas will be subject to intra-site analysis of their metallurgical remains focusing on workshop organisation, the array of metalworking techniques utilized and the chronological variances of multimetal craftsmanship.

A primary aim in the project is to elucidate the conceptual aspects of complex metalworking. The term *multimetality* is used to analytically frame all the societal and cosmological aspects of metal craftsmanship. Through this inclusive perspective both the metal craftsmanship and the metalworkers behind it are positioned within the overall socioeconomic framework. The metalworkers, their skills and competences as well as the products of their labour are viewed as dynamic actors in the landscape and on the arenas of political economy of the Late Iron Age.

This paper aims to present a few examples of the surveyed multimetal sites, discuss workshop reconstruction through metallurgical debris and present preliminary interpretations of the sites internal organisation and placement within the cultural landscape. Many of the sites surveyed so far are interpreted as open air workshops with a relatively long continuity ranging several

*Speaker

generations of metalworkers. How is this to be interpreted? Where the multimetal craftsmanship undertaken of temporary character? And if so, why did the metalworkers continue to use the same workshop site for generations?

The concept of *multimetality* and the possibilities to capture this elusive, yet crucial, element of metal craftsmanship through the study of metallurgical debris will also be discussed in the paper. The surveyed sites and the reconstruction of their internal workshop organisation will serve as examples of how *multimetality* was manifested on the sites and in the landscape.

Keywords: Multimetality, Metallurgical debris, Iron Age Scandinavia, Multimetal Craftsmanship

Tracing a Balkan metalsmith: tools, marks and debris in the 5th millennium BC

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The emergence of copper, gold and tin bronze metallurgy in the early to mid 5th millennium BC Balkans regions speaks of the great demand for shiny metal objects as much as the fast evolving metalmaking skills in the area (e. g. Radivojević, et al. 2010; Leusch, et al. 2014; Leusch, et al. 2015). Nevertheless, while there is vast evidence for extant metal implements in the Balkans, little is known about metallurgical installations, tools and the lives of metalsmiths at the time. The most recent archaeometallurgical research in the region revealed the ephemeral nature of early copper slags and potential smelting installations within the Vinča and Karanovo culture settlements (Leshtakov 2013; Radivojević 2015). Other possibly related evidence includes blowpipes and crucibles from other 5th millennium BC sites, although the great majority of evidence most likely goes unnoticed in the archaeological record due to the untypical shape these artefacts have, either for unidentifiable function or high temperature treatment.

Here we present a synthesis on the current state of evidence related to the 5th millennium BC copper and gold making in the Balkans. We gather all available data to give a general overview of how the typical chaîne opératoire of metallurgical activities looked like, along with a set of tools that we managed to recognise either through archival or own research. To this, we add data from Bulgarian Chalcolithic cemeteries to reconstruct the lives of metalsmiths at the time, and address the current debates on their high social status. Furthermore, we present results from copper smelting experiments aimed to replicate archaeometallurgical materials from the region. Our comparative analyses are used to build explanatory models of how the early smelting process was operated, which tools were used and how can we identify metalsmiths in the archaeological record of the 5th millennium BC Balkans.

Keywords: archaeometallurgy, metal working, Chalcolithic, copper, gold

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Tools and workshop

A stone to die for-evidence for early gold working from Hacketstown, Co. Waterford

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While there are numerous objects in the form of discs, plaques and lunulae to attest that gold-working was an active and developed craft specialisation in Early Bronze Age Ireland, there are very few objects that can be proposed as tools of the trade. One very unusual stone object found at Hacketstown, Co. Waterford, can be identified as die or mould for the production of very fine gold foil discs. These foils were used as covers for objects such as jet buttons. The date of the object is secured by its close similarity to gold discs of the period. Its presence suggests that there must have been an early goldsmithing workshop in the general area of discovery-something that has eluded archaeology in an Irish context.

Keywords: Gold, stone, die

*Speaker

Bragny-sur-Saône and Talant, two late Hallstatt metallurgical production sites in central Burgundy.

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Bragny-sur-Saône (48 km south of Dijon) is a major metallurgical production site on the long distance trade route of the Saône/Rhône valley during the 5th c.B.-C. Talant (western suburb of Dijon), at the same period, was specialized in making small objects either in iron or in bronze. The processing phases on both sites have been thoroughly examined. A common set of tools and techniques have been identified for working and finishing either brooches, bronze vessels, including a range of stone tools. The site at Bragny-sur-Saône includes an earlier phase in the processing, not the smelting, but the refining of blooms and the soldering of bars on a very large scale (15 t is the estimated amount of slags). Therefore, though these sites made the same small objects, the main difference is that Bragny's site yielded a fair number of various imported goods (greek, massilian, etruscan, golaseccian) suggesting wealthy blacksmiths more than a slave activity dependent on a princely site.

Keywords: workshops of the 5th c.B., C., bloom refining, bars soldering, processing lines for iron and bronze manufactured goods

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Fine metalworking tools and workshops in Western and Northern Europe – a diachronic consideration

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This paper deals with an aspect of the history of technology, more precisely with a diachronic overview of tools and workshops used for fine metalworking. It gives a comprehensive assessment of the improvement in morphology, materials and function of early metallurgists' tool equipment. From the inception of metallurgy in Western and Northern Europe in the third millennium BC to the Roman Iron Age and Viking period in the first millennium AD, the tools and manufacturing techniques for gold, silver, and bronze artefacts developed in step with each technological improvement. An interdisciplinary approach to the study of metalworking tools and workshops – combining archaeology, tool mark analyses, ethnoarchaeology, experimental archaeology, iconography, and information from ancient written sources with analyses from material sciences – is proposed. Case studies from Western and Northern Europe illustrate the various specialized implements employed in the fine metalworker's workshop, the raw materials chosen, the tool making, and how tools were handled. This diachronic vision allows us to draw a picture of the metal workshop's equipment and organization through time and space.

Keywords: Keywords: Fine metalworking, tools, workshops, Metal Ages, Roman Iron Age, Viking Age, history of technology

*Speaker

Intentionel or accidental design? The tale of Minoan double axes and chisels

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Numerous Minoan tools have been uncovered by excavations and the most common way of dealing with the material is to classify and place them in a typology. Strictly speaking the typologies demonstrates a tool's development in shape but is also used as a chronological guideline. Typology construction is a method visualizing the archaeological material, but regarding tools, what is it we typologize? – an as-cast tool with no finishing treatment completed or a tool with a hammered body and sharp cutting edges or a used blunt tool? With these aspects in mind what *is it* we really can conclude with so many different parameters in a typology?

The only convincing conclusion is that tools are of different shapes. But is this intentional or accidental? Many improvements of various objects are due to skilled workmen/women with an understanding of the manufacturing process and an understanding of what the end product will be used for. However, many improvements and developments of objects are due by mere chance or in other words accidental improvements, none the less, important but not thought of during the manufacturing process.

I would like to present some thoughts and conclusions on shape and development of tools by using; already existing typologies and experimental archaeology, and by rising the question are the Minoan double axes and chisels intentionally or accidentally designed?

Keywords: Double axe, Chisel, Bronze Age, Minoan

*Speaker

Réflexions sur la structuration de la production métallurgique des sites du Bronze final en Ile-de-France

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A travers un inventaire exhaustif des indices en lien avec la métallurgie d'alliage cuivreux (creuset, moule, tuyère, mobilier lithique, lingot, objets brut de coulé, fours...) notre objectif est d'affiner notre perception des mécanismes d'interactions et d'insertion de cet artisanat en fonction du type et/ou du statut des contextes d'habitat.

Après avoir identifié les éléments qui permettent de définir un atelier (aménagement spécifique, déchets, moules...), nous devons également discuter la question de la représentativité de ces vestiges artisanaux vu leurs découvertes lacunaires (taphonomie, pratiques..). Nous tenterons également de déterminer si certaines activités ou productions spécifiques sont préférentiellement localisées. De fait, si la nature des activités métallurgiques est différente nous devons nous poser la question de la diversification ou de la spécialisation de la production tout en se posant la question de l'éventualité d'une activité artisanale mobile.

The main aim of this paper is to refine the perception of the interaction and insertion mechanisms of metalworking in relation to the type and status of settlement contexts, using a comprehensive inventory of copper working in the region (crucible, mould, tailpipe, stone objects, ingots, casts, ovens, ...). After defining the elements that can be used to identify a workshop (a specific layout, waste products, moulds, ..), the question of the representativeness of these objects in the light of their rarity (taphonomy, practices, ..) will be tackled. It is also necessary to determine the preferential location of specific activities or productions. If the nature of metalworking is in fact different we need to address the issue of its diversification or specialisation as well as tackling the itinerant aspects of this type of activity.

Keywords: métallurgie, Bronze final, artisanat, outils, ateliers, Ile, de, France

^{*}Speaker

The place and space of non-ferrous metalworking in Iron Age Britain and Ireland

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The evidence for the production of Iron Age non-ferrous metal objects in Britain and Ireland ranges from fragments of crucibles to deposits of moulds to concentrations of casting paraphernalia and debris. This paper presents the range of Iron Age data collected from more than 250 sites. Over half of the finds are recovered from pits and ditches or gullies. Whereas only a small percentage are associated with structural remains such as postholes and floors, and even less are associated with specific hearth or furnace features. Tools that may have been used for metalworking are more closely connected with hillforts, ritual sites and burials. Where they are found on settlements they are either the only possible metalworking artefact or are associated with abundant bronze-working debris. Crucibles, on the other hand, have a more widespread distribution, are far more frequent in settlements and quantities vary across a range of sites. In this paper we explore the association between these material remains and the specific features and types of sites to examine the organisation and social significance of metalworking at this time. Does the evidence tell us more about deposition behaviour than production location? If the former, then how does this feed into our understanding of the social context of metalworking, metalworkers, manufacturing tools and casting remains? If the latter, then how may we interpret the association or lack of association with structural features to address the concepts of metal workshops as buildings or as a collection of actions not connected to a specific space?

Keywords: metalworking, non, ferrous, workshops, bronze, tools, crucibles, structural remains

*Speaker

Tools and Techniques-Hands On Experience

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My submission is a powerpoint presentation which is image driven and records my experimentation in the making of a Ribbon Torc, a Lunula, Flanged Torc and some Beaded Wire. Items which are made by forging and not casting, where the plasticity of the metal is exploited, use the same techniques now as were used in antiquity, for example, forging out a bar or sheet from a cast ingot. How it was actually done in antiquity is a matter of conjecture, unless an item is found in the workshop setting with the associated tools in place. This probably does not indicate how many people worked on a specific project.

Keywords: Gold, Torc, Ribbon, Flanged, Twisted, Lunula, Beaded, Wire.

*Speaker

Tools, metal products and workshops in Early Iron Age : towards a first synthesis on metal craftsmen in West Hallstatt territories (630-425 BC).

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For lack of representation in the funeral world or in the written and iconographic sources, our understanding of craftsmen during the early Iron Age has been developed mainly through the study of their end products, taking into account the diversity and degrees of skills used in the manufacturing of those objects. As a complementary source of information, the study of the structure of production [the workshop as a working place, the study of the wastes produced and the range of tools] enables also the characterisation of their activity while it illustrates the organisation of their work as well as their daily life.

The characterisation of the metal production features seems to me a central topic for a period when hillforts and the settlements at the foot of these hillforts are reoccupied, constituting power centres but also main productions centres. At the same time, from a technical point of view, it is the period which also sees the development the iron metallurgy with an increase in the quantities of this metal, which extends little by little into more diversified domains of society than during the time of this introduction when it was limited then almost exclusively to the domain of weaponry.

In this paper, we present some significant examples of tools (their marks on the metal products, their function, their use in the workshop) at the end of the early Iron Age. Finally this paper aims at towards a first synthesis about metal craftsmen in West hallstatt territories, to show how they were actors and essential pillars of the economic development, taking advantage of exchanges, technological and network circulation this period.

Keywords: Tools, workshop, metal craftsmen, technological and typological approaches, Early Iron Age, Hallstatt territories

*Speaker

Un atelier de bronzier au milieu d'un habitat à Montélimar (France, Drôme) au Bronze final

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3

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Rue du Bouquet à Montélimar (France, Drôme), une fouille préventive a été menée par l'Inrap, sur prescription de l'État (Drac Rhône-Alpes), pour une durée de huit mois, entre avril et novembre 2015. Le site archéologique a été mis au jour sur 8 000 m². En grande partie stratifié, il se présente sous la forme d'un niveau d'habitat polyphasé qui concerne des occupations réparties du Campaniforme/Bronze ancien au Bronze final.

Dans plusieurs secteurs où les vestiges semblaient plus denses en mobilier, des fenêtres ont été réservées à la fouille fine avec la mise en œuvre de traitement individuel pièce à pièce, aboutissant au relevé de plus de 16000 pièces (céramique, faune, macro-lithique, silex, bronze). Deux secteurs particuliers illustrent le degré remarquable de conservation du site. Au nord-ouest, un atelier de taille de silex a pu être mis en évidence au milieu d'une série de bâtiments appartenant à la période ancienne (2000 av. n. è.). Parmi les objets fabriqués, on trouve une série de pointes de flèches typiques de cette période ou encore des vases de stockages enterrés en partie aux abords des maisons.

Un atelier de bronzier

Au sud-ouest, près d'un bâtiment et d'une palissade, de nombreux objets permettent de mettre en évidence un atelier de bronzier daté du Bronze final IIa (1200 av. n. è.). Près d'un petit " four " dont il ne reste que des fragments de terre cuite, on trouve un épandage de charbons de bois et de cendres formant un cercle de 0,70 m de diamètre, autour duquel, là encore se concentrent les objets en alliages cuivreux.

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Les objets associés concernent des éléments de parure (quinze anneaux complets et de nombreux fragments, cinq têtes d'épingles, trois épingles entières, un fragment de ceinture), des outils (un fragment de rasoir, de faucille), une pointe de flèche à aileron, des burins, une alène et des perçoirs auxquels sont associés des vestiges liés au travail du métal : un fragment en terre cuite de tuyère, des chutes de découpe, des centaines de gouttes de métal, des fragments " scoriacés ". Y sont associés des outils en galets (polissoirs, aiguisoirs, enclumette), une hache polie en roche verte et des dalles en calcaire ayant pu être utilisé comme aire de travail. Cet atelier a aussi pu servir à d'autres types de matériaux puisqu'un petit fragment de plaque d'or a été retrouvé.

Cette découverte exceptionnelle est remarquable pour le Bronze final où très peu d'installations de ce type ont été étudiées en France. Quel est la fonction de cet atelier ? Comment s'insère-t-il dans son habitat ? Quelle comparaison peut-on faire avec les autres éléments de la culture matérielle ? Il sera intéressant de comparer cet ensemble avec d'autres de la même période puisqu'il semble qu'on retrouve certains types de restes et une absence totale d'autres.

Keywords: atelier, bronze, Bronze final, habitat, Montélimar, outils, anneaux, épingles, Vallée du Rhône, âge du Bronze

Un atelier de travail du fer du (Hallstatt D-La Tène ancienne) en contexte d'habitat, le cas de Weyersheim Les Hauts de la Zorn (Bas-Rhin).

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Découvert lors de la fouille d'un site d'habitat de la fin du premier âge du Fer, l'atelier de forge de Weyersheim (village situé dans la plaine rhénane à 15 km au nord de Strasbourg) est l'un des premiers vestiges de ce type en Alsace. Le site a livré principalement, sur près d'un hectare une cinquantaine de structures de stockage de type silos à profils caractéristiques. Les structures en lien avec la métallurgie sont localisées au sud-ouest de l'emprise (faits 1013-1014 et 1003).

Une particularité du site réside dans la grande homogénéité chronologique du mobilier céramique et métallique, qui indique une occupation bien datée de la fin du Hallstatt et du début de La Tène ancienne. Ainsi de différentes silos proviennent un fer de lance, une hache à douille et un outil à tranchant évasé destiné probablement au travail du cuir. Le petit mobilier en alliage cuivreux correspond essentiellement à de la parure : deux fibules, deux bracelets.

Nos efforts se sont concentrés sur les structures mentionnées ci-dessus qui correspondent aux vestiges exceptionnels d'un atelier de forge et d'une partie de son équipement.

Le Silo 1003, de forme classique, a été comblé rapidement par des sédiments contenant de nombreuses scories, de rares fragments céramiques et quelques éclats de granite, probablement des fragments d'enclumes. Les observations macroscopiques et microscopiques des sections polies de quelques culots complets montrent des pertes de métal importantes et témoignent d'un travail d'épuration de masses métalliques brutes. Cette activité se fait généralement sur une enclume proche du foyer capable de supporter les impacts. La particularité de ce silo réside dans sa

^{*}Speaker

localisation proche de la fosse 1014.

Cette fosse 1014 constitue une découverte exceptionnelle, tant par la quantité et la qualité du matériel archéo-métallurgique mis au jour, que par le nombre d'enclumes en granite retrouvées dans les niveaux d'abandon. On y retrouve en nombre les matériaux qui composent un foyer de forge : des scories, des chutes métalliques et toutes sortes de boulettes rouillées, des fragments de parois de foyer en terre cuite vitrifiée et des battitures innombrables. Les premières couches tapissant le fond de la fosse sont en effet bondées de battitures de toutes sortes et de résidus scoriacés. L'étude des culots, complet dans leur très grande majorité, permet de reconnaître une activité d'élaboration d'objet, et non plus d'épuration. L'observation des sections montre de nombreuses battitures en cours de fusion. Ces mêmes battitures ont été retrouvées en nombre par tamisage. On compte des battitures plates, des billes, en forme de goutte de toutes tailles allant jusqu'au centimètre, autant d'attestation d'une activité variée. Les niveaux supérieurs comptent de nombreux fragments de terre cuite dont certaines faces sont fortement vitrifiées. Les plus grands fragments remontés présentent une surface plate munie d'un évent et de l'emprunte d'une tuyère qui alimentait en air le combustible. Le calcul des surfaces des nombreux fragments retrouvés dans la fosse, confronté à l'élément le plus complet, nous permet d'estimer le nombre de foyers démolis. Tous ces éléments prouvent la proximité immédiate du foyer dont les derniers vestiges ont à peine été " bousculés ". Les derniers niveaux de comblement correspondent à la phase d'abandon. Aux fragments de parois et aux scories s'ajoutent une quinzaine de blocs de granites dont la plupart portent les stigmates d'une intense activité de martelage. En parallèle, d'autres outils lithiques employés en percussion lancée (trois percuteurs) et posée (13 lissoirs/aiguisoirs et trois polissoirs) proviennent du site.

Les deux cas de support de frappe en granite provenant de l'atelier correspondent à une enclume de 4,7 kg (fait 1074) et de 16 fragments associés à une ou plusieurs enclumes de forge, totalisant 216 kg de roche (fait 1014). Ces blocs sont de gros galets roulés ramassés vraisemblablement à une centaine de kilomètres du site dans le massif vosgien cristallin. Les surfaces de ces enclumes montrent des zones irrégulières impactées par des traces de martelage jouxtant des zones de poli. Elles sont visibles aussi bien sur les faces que sur les arêtes, ce qui nous conduit à penser que les pièces sont plurifonctionnelles et probablement déposées, pour certaines, sur un support afin d'être à hauteur d'homme. Elles sont *a priori* utilisées dans un contexte de forge d'élaboration ou de chaudronnerie et peuvent servir également de matrice pour l'emboutissage de tôles. La découverte de Weyersheim est à l'heure actuelle inédite en Alsace et peut, de manière fonctionnelle, être rapprochée des pièces mises au jour sur les sites de Neuville-sur-Sarthe (Jodry 2015) ou de Paule (Menez et al. 2007).

En définitive, même si le niveau de sol de la fosse 1014 n'est pas conservé, les éléments observés permettent de comprendre en partie comment était organisé un vaste atelier de forge de la fin du premier âge du fer muni d'un moins un foyer et de nombreuses enclumes pour le travail de cinglage de masses de fer brute et le forgeage de pièce ou de semi-produits.

Les quantités de résidus archéo-métallurgiques retrouvées, nous permettent d'entrevoir une activité pérenne et diversifiée en sein d'un espace de travail relativement restreint.

La phase d'abandon pourrait être marquée par la volonté de casser l'outil de travail trop lourd pour être transporté.

Jodry 2015

JODRY (Fl.), Les outils macrolithiques du tracé de la LGV-Ouest, dans Langlois J.-Y., Neuville-sur-Sarthe " La Chataigneraie ", rapport Inrap Grand-Ouest.

Menez et al. 2007

MENEZ (Y.), VIVER (J.-B.), CHANSON (K.), DUPRE (M.)- La forge de Paule (Côtes-d'Armor) dans Milcent P.-Y. : L'économie du fer protohistorique : de la production à la consommation du métal, XXVIIIe colloque AFEAF, Toulouse 2004. pp213-237.

Keywords: atelier de forge, Hallstatt final, La Tène ancienne, enclume, fer, habitat

Tools; rituals and society

Artisans du métal laténiens et pratiques rituelles non funéraires : le cas de la Gaule du Ve av. J.-C. à la conquête romaine.

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1

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À partir de résultats de travaux antérieurs sur les sanctuaires (Bataille 2009) et en nous appuyant sur la base de données collective réalisée dans le cadre du programme ANR DÉPOMÉTAL dirigé par Patrice Brun sur les pratiques de dépôts métalliques non funéraires, nous nous attacherons à faire le point sur la représentativité et la place des objets liés à l'artisanat du métal et à ses artisans au sein des pratiques rituelles laténiennes. Pour cette présentation, nous mènerons d'abord une analyse typo-chronologique de ces outils selon leurs contextes de découvertes. Nous conduirons par la suite, un examen basé sur des études d'ensembles des gisements, afin de mettre en exergue les spécificités de l'outillage métallurgique au sein de ces pratiques particulières, toujours dans une logique évolutive permettant également de rendre-compte de changements sociétaux. La synthèse de ces travaux nous permettra de questionner ces résultats en terme, non seulement d'archéologie du rituel, mais plus généralement sur la place donnée à ces artisans au sein des préoccupations sociales sous-jacentes de ces pratiques.

Keywords: Artisans, sanctuaire, dépôt, La Tène

*Speaker

Hammers of the Gods: The role of metalworking tools in the interpretation of hoards in Late Bronze Age Britain

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In mythology and ethnography, smiths have been described as powerful beings associated with the supernatural and engaging in transformative acts. However, it is difficult to see if this was also the case in prehistory. Past interpretations of the smith's position in a community have been based on the objects they made by using modern estimations of their value. Instead, the careful examination of the tools that smiths used is capable of revealing more about ancient smiths than the products of their craft. They are the primary evidence of how metalwork was practiced in the Bronze Age and their presence in hoards can point to the cultural significance of the smith and smithing. By studying the tools used by metalsmiths, questions can be addressed about their function, if there are patterns of deposition, and if they had symbolic meaning. This paper examines the types of metalworking tools found in hoards and how they relate to other objects in the hoard in order to construct a narrative of metalworking and deposition. Using specific examples as case studies, metalworking hoards are interrogated from the perspective of a metalworker. This is done by paying particular attention to the types of tools, their condition, and how they would have been used for different metalworking techniques. These hoards are seen in a new light when the focus is concentrated on the metalworking tools. Rather than discarded objects, these tools become relevant indicators of the smith as a powerful person who both creates and destroys the metal objects that make up the hoard.

Keywords: hammers, hoards, Late Bronze Age, Britain, founders' hoards, ritual, smiths

*Speaker

Life histories of Bronze Age moulds

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A research project based at Bristol University is exploring the organisation and social context of non-ferrous metalworking in later prehistoric Britain and Ireland. The main focus is on the metalworking tools and residues, and the contexts in which they are found. This is not simply a matter of identifying ‘in situ’ evidence that captures the actual moment of metalworking. Arguably, the entire biography of metalworking tools and materials can inform us about this craft and the values ascribed to it. This paper discusses the example of Bronze Age moulds. In this period, moulds were made of three very different materials: clay, stone and bronze. Moulds made from each material show marked differences in their use, and their deposition at the end of their use-life. It also seems that the biographies of moulds could be entangled with those of the objects that they produced.

Keywords: Moulds, bronze casting, deposition, object biographies

*Speaker

Sacred or profane? Some considerations of the purpose of hoarding metals in Bronze Age Western Europe

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An interpretation of the meaning of metal hoards in the Bronze Age sees two possible causes for hoarding: sacred offerings (like gewasserfunde) or stored metals for founders. In many cases, interpretation is difficult due to the ambiguous circumstances of deposition location. Considering metal technology, anthropology and ancient land management, as well as the typology and the conservation status of deposited metals, a more objective interpretation of the meaning of some hoards, might be to knowledge that it is not possible to favor the sacred over the profane. They will be considered examples from Western Europe.

Keywords: Bronze Age, metal hoard, interpretation, Western Europe

*Speaker

Tools in ritual contexts – Remarks on the social position of Bronze Age metal workers through the lens of their implements in hoards and graves

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The emergence of bronze tools in European hoards and graves have long been associated with metalworkers. They are understood as belonging to toolkits of smiths and founders. However, after an analysis of the material it is obvious that certain tools are more appropriate for particular materials and activities than others. It is, therefore, possible to determine how and in which field of handicraft they were used. This leads to a functional typology of tools, which was the basis for further investigation.

On one hand, tools in hoards are seen as an indication that metalworkers participated in the practice of depositing bronzes. But a closer look at the material shows clearly that the percentage of tools in Bronze Age hoards is less than 1%. The majority of these tools are of generic types, which could be used in a number of different crafting activities, and only a few have specific, specialized functions. How likely is it then, that metalworkers can be identified as persons via tools in hoards?

On the other hand the presence of tools in graves is usually interpreted as a marker of the identity and profession of the buried individual. Even if the frequency of these finds is low and their pattern quite heterogeneous, most archeological studies assign the buried "metalworkers" a comparatively high social rank. But clear indications that this indeed was the case, as well as comparative studies of other grave inventories from the cemeteries are lacking.

This paper is based on the results of a broader study of Bronze Age tools, which traditionally were considered to be used in metalworking processes. It focusses on tools in graves and hoards from the Carpathian Basin to southern Scandinavia. Functional analyses of these finds and the overall contexts in which they appear, provide indications of the use of different tool types and the social status of craftsmen. How can metalworkers be identified as individuals? Did they belong to a specific social group or a particular segment of society? Why and to which extent should they be seen as members of social elites?

Keywords: tools, hoards, graves, functional typology, social position of metal worker

*Speaker

Tools in tombs: an overview of Late Bronze Age funerary contexts in eastern France and Baden-Württemberg (14th-12th century BC)

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Late Bronze Age burials in eastern France and Baden-Württemberg include an array of personal objects that pertain to the person's status and function in life. Setting aside the usual bronze jewellery present in most graves, other more out of the ordinary objects such as tools can also be found. They are generally assembled in a small box or leather bag and comprise of a selection of objects such as a knife or small dagger, tweezers, awl, sharpening tool, hammer, touchstone, small bone weighing scales with weights, iron pyrite and flint for fire making, etc. In this paper, we aim to present an overview of tools in funerary contexts as well as drawing parallels with similar objects in hoards. We will also be tackling the question of their use and the status of the people who used them.

Keywords: Late Bronze Age, burials, France, Baden, Württemberg

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poster

Embossed ornaments on Gold objects of the Early Iron Age in South-West-Germany – tools and experimental work

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This presentation Will deal with the tools and techniques used to decorate gold sheet metal objects of the Early Celts north-west of the Alps. One of the most outstanding characteristics of the gold objects of the Early Iron Age are the embossed ornaments, especially on torcs, bracelets, pinheads and small rings belonging to the headdress. Predominantly the ornaments are comparable to older pottery objects, but differing stamps or punches must have been used to decorate pottery on one hand and metal objects on the other hand. The tools used for the embossed ornaments on metal objects must have been punches with engraved motifs, but we don't know any metal tools that could have been used for such purposes deriving from contexts of the Early Iron Age sites in Central Europe. But there are some tools that could have been used as punches that were made of antler. Current investigations within a recent ANR/DFG research project concerning early Iron Age gold objects shall be shown in the presentation, focused on technological studies of the embossed objects, followed by experiments concerning punches made of bone and antler.

Keywords: Gold jewellery, Early Iron Age, South, West, Germany, embossed ornaments, tools, embossing techniques

*Speaker

Experimental casting pit for bronze items

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During an experimental archaeology workshop organized by the University of Bologna in 2015, it has been excavated an experimental casting pit realized a year before and used only one day for the production of several bronze tools. In this pilot experiment the visible remains have been collected in order to verify and compare the evidences of activities and post depositional transformations. Furthermore, a geoarchaeological sample for micromorphological analysis has been taken in order to characterize the degree of thermal alteration of sediments and the microscopic markers related to metallurgical activity. On the long term, this kind of approach may provide relevant data to solve some problems related to the detection of casting pits in the archaeological record and to outline the most suitable strategies of intervention during the field research.

Keywords: Experimental archaeology, casting pit, micromorphological analysis

*Speaker

First results of micrometallographic analysis of metalworking tools in graves of metallurgists in Moravia/Czech Rep.

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There are 21 recorded graves of metallurgists (20x metalworkers, 1x caster) in the Moravian region today. Graves belong to the Late Copper Age, clearly dominate in BBC (17x), in CWC (3x). The presence of silver on the anvil from Gr. 1 in Těšetice (Dist. Olomouc) is surprising in comparison with the absence of any silver products within this culture. We observe, in the BBC, a clear link between graves of metallurgists and adult male burials (less maturated-age?) with rich grave goods. These graves were marked by a striking and complex funeral architecture (tiered treatment, chamber, timbering, ring ditches) belonging to the earlier period of BBC. Men, who have metal production of artefacts under their "political" control, combine the leading people of society (archer / hunter / warrior) with a skilled and rich craftsman.

This poster presents preliminary detailed results of the micrometallographic analysis of metalworking tools (hammers, anvils, whetstones, polishers etc.), most of the available artefacts, using a scanning electron microscope with EDX microanalyzer (Laboratory of Electron Microscopy and Microanalysis, Institute of Geological Sciences, Faculty of Science, Masaryk University). The particles (flakes) of metals (Cu, Ag, Au) were registered on the surface of the stones with a size of about 3-5, occasionally up to 10 μm on all the working edges. Furthermore, traceological analysis demonstrates multipurpose utilization of most of the stone objects. Almost all analysis of artefacts provided positive results (81%) with one (Cu or Au), a combination of two (Cu + Au or Cu + Ag) and most frequently three metals (Cu, Ag, Au). Evidence of local metallurgy on open settlements of BBC is assured by the presence of copper and gold on artefacts from Bořitov (obj. 76). Similar results on the surface of boar tusks (Přerov-Předmostí Gr. 1/57: Ag, Cu) are more surprising. The tusks are very often combined with the so-called metallurgical package. It is therefore obvious that the metalsmithing set was deposited into graves as used. Nevertheless, negative findings (Amesbury, Lunenburg, Soesterberg) would be better to review.

Keywords: metallurgy, metalworking tools, Bell Beaker Culture, Moravia/Czech Rep.

*Speaker

Les outils lithiques liés à la déformation plastique des métaux du site de Cuciurpula (Corse, Bronze final/premier âge du Fer)

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Le site de Cuciurpula est implanté dans la haute vallée du Rizzanese, au nord de la microrégion de l'Alta Roca, dans le sud de la Corse. Cet habitat occupe une superficie de 12 hectares sur un versant d'adret pentu et encombré de chaos granitiques. Les fouilles menées entre 2008 et 2015 ont permis d'y individualiser plus d'une quarantaine d'habitations de forme elliptique, des abris sépulcraux, des enceintes, des terrassements et des carrières de blocs. L'occupation est continue entre la fin du XIII^e et la fin du VI^e siècle av. J.-C. et caractérise donc l'intégralité du Bronze final et du premier âge du Fer. Plusieurs formes d'artisanat sont bien documentées par les assemblages mobiliers : poterie, métallurgie (bronze, fer, peut-être plomb), vannerie, obtention de pigments (sur hématite), fabrication d'adhésifs (à base de brai de bouleau), de poix, travail de la labradorite, de la stéatite, apiculture (production de cire), etc. La fabrication et l'utilisation *in situ* d'objets en alliage cuivreux ou en fer est matérialisée par des scories, des gouttelettes métalliques, des blocs de minerai, des moules (stéatite ou terre cuite), des creusets et quelques objets finis. Trois contextes, deux habitation (structure 6, Bronze final ; structure 1, premier âge du Fer) et une zone de dépotoir (secteur G1, Bronze final/premier âge du Fer), ont en outre livré des objets ayant pu être utilisés dans le cadre de la déformation plastique des métaux.

Keywords: Cuciurpula, Corse, Bronze Final, premier âge du Fer, outils lithiques, déformation plastique, métallurgie

*Speaker

Metallurgists and their craftwork in the archaeological record

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The past decades have seen a notable rise in interest in the role of crafts and craftsmen in prehistoric societies. Within the chronological span of the early metal ages, attention has often been drawn to those crafts, that involve metalwork and to early metalworking specialists. Because of their growing experience and insight resulting in a high degree in specialisation of prospecting, mining, smelting, and metalworking, a special status has repeatedly been postulated for this latter group of craftsmen in the Late Copper and Early Bronze Age societies.

Within the context of a doctoral thesis, finds and sites relating to the metalworking evidence of the European Late Copper and Early Bronze Age have been compiled and evaluated. The resulting picture essentially does not contradict the perceived view, although by no means all contexts – and the burials are especially prominent in this respect – indicate that a special status was associated with these crafts skills.

At this point the question is what symbolism a single metalworking tool can have if it is the only grave good.

Beside some scientific analyses (SEM, EDX) on metalworking tools, the lecture/poster presentation will provide a brief insight into the picture of the early metalworking craft as composed from the evidence identifies the knowledge gaps in our interpretation.

Keywords: burials of metallurgists, metalworking tools, scientific analyses, interpretation of the social status of metallworkers

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Mines - Copper - Artisans in the steppe of the Late Bronze Age

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Widespread of bronzes production in the Bashkir Urals is connected with the Late Bronze Age. The study of settlements and funerary monuments of the Late Bronze Age in this area gave massive material on bronze production in the region (waste products, casting molds, copper drops and ingots, particles of copper ore, containers with traces of waste products) and also numerous products made of bronze (knives, chisels, awls, holdfasts for vessels, sickles, ornaments and so on). E. Chernykh distinguished in this area a West-Asian metallurgical province connected with the Eurasian Steppe. It is connected with a contact between the two groups of population in the southern Urals: Srubnaya and Andronovskaya (Alakulskaya) cultures. In Bashkir Urals, in the area between the rivers Dema and Urshak, Kazburunovsky archaeological micro-district belonging to the late Bronze Age is identified. There is a group of 5 settlements and 4 barrow burials here. In the process of investigation the complex of sites consisting of five simultaneous settlements – Usmanovo I - III settlements, Muradymovo I, VII, VIII settlements and 57 Kazburun barrows was examined. Radiocarbon dating (Beta Analytic: 1890 – 1750 BC), proved chronological unity of these barrows and settlements. Numerous traces of bronze production were also found on the territory of Kazburunovsky district. In Bashkir Urals, close to Kargalinskiy mines, there are 770 mines for the extraction of copper sandstones. V. Lunkov (Laboratory of Naturally Scientific Methods, Institute of Archeology, RAS, Moscow) and M. Radivojević (Jesus College Research Fellow McDonald Institute for Archaeological Research) carried out a complex of analyses of all bronze material belonging to one of the large settlements – Muradymovo settlement (Kazburunovsky archeological district). Metal was worked on this site – refining, melting, casting. The primary (Cu) metal could have been imported from other regions as ‘raw’ ingots (bars)/ artefacts. The provenance analysis imply that the metal worked in the site of Muradymovo settlement was likely acquired from the ores exploited in the Tien Shan mountains. The UCL and RAN analyses show that there is a significant number of pure copper artefacts that represent stock, ingots, working debris. The pure copper artefacts as implements (knives etc) need a closer look typologically etc (RAN analyses). The tin bronzes are already present as finished artefacts and there is no evidence for their production thus far in this site. Due to the research, a new interesting problem in Bashkir Urals archeology came up. Having a large number of copper sandstones and mines, developed in the Late Bronze Age (Kargainskiy mines), we got an interesting result: the export of ore from northern Tien Shan. Also there are

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interesting of problems. There are many hoards with bronze ware of the Late Bronze Age were found in the Urals. However, near the Kazburunovsky archaeological microdistrict was found only Kuganaksky treasure with cast bronzes of the Early Iron Age (exports from Siberia). Unfortunately, we have not met metallurgists burials (with the mould of an axe) in Kazburunovsky archaeological microdistrict. Only one such burial was found at Kargaly (Persin mound). As a result, deposits of copper sandstone of Upper Permian red color formations in Southern Urals from Kargalinskiy mines to Eek River in the area of 16378 square km were examined. Paleogenetic studies have identified several groups in Kazburunovsky archaeological micro-district. Probably in the late Bronze Age the ore came with population of Andronovskaya (Alakulskaya) culture of South-Eastern Kazakhstan. This confirms the theory of E. Chernykh about the unity of West-Asian Metallurgical Province.

Keywords: mines, copper, Eastern Eurasia, Late Bronze Age

The metalworking toolset found at Upton Lovell G2a, Wiltshire, England.

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The Early Bronze Age double burial from Upton Lovell G2a has been well known in the antiquarian and archaeological literature for more than two centuries. Unearthed by William Cunnington in 1801 and published 5 years later, this is probably one of the most unusual burials from the Wessex Culture. Known as shaman-metalworker's burial, Upton Lovell G2a contained a wide range of objects, including at least three dozen perforated bone points, three complete ground flint axes and the fragment of a fourth, several perforated boars' teeth, five broken "eagle-stones" and some pebbles of non local origin, a perforated stone battle-axe, several flat and grooved whetstones, five stone mullers, a keeled sarsen muller, a shale ring and beads, a bone bead, bronze awl, and a pebble hammerstone. Stuart Piggott in 1973 recognised the several stones as parts of a metalworking toolset, but this set has never been completely published. This poster presents the complete toolset found at Upton Lovell G2a and contextualizes those tools in a *chaîne opératoire* of early Bronze Age metalworking.

Keywords: Early Bronze Age, Upton Lovell G2a, metalworking stone tool, burial

*Speaker

Author Index

- Štelcl, Jindřich, 45
- Adams, Sophia, 27
Armbruster, Barbara, 24
Armigliato, Alessandro, 44
- Béranger, Marion, 32
Bataille, Gérard, 36
Boutoille, Linda, 11, 26, 46, 50
Brandherm, Dirk, 11
Brunet, Paul, 26
- Cabboï, Luisella, 32
Cahill, Mary, 22
Cardoso, João Luis, 11
Clarke, Brian, 28
Clerc, Patrick, 32
Cousseran-Néré, Sylvie, 30
Cowie, Trevor, 17
- Delfino, Davide, 39
Delgado Raack, Selina, 14
Dubreucq, Emilie, 29
- Flouest, Jean-Loup, 23
Fregni, Elpidia, 12, 37
Freudenberg, Mechtild, 16
- Glaser, Leif, 16
Gouge, Patrick, 26
- Jodry, Florent, 32
- Labeaune, Régis, 23
Lachenal, Thibault, 13
Le Cozanet, Thibault, 36
Leonova, Tatiana, 48
Leusch, Verena, 20
Lowe Fri, Maria, 25
- Martin, Katja, 47
Melin, Muriel, 26
Michler, Matthieu, 32
Mordant, Claude, 41
Murillo Barroso, Mercedes, 9
- Néré, Eric, 26, 30
Nessel, Bianka, 40
Nicolas, Théophane, 26
Nordez, Marilou, 30
- Peška, Jaroslav, 45
Peake, Rebecca, 26, 41
Pecche-Quilichini, Kewin, 46
Piccardo, Paolo, 10
- Pieters, Maxence, 8
- Radivojević, Miljana, 20, 48
Roscio, Mafalda, 41
- Schorer, Birgit, 43
Shcherbakov, Nikolai, 48
Shuteleva, Iia, 48
Simonin, Daniel, 26
Svensson, Andreas, 18
- Vernet, Justine, 10
- Webley, Leo, 38
Wirth, Stefan, 41

