CONGRESS BOOK

DECEMBER 2010

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The **1st International Congress on Settlement and Mining Exploration in the Atlantic Western Europe** is organized by the Transdisciplinary Research Centre: Culture, Space and Memory (CITCEM), Landscapes, Borders and Powers Group, the Portuguese Association for the Quaternary Studies (APEQ) and the Faculty of Engineering of the University of Porto (FEUP), which will be held in the Museum Auditorium D. Diogo de Sousa, Braga, Portugal, December 10 and 11, 2010.

This Congress aims to present the latest works in the mining area and its implications on settlement and society, in the archaeometallurgical area, including analysis of materials and jewellery, and in the new methodologies applied to archaeology, especially geophysical prospecting and systems of geographical information.

This Congress is integrated in the research project **Territorial Organization and Roman Exploitation of Resources in the Conventus of Bracara Augusta**, with the support of FCT (SFRH/BPD/41771/2007).
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10th December 2010

8.30 h Opening of the secretariat. Delivery of documentation

9.00 h Opening session

9.30 h Inaugural session
   **The inception of metallurgy in Western Europe**
   Paul T. Craddock (British Museum, London)

10.15 h Coffee-Break

10.30 h Thematic session 1. *Settlement and society*
   **Moderator**: Maria Manuela dos Reis Martins (Univ. Minho, CITCEM)

10.30 h Conference
   **Mining and Roman settlement at Orillas del Cantábrico**
   Cármen Fernández Ochoa (UA, Madrid) & Ángel Morillo (UC, Madrid)

11.00 h Oral communications

11.00 h Challenges and prospects of the application of GIS to the study of Bronze Age hoards in Atlantic Europe
   Alejandro Manteiga Brea, Beatriz Comendador Rey

11.15 h The social role of matellic amortizations for the structuration of the landscape in Northwest Iberic Peninsula Bronze Age: the Penha’s (Guimarães) and Saia’s (Barcelos) Mounts as case studies
   Hugo Aluai Sampaio

11.30 h Metallurgy from the Hill fort of “Cabeço da Argemela” (Fundão): shapes, significance, productions and contexts
   Raquel Vilaça, Sara Almeida, Carlo Bottaini, João Nuno Marques

11.45 h The Castro of Senhora Aparecida (Pinheiro, Felgueiras) and the tin mining exploration – from the Final Bronze Age to the Romanization
   Marcelo Mendes Pinto

12.00 h The exploitation of the iron mineral resources from Iron Age to the Middle Age in the Odemira (SW Portugal): current research
   Jorge Vilhena, Mathieu Grangé

12.15 h **Landscape, Settlement and Ancient Mining in the Upper Valley of Terva River, Boticas**
   Luís Fontes, Mafalda Alves, Carla Martins, Bruno Delfim, Eurico Loureiro

12.30-13.00 h Debate
15.00 h  Thematic session 2. Mining exploration and technology  
*Moderator:* Carla Maria Braz Martins (CITCEM, Univ. Minho, FEUP)

15.00 h  Conference  
**Roman Mining in the NW of Hispania: mining technology and territory exploitation**  
J. Sánchez-Palencia (CSIC, Madrid)

15.30 h  Oral communications

15.30 h  *Archaeo-Mining in the Beira Interior (Central Portugal) from the Calcolithic to the Roman Age*  
Carlo Bottaini, Claudia Chiappino, Francesco Lemmi

15.45 h  *Etnoarchaology of mining enclaves in river Ribeira valley and O Tameirón (A Gudiña, Ourense, Spain)*  
Cristina I. Fernández, Abraham Herrero, Aarón Lackinger, Marta Lorén

16.00 h  *Primary gold deposits in the Leon Province (Spain): roman mining techniques*  
Roberto Matias Rodríguez

16.15 h  *Roman mining in the lower basin of River Minho*  
Brais X. Currás Refojos, Luis F. López González

16.30 h  Coffee-Break

16.45 h  Oral communications

16.45 h  Poster communications

17.15 h  *Contribution to the study of the Roman Gold Mining at Rio Terva Basin*  
Alexandre Lima, Roberto Matias Rodríguez

17.30 h  *Contribution to the study of the Roman Gold Mining in Banjas Hills*  
Alexandre Lima, Roberto Matias Rodrigues, Natália Félix, Antónia Silva

17.45 h  *The MINEDOR Project. Archaeological and paleoenvironmental characterization of the Arvernian gold mines of Upper Combraille (Iron Age - Middle Ages), Massif Central, France*  
Frédéric Trément

18.00 h  *Use of iron ore in the mountain Basagain (Anoeta, Gipuzkoa, Basque Country) from the Protohistory until our days. Preliminary study*  
Sonia San Jose Santamarta

18.15-18.45 h  Debate
11th December 2010

9.30 h  Thematic session 3. Archaeometallurgy
Moderator: Beatriz Commendador Rey (Univ. Vigo, CITCEM)

9.30 h  Conference
Archaeometallurgy in the Atlantic Europe – the gold before the iron
Barbara Armbruster (CNRS, Toulouse)

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10.00 h  An archaeometallurgical working group in Portugal: research achievements and perspectives
Maria de Fátima Araújo, Rui J. Silva, João Carlos Senna-Martinez, Pedro Valério, Elin Figueiredo, A. Monge Soares

10.15 h  The contribution of a multi-analytical approach to the comprehension of ancient metallurgy of the Portuguese territory
Elin Figueiredo, Maria de Fátima Araújo, Rui J.C. Silva

10.30 h  First Bronzes of North-West Iberia: The data from Fraga dos Corvos Habitat Site
João Carlos Senna-Martinez, Elsa Luís, Maria de Fátima Araújo, Rui Silva, Elin Figueiredo, Pedro Valério

10.45 h  Metallurgy and Society in Mondego’s River Platform (Central Portugal) First Bronze Age
João Carlos Senna-Martinez, Elsa Luís, Maria de Fátima Araújo, Pedro Valério, J. M. Q. Ventura

11.00 h  Metallurgy and Society in “Baiões/Santa Luzia” Culture Group: Results of the METABRONZE Project
João Carlos Senna-Martinez, Elin Figueiredo, Maria de Fátima Araújo, Rui J. C. Silva, Pedro Valério, João Luís Inês Vaz

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11.30 h  Iron Metallurgy in a Late Roma site, El Castillón (Santa Eulalia de Tábara, Zamora)
José Carlos Sastre Blanco, Antonio J. Criado Portal, Patricia Fuentes Melgar

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Susana Rodrigues Cosme

12.00 h  Mineralogy and chemistry of copper ores and slags from Ingadanais mines: implications for ancient mining
Miguel Gaspar, João Carvalho
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15.00 h Visit to the Archaeological Museum D. Diogo de Sousa

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João Tiago Tavares, Abílio Cavalheiro, Fernando Ernesto Rocha de Almeida, Jorge Carvalho, Pedro Garcia

17.30-18.00 h Debate

18.00 h *Final conference*
Beakers and early copper mining in Atlantic Europe, 2500–2000 BC

William O’Brien (Univ. College Cork, Ireland)
ABSTRACTS OF THE
PLENARY CONFERENCES
The inception and nature of metallurgy in Western Europe

Paul T. Craddock
Dept. of Conservation and Science, The British Museum, London WC1B 3DG

Abstract

Our knowledge of Bronze Age extractive metallurgy in Western Europe has been revolutionised in the last half century. However, there is still much that is currently conjecture. The very inception of metals seems to have undergone a sea change. The once derided diffusionist mechanisms for the dissemination of metallurgy from the Eastern Mediterranean-Middle East are back in fashion and it is independent discovery that is rejected. This uncertainty extends beyond fashionable paradigms to the nature of the actual technologies of extractive metallurgy. Even in the relatively well preserved Bronze Age copper mines it is often difficult to be sure which ore (sometimes even which metal) the ancient miners sought. The mineralisation that is now in the mines need not necessarily be a good guide. After all the ancient miners worked the deposits very thoroughly and only left behind what was not wanted, the ore they did need and smelted has largely gone.

The main problems come with trying to reconstruct the smelting processes of the European Bronze Age. This is because they have apparently left so little evidence in the form of furnaces, crucibles, tuyeres or, above all, of slags, the partially vitrified remains of the ore.

The most common copper ores even in the most ancient mines are often the copper iron sulphides, chalcopyrite and bornite, and it is believed that these were processed in the Bronze Age. So far it has not proved possible to smelt these, completely separating the copper from the iron without creating durable debris, namely a slag. Processes have been postulated and even been demonstrated experimentally to produce copper, but all do produce slag in quantity, at least as much slag as metal.

Yet the very few Bronze Age smelting sites that have been identified in Western Europe only have tiny amounts of slag, sometimes of the order of a only a few hundred grams. Clearly there are problems here. Possibly other copper minerals constituted the ore, in which case where are the copper-iron sulphide minerals that must have been discarded in quantity at many of the mines? or possibly the putative smelting places have been misidentified, in which case where are the real smelters with their slag heaps, and why cannot we find them? or are the extractive processes used in antiquity currently misunderstood?

The problems stem to some degree from having to try and integrate the negative evidence into a positive process; it is notoriously difficult to recreate a real process from nothing, but clearly for much of Western Europe, especially for the British Isles and Iberia there is something we do not understand.
Explotación minera y poblamiento romano a Orillas del Cantábrico

Carmen Fernández Ochoa [1], Ángel Morillo Cerdán [2]
[1] Universidad Autónoma de Madrid
[2] Universidad Complutense de Madrid

Resumen

La explotación de los recursos mineros fue uno de los incentivos económicos más importantes de la implantación romana a orillas del Cantábrico. El poblamiento romano regional se densifica notablemente en torno a los criaderos de oro, hierro, plomo y zinc de la franja costera. La variedad de los recursos, las necesidades propias de la extracción de cada mineral y la dinámica poblacional precedente en cada zona, determinan las diversas formas de ocupación del espacio en la Antigüedad.
Minería romana en el Noroeste de Hispania: tecnología minera y explotación del territorio

F.-Javier Sánchez-Palencia
Gli: Estructutra Social y Territorio – Arqueología del Paisaje, CCHS del CSIC, Madrid

Resumen

Las investigaciones sobre la minería romana en el cuadrante noroeste de la Península Ibérica no han dejado de proporcionar nuevas evidencia a lo largo de las últimas décadas, tanto en territorio español como en el portugués.

De acuerdo con la famosa descripción de Plinio el Viejo, la importancia de las minas de oro de Gallaecia, Lusitania y, sobre todo, Asturía tiene que ver cada vez más con los múltiples aspectos de la provincialización del territorio hispano, desde su ocupación y nueva ordenación territorial hasta su plasmación en las formas de ordenación y apropiación del espacio.

Hay que entender por lo tanto la tecnología minera dentro de una escala y perspectiva histórica integral, lo que implica a su vez un abandono de la visiones actualistas y de la explicación de la actividad minera como una actividad sectorial. Ese enfoque se va a exponer como síntesis a partir de los resultados obtenidos en diversas zonas mineras del cuadrante noroccidental de la Península Ibérica. Se va a prestar una atención especial tanto a los diversos aspectos de la tecnología como a la cuantificación, al menos relativa, de las labores realizadas.
Gold work is one of the most exclusive artefacts to deal with in Bell Beaker and Bronze Age archaeology since it constitutes a rare but important material for the production of prestigious jewellery or luxury table ware in later prehistory. Atlantic Europe is a large geographic area from the south of Portugal up to the north of Scotland that produced an important quantity of high quality gold work in that time span. This paper deals with the archaeometallurgy and implicitly with the technology of later prehistoric gold in Atlantic Europe. It especially is concerned with an interdisciplinary approach in the study of technological aspects of precious metal work and aims to point out that gold technology can be seen as active material culture. An introduction gives a general view on methods in the domain of archaeometallurgical research relevant for understanding the material, conception and manufacture of precious metal objects: A combination of information from material sciences, the identification of tool and wear marks, experimental archaeology, analogies from ethnoarchaeology, ancient illustrations and literary descriptions. Case studies of gold working in Atlantic Europe then reveal the evolution of the craft through time and space. From the beginning of gold metallurgy in the third millennium BC up to the introduction of iron in the first millennium BC, gold technology and typology do not advance homogeneously in Western Europe. There are regional developments in gold work as well as supra-regional features to exemplify. The talk discusses the design related to symbolism, the operational sequence of manufacturing techniques and the workshop equipment implied in the production of the gold artefacts. It will also highlight the importance of technology in the perception of tradition, innovation and cultural change. The outlined processes comfort the idea that archaeometallurgical studies of gold technology can provide a mirror of social factors of the past.
Técnicas não intrusivas na prospecção arqueológica

Fernando de Almeida Rocha [1], Jorge Carvalho [2]
[1] Universidade de Aveiro

Resumo

A geofísica aplicada à arqueologia permite um mapeamento não intrusivo nem destrutivo do subsolo, potencialmente relacionável com a presença ou ausência de estruturas/objectos interessantes do ponto de vista arqueológico. Diversos métodos geofísicos, utilizando diferentes equipamentos e procedimentos de recolha de dados, sensíveis a contrastes de diferentes propriedades físicas e químicas do subsolo, podem ser utilizados individualmente ou de forma complementar. Os dados processados e interpretados, apresentados sob a forma de perfis 1D, secções/mapas 2D ou blocos 3D eventualmente integrados num SIG, são susceptíveis de permitir a divisão das zonas prospectadas segundo o seu potencial interesse arqueológico orientando, nomeadamente, a programação de futuras escavações. Também neste contexto, os SIG podem funcionar como potenciadores de um modelo interpretativo mais abrangente, integrador e representativo da realidade. De entre os diferentes métodos geofísicos, será dada ênfase aos métodos eléctrico, magnético e electromagnético. Será também abordada a eventual mais-valia da geoestatística, no mapeamento da variabilidade espacial dos dados obtidos nos reconhecimentos geofísicos realizados.

Palavras-chave: geofísica, arqueologia, SIG, geoestatística.
Beakers and early copper mining in Atlantic Europe, 2500–2000 BC

William O’Brien
University College of Cork, Ireland

Abstract

This paper will examine the spread of metallurgy in Atlantic Europe during the third millennium BC, in relation to the supply of copper from particular mine sources in Spain, France and Ireland. The geological setting and technological background of these mines are considered, with reference to the development of a widespread fahlore metallurgy in those areas during the Chalcolithic. The dominant position of such mines as El Aramo, Cabrieres and Ross Island in regional networks of copper supply is considered. The cultural context of this mining is explored, with particular attention to the role of the Beaker ‘culture’ in both the supply of metal and the dissemination of mining and metallurgical knowledge in this period.
ABSTRACTS OF THE
ORAL COMMUNICATIONS
Challenges and prospects of the application of GIS to the study of Bronze Age hoards in Atlantic Europe

Alejandro Manteiga Brea[1], Beatriz Comendador Rey[2]
[1] Department of Archaeology, Connolly Building, University College Cork, Ireland. alex.manteiga@gmail.com

Abstract

In recent years there has been an increase in the number of GIS studies dedicated to settlement analysis; however the examination of the hoarding phenomenon is still very limited. Most researchers have prioritized chronological, typological and archaeometrical approaches due to the development of procesualist Archaeology. The local or regional character of published catalogues has made relatively limited the analysis of hoard deposition and metal circulation in Atlantic Europe. Different aspects of the typological and archaeometrical analysis of the deposits, as well as the discovery of some Bronze Age shipwrecks may offer new insights on the traditional explanation of metal movement and hoarding practices during this period.

The aim of this paper is to review the metal deposits of the Bronze Age, with a special emphasis on the so-called founder’s hoards and the circulation of metal. This review summarizes the different categories of analysis taking into account their location and deposition. Subsequently we propose an examination of these archaeological phenomenons’s trough the use of Geographical Information Systems. This analysis will assist in the relation of “founder’s hoards” to contemporary settlements, possible sources of metal ores and other geographical features, including the proximity to riverine locations, coastal situation and principal communication routes. New categories of analysis could be added according to current needs, such as new analytic variables (mineral sources), or implementation to specific problems.

Key-words: Hoards, Atlantic Europe, Metal, Bronze Age, Geographical Information Systems.
The social role of metallic amortizations for the structuration of the landscape in Northwest Iberic Peninsula Bronze Age: the Penha's (Guimarães) and Saia's (Barcelos) Mounts as case studies

Hugo Aluai Sampaio
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Abstract
In this communication we intend to, giving light of new assumptions and concepts, understand the social role which may have played the depositions of metallic objects in places like Penha’s Mount (Guimarães) and Saia’s Mount (Barcelos). Also what importance they may have had in the Bronze Age landscapes.

Methodologically we question the idea, often adopted, that metallic objects determine an occupation which is commonly classified as “settlement”. We understand “landscape” as a stage and, simultaneously, as product of human agency which continuously, creates and recreates places (Ingold 2001; Barrett 2001). This is something complex and imbued with strong dynamics. It’s accepted that “place” will be any site that, as a result of memories and other practices, instills in the communities which contact with it a sense of belonging, shaping it throughout its existence in a space of great social significances (Van Dyke & Alcock 2003). As J. Thomas (2003: 173) stresses out “... landscape is thus a network of related places, which have gradually been revealed through people’s habitual activities and interactions, through the closeness and affinity that they have developed for some locations, and through the important events, festivals, calamities, and surprises which have drawn other spots to their attention, causing them to be remembered or incorporated into stories”.

From these assumptions and from the analysis of the metallic amortizations in interaction with those two “natural” surroundings which involved them and with which they interacted (the Penha’s and Saia’s Mounts), it is raised the hypothesis, in this precise contexts, that the hoards may be the materialization of certain social actions, within frames of integration and symbolic order of communities, in the world which they are immersed. They celebrate or incorporate “places”. This however was already defended for the Penha’s Mount (Sampaio et al. 2009) where, actions of exceptional character that included the deposition of diverse metallic objects in copper, bronze and gold, could have exerted a commemorative purpose of a “place of great collective importance” in the Bronze Age landscape in Ave’s basin. This indicates its concealment, of the incorporative act regarding the construction and reinterpretation processes within ancient combined memories.

With this type of interpretation it is assigned a greater complexity for places lived, experienced, practiced and perceived during the Bronze Age, beyond traditional taxonomic classifications of settlements, necropolis and hoards is equated.

Key-words: Ave’s basin; Bronze Age Landscape structuration; Penha’s Mount; Saia’s Mount; metallic depositions/amortizations; Places.

Metallurgy from the Hill fort of “Cabeço da Argemela” (Fundão): shapes, significance, productions and contexts

Raquel Vilaça [1], Sara Almeida [2], Carlo Bottaini [3], João Nuno Marques [4]

[1] Instituto de Arqueologia. Departamento de História, Arqueologia e Artes da Faculdade de Letras da Universidade de Coimbra; CEAU/C/FCT
[3] CEAU/C/FCT

Abstract
Located on top of the hill known as “Cabeço da Argemela” (Lavacolhos, Fundão), an elevation recognisable in the chain of reliefs that make up Serra do Gomes, this fortified settlement appears in the bibliography since the end of the 19th century. However, the first scientific surveys were only undertaken in 2003 and later in 2006 and 2009 by Palimpsesto Lda., all of them possible due to the mining activities carried out by Unizel-Minerais Ld.ª, and their knowledge and will to preserve the archaeological heritage. These works revealed the existence of two different phases of occupation, one in the Late Bronze-Early Iron Age, and the other at the end of the 1st millennium a.C. The results from the excavation work and all the data collected during the fieldwork carried out, provided elements related with the Bronze mining “chaîne opératoire”, which will be discussed in this article.

Artifacts in their different dimensions are analysed (morpho-typological, technological, chemical, structural, economical and symbolic characterization) focusing on their different contexts of origin without forgetting what is known about mining in the area during late prehistory. The data collected till now allowed viewing the Argemela hill as an “anchor settlement” in the regional settlement web, i.e. “Cova da Beira” where mining assumed paramount importance. This analysis values the location of the hill “Cabeço da Argemela” in a region favoured with mining resources, either by the existence of quartz cassiterite vein deposits, or by the tin and gold alluvial deposits of the Zêzere river, that runs in the foothill.

Key-words: Late Bronze Age/Early Iron Age; Beira Interior; Bronze metallurgy.
The Castro of Senhora Aparecida (Pinheiro, Felgueiras) and the tin mining exploration – from the Final Bronze Age to the Romanization

Marcelo Mendes Pinto
Gabinete de Arqueologia da Câmara Municipal de Felgueiras

Abstract
The Castro of Senhora Aparecida (Pinheiro, Felgueiras) was recognized in 1990 and revealed a settlement since the Final Bronze Age to the end of the Roman Empire.

The highest Castro in the region, it controls the Sousa River’s basin and its importance is due to the proximity to the hills of Seixoso and Penouta, where tin mining evidences exist. Its importance was increased with the control of the routes of tin commerce to the north, to the littoral and to the Ave and Tâmega valleys.

Archaeological digs showed an Iron Age and a Roman settlement too, from the 1st to the 5th century AD, and it was found there a little statue of a Roman divinity.

Key-words: Final Bronze, Tin, Iron Age site; Roman site.
The exploitation of the iron mineral resources from Iron Age to Middle Age in Odemira (SW Portugal): current research

Jorge Vilhena [1], Mathieu Grangé [2]

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[2] Doctoral student at University of Paris 1 Panthéon-Sorbonne (UMR 8167, Orient et Méditerranée, labo “Islam Médiéval”); Research Fellow of the Fundação para a Ciência e Tecnologia (Portugal)

Abstract

In the late 19th century, mining engineers and prospectors noticed the presence of old mining works, which they considered as “roman” or “ancient”, in the iron and manganese mines of Odemira and Cercal (Southwest Portugal). They have also acknowledged the presence of slag close to pre-industrial shafts and adits. Despite this information, there has been, until recently, a lack of archaeological research focusing on those remains. Even at present, ancient iron metallurgy seems to be widely overlooked in relation to the on-going interest in the study of the non-ferrous metallic minerals, particularly of the Iberian Pirite Belt (IPB).

In the Odemira district, the ironworks sites started to be investigated within the scope of the BRONZMIRA archaeological project (1998-2002, J. Vilhena dir.). Field surveys allowed us to attest the importance of ferrous metallurgy activities in this area from Late Iron Age to the end of Middle Age. Research also showed that not only were exploited the main ores of Cercal hills belonging to a branch of the IPB volcanic and sedimentary complex, but also minor iron mineralizations widely scattered outside that area. More recently M. Grangé carried out the first archaeological excavation of an early medieval bloomery.

This paper looks at several aspects on the iron production in Odemira, from the Iron Age to its development in Roman and Islamic periods and its decay in Early Modern Era:
- The type of ores exploited
- Spatial and chronological distribution of ancient works
- Production contexts, with special focus on the different steps of the chaine opératoire, within the scope of the Anthropology of Techniques.

Keywords: Ferrous metallurgy; Iron Age; Roman period; Islamic period, Southwest Portugal.
Landscape, Settlement and Ancient Mining in the Upper Valley of Terva River, Boticas

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Abstract

Understanding landscapes, settlement patterns and ancient mining evidences in the Upper Valley of the Terva River, Boticas, is one of the main objectives of the research project that the Archaeology Unit of the University of Minho is developing, regarding the local County program of “Conservation, Study, Valorisation and Publicize of the Ancient Mining Complex of the Upper Valley of the Terva River, Boticas”, developed within the institutional protocol between the University of Minho and the Boticas County.

Besides a brief exposition of the project, we intend to present a synthesis of the ongoing research, that already allowed us to identify and characterize a significant sum of data regarding the long term settlement in the Upper Valley of the Terva. Amongst the data we’ve collected, stand the remarking evidences of Iron Age Hill forts, Roman Settlements and mining areas.

Furthermore, our objective attends to reflect over the investigation guidelines that will conduct the project development.

Keywords: landscape, settlement, mining.
Archaeo-Mining in the Beira Interior (Central Portugal) from the Calcolithic to the Roman Age

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Abstract

This work represents the first step of a multi-disciplinary project under the title of “Archaeo-Mining in the Beira Interior (Central Portugal) from the Calcolithic to the Roman Period”.

The project’s general aims concern:

a) checking and locating traces of ancient mine-scouting in Beira Interior, from the eldest exploitation phases to Roman age included;

b) appraising the results of a) in terms of connection between mining activities and local population development;

c) valorizing data and resources for a sustainable territorial growth and the development of cultural tourism.

As a matter of fact, the presence of mining resources is a major factor in human settlement on a territory: not only it sets an economic frame but it’s a main influence on territorial dynamics resulting in the forms of social patterns and political organization.

In the focus area of our project, differing from other Portuguese areas (Batata 2006; Martins 2009; Barbosa et alii 2003; Merideth 1998), we lack of archeo-mining studies and essays.

We will show a bibliographical revisal’s first results - in both archeological and geological-mining editing; we’ll locate even small-sized ore bodies (especially copper, tin, iron and gold) and traces of human settlement, mining-sites (open pits, galleries and shafts) marking features of material culture such as mining tools, hammers, slags and cinders and so on.

Finally, we’ll work on data integration until establishing an organic frame of archeological, mining and metallurgical notions.

Key-words: Archaeo-Mining, Beira Interior, Calcolithic/Roman Age.

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Etnoarchaology of mining enclaves in river Ribeira valley and O Tameirón (A Gudiña, Ourense, Spain)

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Abstract

The present study summarises the preliminary results of an ongoing ethnoarchaeological investigation concerning the contemporary mines in A Gudiña municipality (SE Galicia, Ourense, Spain). This work is part of the Archaeological Intervention project in the Monte Urdiñeira Environment (A Gudiña-Riós, Ourense), carried out by the University of Vigo. This area is central to the study of the origin and spread of bronze alloy in the Iberian Peninsula, with special emphasis on the relationship with settlements and overland routes. The main aim of this study is to obtain information on mining in recent history from a multidisciplinary perspective, utilizing documentary and bibliographical reviews, field surveys, records of the material evidences and direct ethnographic interviews. Within this framework our aim was to better understand the potential uses of tin ore deposits in prehistoric time.

Until now four tin mines situated along the river Ribeira (only 3 Km stretch) were documented, and another in the Tameirón area, where the mine works appeared to be earlier.

Keywords: tin ore, mining, Prehistory, A Gudiña, Iberian NW, Etnoarchaeology.
Primary gold deposits of the León province (Spain): Roman mining techniques

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Abstract
The Leon province in Spain is very representative of the roman gold mining because of the large amount and outstanding mines, developed in secondary gold deposits using hydraulic techniques. However, there is as well, a significant amount of mines over primary gold deposits, where Romans made important mining works. Romans used different techniques besides hydraulic ones. Field works carried out in these deposits clearly show a systematic way in the methods used for the ore extraction and recovery. Sometimes these methods superimpose over each other, which bring to light the complexity of these exploitations and a perfect adaptation of the mining technology to geological setting of the ore mineralization.

Key words: roman mining, gold, mining technology, primary deposits.
Roman mining in the lower basin of River Minho

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Abstract

This paper presents the results of recent investigations of the impact of Roman mining in the lower basin of River Minho. Until now, the region appeared marginally characterized in the overall deployment of Roman mining in the Northwest. This work allowed us to identify and interpret the structures mining for gold exploration in the valley of the Minho, proving to be one of the most active in the antiquity in the Northwest Peninsula. Our study focuses in the evaluation of mining and its impact on social structures and forms of settlement.

Keywords: Roman mining, River Minho, settlement.
Contribution to the study of the Roman Gold Mining at Rio Terva Basin

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Abstract

The Rio Terva basin is known by many different Roman Gold Mine vestiges that we can found in the bibliography. This work summarizes research carried out in the region, principally in geochemistry anomalies and their relationship with the mining exploitations.

A recent drilling core campaign in the area was able to identify in deep a gold mineralization, punctually very rich (50g/t). There are also coarse gold as small nuggets of a half millimetre. The granitic rock present in this mineralization is sometimes altered, which explains the importance of hydraulic processing in the exploitation. These data are supported by the identification of at least one aqueduct and a dam in the surrounding area of Ardãos village.

Once integrated in a GIS Project, all these data are able to clarify some doubts from the field work, principally in identifying real ancient gold mines instead of other kind of works.

Keywords: Gold Mines, Romans, Rio Terva.
Contribution to the study of the Roman Gold Mining in Banjas Hills

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Abstract

Banjas Hills are known for their important vestiges of Roman Mining that we could found easily in the bibliography. The present work focuses in recent research carried out by the authors in these hills with the aim of all mine works detailed mapping. The work start from ancient mapping of mining concessions: Vale do Braçal, Vale Fundo and Serra de Montezelo.

These mining complexes were integrated in a GIS project, with ancient cartography and actual survey of open pit and underground works. The shafts were visited using speleologist methods. In connection with these mining complexes were found many vestiges of quartzite and granite mills.

Close to these ore treatment vestiges there are evidences of habitation /officinal structures, with tegula, sigillata and other common ceramics.

Keywords: Gold Mines, Romans, Paredes.
The MINEDOR Project
Archaeological and paleoenvironmental characterization of the Arvernian gold mines of Upper Combraille (Iron Age - Middle Ages), Massif Central, France

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Abstract
The MINEDOR project aims to study from an interdisciplinary and diachronic point of view the ancient gold mines, traditionally attributed to the Gaulish period, discovered in large numbers at the fringes of the Arverni and Lemovices territories, in the area of Upper Combraille (Puy-de-Dôme). The goal is 1) to accurately map the mines through fieldwalking and aerial surveys, analysis of vertical aerial photographic coverage and localization by dual-frequency DGPS, 2) to assess their impact on the landscape through palaeoenvironmental (palynology, microfossils) and geochemical (heavy metals, trace elements, lead isotopes) analyses made at high resolution from cores extracted in wetlands (bogs, marshes, ponds), and 3) to date the phases of exploitation. These new data will highlight an important aspect of the ancient economy of the Massif Central. The hypothesis of an exploitation of gold mines in Roman times could explain the density of settlements identified by prospections in recent years in this highlands area (900-1000 m), and whose occupation dates from the first two centuries AD. As wetlands contain considerable stocks of water at the head of the watershed, it will also be possible to assess the environmental consequences of ancient mining pollution in the short, medium and long terms.

Keywords: Archaeology, palaeoenvironment, mining, wetlands, palynology, geochemistry, mining pollution, Arverni, Minedor.
Use of iron ore in the mountain Basagain (Anoeta, Gipuzkoa, Basque Country) from the Protohistory until our days. Preliminary study

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Abstract

The purpose of this communication is to present the preliminary results of the archaeometallurgical study being carried out on Basagain Mountain in Anoeta. The mountain’s peak is home to an Iron Age fortified settlement, subject since 1994 of an excavation led by X. Peñalver of the Aranzadi Society of Science’s Department of Prehistoric Archaeology. On the slopes of the mountain, outside the walled area, various traces of exploitation of the mountain’s iron mineral have been found. These traces include a number of mines from recent times and the remains of slag from mineral processing.

In the excavation of the site, abundant remains related to the processes of obtaining and working iron have led us to believe that metallurgy was one of the important activities carried out by the settlement’s inhabitants and that the mineral’s presence on the slopes of the mountain is perhaps one of the main reasons for the construction of the protohistoric settlement at this location in the Oria Valley.

For this reason, we have begun a study including analysis of the archaeometallurgical materials found in the mountain’s fortified village as well as the prospecting and cataloguing of the remains of mines and slag found on its slopes in order to identify the origin of the mineral used in the Iron Age and determine the typology and chronology of the mines, with the aim of obtaining a diachronic view of the exploitation of the mineral on this mountain.

Key-words: Archaeometallurgy, Basagain, iron ore.
An archaeometallurgical working group in Portugal: research achievements and perspectives

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Abstract

In the recent past, an interdisciplinary working group focused on archaeometallurgical issues of the Portuguese territory joining resources of ITN and CENIMAT/I3N has emerged, helping to cover a gap that existed among national archaeometric studies.

Various large and small scale investigations have been conducted on ancient metallurgy of the Portuguese territory, in close collaboration with Museums, Universities and archaeologists from private and public organizations. Results have been regularly published in international and national journals and disseminated in various scientific meetings.

For the last years our research has been strengthen, particularly on the sequence of current PhD’ programs in Conservation Science and the Metabronze project “Metallurgy and Society in Central Portugal Late Bronze Age” (POCTI/HAR/58678/2004).

Recently, a large project “Early Metallurgy in the Portuguese Territory - EARLYMETAL” (PTDC/HIS-ARQ/110442/2008) has been approved by the FCT and was initiated in April 2010.

EARLYMETAL project main goal is to investigate the metallurgical evolution from Chalcolithic to the Orientalizing period in the Portuguese territory.

In the present communication a brief history of the archaeometallurgical studies carried out by our team in the Portuguese territory will be presented, as well as the joint venture taken by the present team including its expertises and to finish a concise presentation of the EARLYMETAL project.

Keywords: archaeometallurgical studies; Portuguese territory; alloy composition; microstructural characterization; lead isotopes.
The contribution of a multi-analytical approach to the comprehension of ancient metallurgy of the Portuguese territory

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Abstract

In the present communication some results obtained in the framework of the PhD project of the first author on ancient metallurgy of the Portuguese territory are presented. The PhD deals with the metallurgy performed over a period of ~3 millennia, with a special focus on Late Bronze Age metallurgy.

For the study, more than a thousand of artefacts and fragments attributed to different cultural periods, including Copper Age, Late Bronze Age and Iron Age, were studied by diverse analytical means. Energy dispersive X-ray spectrometry (EDXRF) and micro-EDXRF have been performed to study the elemental composition of metallic artefacts, fragments and other metallurgical remains, and optical microscopy (OM) and scanning electron microanalysis (SEM-EDS) have been performed on some artefacts and fragments to study their microstructural features.

Overall, the analytical procedure employed has shown to be of major importance for the study of various technological features and to provide some metallurgical particularities ascribed to each cultural period. In the present communication, the applicability of these techniques for a comprehensive study of ancient metallurgy will be demonstrated. General metallurgical trends for the different pre-historic periods in the Portuguese territory will be illustrated with the presentation of some specific case-studies.

Keywords: Portugal; copper-based alloys; analytical studies; composition; microstructure.
First Bronzes of North-West Iberia: The data from Fraga dos Corvos Habitat Site

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Abstract

The evidences of binary bronze production, recently produced for domestic contexts in two sites of Northern Portugal, dated of the second millennium’s second quarter, provoked an import change in our comprehension of its origins and dispersal in the western Iberian façade (Comendador, et al. 2008; Bettencourt, 2000; Senna-Martinez, 2007).

The Fraga dos Corvos habitat excavation and study (8 field seasons, 2003/2010, with 137m$^2$ of open area) allowed the identification of binary bronze foundry areas (melting and probably smelting as well – Senna-Martinez, et al. 2010), as well as metallurgical leftovers, a crucible and molds.

The data obtained, together with the study of the 19 domestic structures (“huts”) distributed between five stratigraphic phases all attributed to a second phase of the First Bronze Age (c. 1750-1250 a.C.), allow us to perspective metallurgical production in its technical and social context.

The metallurgical working areas of Fraga dos Corvos, together with the data from Sola habitat (Braga) and their probable association to the production of axes of Bujões/Barcelos type allow us to consider the processes of dispersal of bronze artefacts production southwards from their northern prototypes.

Key-words: Fraga dos Corvos; Northern Portugal; First Bronze Artefacts: Archaeometallurgy.

References

Metallurgy and Society in Mondego’s River Platform (Central Portugal) First Bronze Age

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Abstract

The recovery of an early dagger at Quinta do Vale do Gato (Nelas), provides us with the opportunity to revise and discuss the early metallurgical productions of Centre Portugal as well as their social implications.

This artefact typological and compositional analysis (EDXRF) will be compared with those already known for other contemporary regional specimens (with revisions) allowing us to address some of the possible interpretations for the available data and their implications for the technical and social constraints on metal production in this area’s First Bronze Age.

So, we aim to develop a revised regional model to understand the role of metal artefacts in the growing social complexity traditionally connected to the rise of Bronze Age.

Key-Words: First Bronze Age; Centre Portugal; Spit Dagger; Early metallurgies; Social Complexification.
Metallurgy and Society in “Baiões/Santa Luzia” Culture Group: Results of the METABRONZE Project*

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* O projecto METABRONZE (Metallurgy and Society in Central Portugal Late Bronze Age – POCTI/HAR/58678/2004) decorreu entre 2006 e 2009 tendo sido financiado pela Fundação para a Ciência e Tecnologia (FCT).

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Abstract

Since 1984 references to the so called “Baiões Hoard” supported several studies on the Western Europe LBA metallurgy and its relations with the Mediterranean. The revision of its materials for the exhibition “Por Terras de Viriato: Arqueologia da Região de Viseu” (MNA 2000-2001) provided the basis to its characterization not as a hoard but as part of a foundry area. During the exhibition it was also possible to publicly present the large majority of the known artefacts connected to the metallurgy of this Culture Group.

As a result of the 2000/2001 exhibition it was then possible to submit to the Portuguese National Science Foundation (FCT) the project “Metallurgy and Society in Central Portugal Late Bronze Age (METABRONZE)” (POCTI/HAR/58678/2004). We here present the results of this project as well as their profound repercussions on the understanding and characterization of metallurgical production in the Late Bronze Age Baiões/Santa Luzia culture group.

Key-words: Baiões/Santa Luzia Culture Group; Arqueometallurgy; Late Bronze Age; Centre Portugal.
Iron Metallurgy in a Late Roma site, El Castillón (Santa Eulalia de Tábara, Zamora)

Jose Carlos Sastre Blanco, Antonio J. Criado Portal, Patricia Fuentes Melgar
Proyecto de Investigación y Difusión sobre el Patrimonio Arqueológico Protohistórico de la Provincia de Zamora (P.I.D.P.A.D.Z.)

Abstract

From 2007 we started an Archaeological Investigation Project in El Castillón. This project is investigating the structures related with Late Roman period and Iron Age in the province of Zamora. These archaeological seasons discovered and excavated two metallurgical furnaces with a circular, this furnaces are related with iron metallurgy. Discovered inside of this furnaces great amount of iron slags, as well as an important amount of iron artefacts, and also in bronze and copper.

About the numerous metallic artefacts that we have located, predominate especially the great amount of nails, iron striker pins and knives, as well as horseshoes of horse, washers, etc.

All these artefacts and the iron slags found in these furnaces are analyzed by the Group of Investigation of Technology Mechanic and Arqueometalurgic of the Universidad Complutense de Madrid, directed by Professor D. Antonio J. Criado Portal, with the objective of knowing with exactitude the use duration of the diverse furnaces and the different reusabilities and repairs that we can see in stratigraphic sequence.

Key words: Late Roman period, iron metallurgy, iron slags, furnaces.
The metallurgical activity and mining exploration in the roman site of S. Faraústo 2 (Oriola, Portel, Évora)

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Abstract

The archaeological site of St. Faraústo 2 (Oriola, Portel, Évora), designated as such by the existence of small religious temple in ruins, is located near the Riverside Oriola at an altitude between 198 m and 205 m.

The archaeological intervention took place between April 2005 and November 2006, under the Plan to Minimize Impacts on Cultural Heritage in the course of construction of the Section of Liaison Loureiro / Alvito, leaving it to the Archeo’Studies, Ltd. The works identified two distinct zones of occupation in Roman times: at North or Residential Area, and another at South or Industrial Area.

The living space at the level of foundations due to the ongoing destruction caused by agricultural use is characterized by a building whose walls are made of schist and Tegula, finding the open trench construction in bedrock.

With regard to the industrial area, were identified a series of deposits consisting of significant amounts of common ceramics and construction, as well as blocks of slag that were subjected to various tests for its characterization. There were also detected seven furnaces in Covacha with about 2 m diameter; the filling was done by black sediment and ceramic material and a refractory clay oven. All these elements orientate the presence of a metallurgical activity.

The living space features a timeline between the third and fifth centuries AD, while the materials of the industrial zone us back to a time interval between the first and fifth centuries BC and fifth century AD.

Key-words: Settlement, Roman period, metallurgical activity.
Mineralogy and chemistry of copper ores and slags from Ingadanais mines: implications for ancient mining

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Abstract

The copper mines of Ingadanais, Vila Velha de Ródão, Portugal, comprise several ores mined between 1904 and 1986, but where ancient roman Cu exploitation have been suggested. The copper mineralization occurs in a NE-SW fault system (Ponsul fault) that has an inherited Variscan geometry and an Alpine reactivation.

The primary mineralization comprises Cu-Fe sulfides and Fe-Ni-Co sulfoarsenides in quartz veins or silicified greywacke brechias. Oxidation of the primary ores results in a superimposed secondary mineralization comprising Cu sulfides, Cu oxides and sulfates, and Fe hydroxides.

The petrography and geochemistry of ores and slags indicates a) at least three mineralization stages through fault reactivation; b) that slags match their closest Cu ores; c) different metallurgical processes, including fractionation controlled by incomplete oxidation reactions.

Keywords: Cu slags, Cu ores, ancient mining
Application of Geo-radar in the recognition of a structure in mining complex of Três Minas, Vila Pouca de Aguiar, Vila Real

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Abstract

The mining complex of Três Minas, located in the parish of Três Minas, municipality of Vila Pouca de Aguiar, Vila Real district, is known for the many traces related to the mining exploration in Roman times.

Três Minas, already extensively studied by J. Wahl (1988, 1993), and currently by C. Batata (2009), presents a whole set of structures related to mining, including the village, the necropolis, facilities for washing ore and a complex hydraulic system including dams, reservoirs and aqueducts.

This work focuses on a structure located near the front of exploration called Corta das Covas, identified by J. Wahl (1988, 1993) and interpreted by him as a Roman amphitheater. Indeed, the apparent configuration ellipsoidal / oval of the remains of the structure, associated with other factors also cited by C. Martins (2010) in a previous publication, seem to point to it.

However, the structure’s plant, in which there is an ongoing project of archaeological works (Batata 2009), may be a decisive factor in answering questions that still remain.

In this context, we used a recognition by geophysical exploration geo-radar, GPR, to be assessed the adequacy of the method and equipment used and, where possible, identify the progress of the buried structure. There were conducted eighteen GPR profiles, with different orientations, with a 279 MHz antenna. The results will be presented, allowing us to infer the possible plant of the structure and in the vicinity the possible presence of others.

Keywords: geophysical exploration, geo-radar (GPR), mining exploration, Roman times.

References


Côvo Glass Factory: archaeological potential assessment – a case study

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Abstract

In 1528, D. João III bestowed on glassmaker Pero Moreno the exclusive manufacture and sale of glass between river Tejo and Galiza, allowing him to establish in the place of Côvo, San Roque, in the county of Feira, in order to build a glass furnace. Since then, the glass industry holds a long tradition in the municipality of Oliveira de Azeméis, being one of the main causes of municipal development, with a peak in the first quarter of the twentieth century. The glass factory of Côvo is an undeniable reference of the archaeological heritage industry, both regionally and nationally, with the specificity that it has remained held by the same family over four centuries. Also specific is the fact that after closing the factory was completely dismantled leaving no traces of its activity above the ground surface. Being a place of high symbolic meaning, it was important from the perspective of heritage management and preservation, to be aware of the site archaeological potential. Using archaeological surveys insufficiently targeted on a private property would involve unavailable resources. Alternatively, the application of geophysical techniques to the identification of areas with high archaeological potential, allowed planning future archaeological surveys in sites previously selected, with an increased probability of success. The used geophysical methods were the magnetic and electromagnetic GPR. The integration, visualization and joint analysis of information has been carried out in GIS environment. Herein is presented a generic description of the achieved work.

Keywords: Glass, Archaeology, Geophysical Exploration, Magnetic, Ground Penetrating Radar.
ABSTRACTS OF THE
POSTER COMMUNICATIONS
Theme 1

Mining engraved in rock: Miner’s tools represented in “Fraga da Ferradura” rock art site (Arouca, Portugal)

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Abstract

Relationships among rock art and different aspects of ancient metallurgy have been described some times by diverse researchers (e.g. Batista, 1983-1984; Bradley, 1998; Alves and Comendador Rey, 2010). These relationships do either relate to geographical positions, i.e. proximities among ancient mining evidences and sites with rock art engravings, or they rather focus on the metallic artefacts that are represented in the rock art, e.g. Late Bronze Age spear heads and swords.

The rock art site of “Fraga da Ferradura”, situated in Arouca, is a singular site, where besides various engravings from diverse periods there are two large sized objects that can be directly related to mining works. One of them represents a double headed mining hammer, with two flat heads, and the other a single headed hammer, with one flat head and a point, or a pick. These tools are known since Roman times (Healy, 1978).

The region of Arouca is rich on ancient mining vestiges (Figueiredo and Silva, 2005), which seem to date back at least to the Roman times. The region is very rich in minerals but also in other geological resources and features, that have been valued internationally very recently with the formation of the Arouca Geopark by UNESCO.

The rather original theme that is represented in this rock art site makes it unique in the region and probably among the Western Atlantic Europe, presenting a singular and close relationship among rock art and mining. Additionally, it seems to emphasize the importance that the region’s minerals had among the local past societies.

Keywords: mining tools; rock art; Arouca Geopark.

References

Identification of probable metallurgical workshops in the Citânia de Briteiros (Guimarães)

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Abstract

With this poster we present a cartography of the metallic finds, or finds related with metalwork, inside the excavated area of Citânia de Briteiros, during the fieldworks made since the 19th century. This identification of the possible spots where metallic pieces were found, intend to give a more clear view of the functional areas inside the oppidum, in Late Iron Age, establishing possible relations between the forges and the road ways, urban density and access to water.

Keywords: Citânia de Briteiros, Urbanism, Late Iron Age.
The village of Chão das Servas is constituted by the archaeological sites of Casarões do Vale, Chão das Servas, Várzea and Ponte dos Bugios 1, all located in the parish and municipality of Vila Velha do Ródão, district of Castelo Branco.

The intervened sites are located in a meander of the River Ocreza, near the Bugios bridge, where can be seen several areas of “conheiras” either on the left or the right bank of the river, while the village is on top of th ridge and on a plateau facing Southeast.

The mining sector is targeted to obtain the gold ore in the following type of exploration:

- primary veins removal from the quartz veins into schistose rock embedding;
- secondary deposits (“conheiras”); and
- alluvial deposits

The mineralogical composition on the site was established from analysis performed on samples of quartz fragments, while the slag made possible to characterize the metallurgical activity developed there.

Key-words: roman settlement, mining exploration, primary veins and secondary deposits.
Theme 2

Ancient mining works and roman occupation at Douro River’s terminal basin – recent discoveries and state of the question

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Abstract
The poster and subsequent paper are about ancient mining at Douro river’s terminal basin, focusing in particular its South edge, area where a significant number of ancient mining works, probably dating of Roman period, have been found in latest years.

Those mining remains, which include as subterranean as surface works, seems to be related mainly to gold exploitation, suggesting economic dynamics that the known general archaeological record of Roman period doesn’t reflect at all.

The research project, rooted mainly upon field survey, aims to update the inventory of those mining remains, presented throughout a GIS application, essaying also an analysis of its spatial distribution in the regional Roman occupation framework, pointing out the main research queries and problems.

Key-words: Ancient Mining; NW Iberia’s Romanization; Douro’s basin.
Theme 3

Copper objects from the lower basin of the Vouga River (Central-North of Portugal)

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Abstract
The aim of this work is to present two metallic objects found in archaeological contexts in the lower course of the Vouga river and contribute to the study of the first metallurgical productions at the western facade of the Central-North of Portugal.

The first artefact, an early dagger, was found at the site of Espinheiro, in the Sepins surroundings, county of Cantanhede, at a low platform of the NW side of the Sepins plateau, overlooking the Vala Real (Ponte river), tributary of Cértima river, a tributary of the Vouga river. The finding was detected during field work, in an area of about 1000m$^2$, within which occurs patches of dark earth, concentrations of pottery, carved and polished stone artefacts and some pebbles and blocks that result from the destruction of stone structures.

The second object, a flat axe, was found in Pedrulhais, in the Sepins surroundings, county of Cantanhede, at a large archaeological site located in the Sepins plateau overlooking the Ponte river, a tributary of Cértima, about 1.5 km East of the first. In this archaeological site two great moments of occupation were detected: a Prehistoric, which might be associated with this finding, as well as a gold pin, and another from Roman times (Cruz 2005).

In both contexts there is pottery fragments of the “Penha type” profusely decorated, typical of the Chalcolithic of the Northwest of Portugal, as well as pottery with combed and spines decorations, common in the Chalcolithic of the Northeast of Portugal and in the Chalcolithic and Early Bronze Age in Alto Douro and Beira Alta regions, chronological milestones where these pieces could be inserted.

Although the ceramic collection suggests contacts with the Northwest of Iberian Peninsula and areas further inland of the Mondego river, the dagger finds similarities to the Chalcolithic Southern tradition. This indicates that the lower course of the Vouga basin was an area where different cultural traditions meet during the III millennium BC.

The chemical composition of the metallic objects, determined by energy dispersive X-ray fluorescence spectrometry, will contribute to a more complete characterization of the first metal productions in the west facade of the Central-North of Portugal and will allow the contextualization of these findings among the Iberian ancient metallurgy.

Key-words: lower course of the river Vouga; Metallic artefacts; archaeometallurgy; copper; Early Prehistory of the west facade of the Central-North of Portugal.

References
Theme 3

Bronze Age metallurgic practices in Portuguese Northwest: Pego’s site, Braga

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Abstract

The goal of this poster is to acknowledge the metallurgic production processes dating from the Late Bronze Age at Pego’s site, Braga, in the Portuguese northwest. As a starting point, the data recovered from the excavations conducted between October 2003 and June 2010 was analyzed. As a result the different productive technologies were identified, inferred by clay and lost-wax moulds and other evidences of metallurgic practices.

Due to the quantity of the remains left from these practices, bearing in mind the excavated area, it leads us to consider the hypothesis of a local production, not significant, but probably intended for population needs who attended the site. This seems to correspond with other Late Bronze Age contexts, known and excavated in the northwest, such as Santinha (Amares) and S. Julião (Vila Verde). At Castelo de Matos (Amares) and Falperra (Braga) settlements, various metallurgic production remains were also exhumed, although unfortunately, in both sites the excavated area was too restricted to allow similar conclusions/deductions (Bettencourt 1999, 2001).

Through the physical contextualization of Pego’s, Santinha’s and S. Julião’s sites, which locally have potential tin mining areas, we question if the distance of these points (about 10/12 km) may have contributed for the low practice of this production in these specific archaeological contexts. This may perhaps reinforce the hypothesis of an itinerant metallurgy for the Northwest (Bettencourt 1999, 2001).

The search for metal traces from the molds found at Pego and their chemical composition analysis, taking place at the Instituto de Tecnologia Nuclear of Lisbon, may determine whether the metallurgy from this site presents binary compositions, like other pieces of the Late Bronze Age Northwest (Bettencourt 1998, 2001), which would depart them from their counterparts of the Atlantic coast of western Europe.

Key-words: Portuguese northwest; Late Bronze Age; Pego, metallurgic production; local production.

References

Abstract

This work presents a multidisciplinary study of metallic artefacts from the Orientalising site of Quinta do Almaraz (Cacilhas, Portugal) carried out in the framework of the project “Early Metallurgy in the Portuguese Territory - EARLYMETAL” (PTDC/HIS-ARQ/110442/2008). Elemental and microstructural characterization by Micro-EDXRF, OM and SEM-EDS allow establishing alloying elemental contents, significant impurity distribution patterns and thermo mechanical operations used in artefact manufacture. Results evidence that collection is mainly composed by Cu-Sn alloys with low Sn contents (~2.2 to 8.8 %), despite the presence of few unalloyed coppers and leaded bronzes (Pb > 2 %). Relatively high Fe contents (~0.2 to 0.9 %) point to the use of efficient smelting furnaces that promote incorporation of Fe in metallic copper. Concerning the manufacture operations, artefacts show evidences of hammering and annealing operations regardless of their typologies. Comparison with neighbouring Early Iron Age collections shows different metallurgical traditions and developments, i.e. allows recognition of local and Orientalising signatures of bronze metallurgy at the southern Portuguese territory.

Key-words: Bronze alloys; elemental composition; microstructures; Early Iron Age.
Theme 3

Cerâmica associada ao processo metalúrgico no Sudoeste da Península Ibérica durante o III Milénio ANE. Estudo comparativo de dois casos: Valencina de la Concepción (Sevilha) e Cabezo Juré (Huelva)

Nuno Miguel de Franco Inácio

Abstract

- to indicate -
Abstract

The so-called “Recouso treasure” is a good example of the persistent issues concerning the research on the castro-culture goldwork: lack of detailed publication, scarcity of information concerning its circumstances of discovery... This hoard, found by chance at the beginning of the twenties, is composed of 16 decorated earrings, some of them with associated hanging elements (ornamented terminals, rings and “loop in loop” chains). It also comprises several fragments of these elements, as well as four ingots made of a Au/Ag alloy. From the point of view of its composition as well as of the number and characteristics of the objects recovered, Recouso is one of the most important finds of the castro-culgure goldwork.

The hoard, kept in private hands from its discovery, was studied by X. Carro García in the twenties. The short information he provided was the basis for subsequent publications, which were not supported in a direct observation of the materials.

The recent arrival of the hoard to the Museo das Peregrinacións, in Santiago de Compostela, has allowed us to undertake a detailed study, still unfinished. This poster shows the first results of our work, focusing on the issues of technology and interpretation.

Keywords: Castro culture; Iron Age; goldwork; earrings; gold technology; mode of production; goldsmith hoard.
Integration of airborne LiDAR and Vertical Aerial Photography in the documentation and investigation of Cultural Heritage

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Abstract
Airborne LiDAR (Light Detection and Ranging) or Airborne Laser Scanning (ALS) is one of the most innovative and promising active remote sensing techniques for Landscape Archaeology. However, it’s only by the combination of different techniques in an integrated perspective that we acquire a more complete overview of the hidden Archaeology.

In this poster, we present a pilot study where we integrate Airborne LiDAR and Vertical Aerial Photography to document and investigate heritage elements, in this particular case two Iron Age hillforts in Northern Galicia (Guitiriz, Lugo, Spain).

At the end, we discuss the methodology and the results and we also make some considerations about future perspectives.

Keywords: Airborne LiDAR, Vertical Aerial Photography, integrated perspective, Cultural Heritage.
Abstract

The Castromil Gold Mines are in granitic geological setting. Caused by natural and human action, some underground works are interrupted and we do not know their continuity in deep.

Initially a 2D electrical resistivity profile was carried out on a slope road, which cuts the mining area, and where it was possible to observe the response of this methodology applied to subsurface mining structures and partly filled due to security reasons by the railway company CP.

Applying the method to other areas where there was some evidence of continued underground work we obtained some cases with some degree of success.

Keywords: Geophysics, 2D Resistivity, Castromil.