

ESF Exploratory Workshop on
IRON AND CHANGE IN EUROPE – THE FIRST 2000 YEARS

London, UK, 26-28 March 2010

Convened by:

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SCIENTIFIC REPORT

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1. EXECUTIVE SUMMARY

1.1 Introduction

The period 1000 BC to 1000 AD is pivotal in the development of Europe. It included:

- movement and interaction of “Celtic”, “Germanic” and “Slavonic” peoples across northern and eastern Europe throughout the timespan
- the Rise and fall of the Roman empire
- the Carolingian era and the birth of the Holy Roman Empire.
- the Viking Age
- the development of towns
- the development of new agricultural systems
- the growth to dominance of Christianity and the beginning of cathedral construction and monastic communities.
- environmental change, some induced by changes in climate, others anthropogenic

The mastery of iron is a crucial factor in many of the above facilitating the development of more efficient and powerful weapons and tools, yet the study of iron in its own right has often been glossed over or overlooked completely in “mainstream” histories.

Recent research carried out in France, Denmark and Germany now allows us to source iron through the identification and analysis of slag inclusions and isotopes. These breakthroughs have enabled archaeometallurgy to advance beyond the *Chaîne opératoire of iron production* to a state in which it can make a major contribution to wider understanding of the human past and its relevance for the future. For example study of slag inclusions in Scandinavia has made it possible to identify a broad area where an object was produced. The ability to identify the origin of the ore, the place of manufacture and the eventual find spot of an object can reveal important patterns of trade and communication that underpin the diffusion of other artefacts as well as cultural connections. With these important new methods we can revisit much of the history of the period with a new understanding of the connections that existed between people and places. Although there have been a range of international conferences on archaeometallurgy including the study of iron, these have tended to consist of disparate, often site based presentations which seldom venture beyond quantification or analysis of slag or iron objects. It has become clear that a unified approach is essential to enable the sharing of innovative scientific methodologies developed by participants in order to take the subject forward, engage with scholars from other fields including archaeologists and historians of these periods and give the prominence to the subject that it now deserves

The need for trans-European collaboration in this project is self evident in order to address the research questions listed. The workshop also will be multi-disciplinary, involving a range of physical, chemical and environmental sciences and archaeology.

1. Aims of the workshop

- To bring together those working on iron in this era in Europe,
- To consider the extent to which it may now be possible to answer the fundamental research questions (listed below) of all participants in order to move towards a greater, unified understanding of the wider significance of iron in this region
- To assess the extent to which current knowledge and techniques are able to answer the research questions
- To establish a basis for further research collaborations

1.2 Scientific Committee present

| | |
|--------------------|-------------|
| Brigitte Cech | Austria |
| Greta Anthoons | Belgium |
| Jan Claesen | Belgium |
| Arne Jouttijärvi | Denmark |
| Brian Dolan | Eire |
| David Dungworth | (UK) |
| Peter Halkon | (UK) |
| Gerry McDonnell | (UK) |
| Tim Mighall | (UK) |
| Eleni Asderaki | Greece |
| Philippe Dillmann | France |
| Sylvain Bauvais | France |
| Michael Brauns | Germany |
| Miklos Kazmer | Hungary |
| Marco Benvenuti | Italy |
| Claudio Giardino | Italy |
| Bernt Rundberget | Norway |
| Szymon Orzechowski | Poland |
| Martina Renzi | Spain/Italy |
| Vincent Serneels | Switzerland |
| Marianne Senn | Switzerland |

1.3 Organisers

Peter Halkon, Vincent Serneels

1.4 The exploratory workshop

The exploratory workshop took place at the St Giles, London, 26-28 March 2010. All participants apart from representatives from the Institute of Archaeology, University College London, were staying at the hotel.

The conference began with an introduction by the ESF representative, Prof. R. Brulet who outlined the role of the ESF and what it offered. During the morning, the representatives of the 15 European countries listed in Section 1.2 above, presented a brief statement of the state of knowledge in their area and comment on current research activity.

In the afternoon, the focus was on specific topics at the cutting edge of research on early iron such as the environmental impact of iron, the traceability of iron objects. On the following day delegates discussed ways forward and the possibility of establishing an ESF Network.

1.5 Outcomes and further collaboration

It was decided that:

- the summaries provided by each participant and their PowerPoint presentations should be made available on the internet
- a series of articles on theme of the conference should be produced to popularise the study of early iron and its impact aimed at the “popular” archaeology press
- an application should be made to the European Science Foundation to establish an ESF Network to continue the progress made at this workshop.

2. SCIENTIFIC CONTENT

The participants were asked to present a survey of current research on iron production and use from its beginnings as a material for human use to 1000 AD. A list of simple questions was provided as a guideline for their presentations. The situation in 15 European countries was reviewed. The answers are collated under the headings below.

1. When was the first appearance of iron?

In most European countries, the first appearance of iron has been investigated, but there is a need for a critical review of the evidence. In general, the first iron appears either as small objects such as pins or decoration in iron on copper alloy objects. In many mid-northern European countries rare iron artefacts appear in Late Bronze Age contexts and are usually regarded as imports.

On the surface it appears that the idea of diffusion of archaeological objects and ideas, often regarded as outdated, may be apparent, suggesting a chronological shift from South-East to the West and North across Europe as already suggested by previous work.

| DATE (century BC) | Region |
|-------------------------------------|--|
| 13 th - 12 th | Cyprus, Greece & Southern Italy |
| 11 th - 10 th | Mediterranean France and Southern Spain |
| 10 th - 9 th | Central Spain, Central France, Switzerland, Germany, Austria, Poland |
| 9 th - 8 th | Southern UK |
| 7 th - 6 th | Ireland, Scotland, Denmark |

BUT a challenging view is provided from Sweden where recent evidence pushes back the date of the appearance of iron to the 13th C. BC.

Across Europe early iron objects seem to have been restricted for prestige use and cannot be associated with significant evidence for local primary production. The introduction of the first iron in the archaeological record is something relatively easy to record but was probably not very significant in terms of major socio-economic change, but its use for display may have enhanced the power of existing elites.

2. When did iron become more commonly used (general availability of tools and weapons)?

More common use of iron for weapons and tools follows the introduction of the first objects after several hundred years. In order to propose a detailed picture of the “common” use, a set of quantitative criteria must be prepared to evaluate this.

The more widespread adoption of iron for prestige weapons seems to have happened quickly - a rapid evolution after the first appearance of iron - but again it seems not to have initiated much change, even with regard to warfare efficiency and techniques. The effect of iron on warfare, perhaps by the examination of proxy data such as marks made by weapons on human skeletal material needs further research. The appearance of burials containing swords, spears, shield fittings and harness fittings for horse and chariots does however imply continued elite control of iron particularly in a band running from East Yorkshire in the UK as far east as the

Czech Republic. It is interesting to note that in the East Yorkshire Arras Culture the largest iron industry yet known from England coincides in time and space with these burials.

The use of iron for craft tools may be more significant in terms of economic impact and technological development, but this remains difficult to measure. Finally, the introduction of iron tools for farming is certainly a very important event, as it will influence agricultural practice and production significantly.

There seems to be a general pattern in the more widespread adoption of iron as follows:

1. the increase of large prestige weapons,
2. the introduction of a few specialized craft tools, probably related to prestige good production.
3. The increase of frequency and diversification of types of craft tools
4. "typical" farming tools appear.

This progressive increase of use of iron extends throughout the pre-roman Iron Age period. A similar chronological shift from South East to North and West still seems to be present. Greece and Italy reach a high consumption level as early as the 7th BC, whereas in the Celtic world, the significant increase seems to be later c. 250 – 150 BC.

3. When did iron become a very common material (general availability of nails, fittings and so on)?

After the Roman conquest, it is obvious that iron is a very common material everywhere inside the Empire. Almost all weapons and craft tools are made of iron, iron tools for agriculture are very common, nails and fittings are used at a large scale for building. In several areas, the diversification of use was already a reality a few decades before the conquest.

It remains unclear whether this diversification reflects a significant increase of the production or not. The quantity of archaeological iron dating from the period after the Roman conquest seems much higher than in the pre-roman Iron Age, but the archaeological record itself is biased (more finds for Roman times than for pre-roman finds). The Roman Empire brings a significant intensification of iron consumption, but this tendency may have started before.

Outside of the Empire, there is apparently no such important increase at the beginning of the era.

As a general rule, iron artefacts are neglected in the archaeological record in general. This situation results from the combination of frequent poor preservation and insufficient training of the archaeologists. Iron has not been regarded as an "interesting" material, especially when it becomes a very common. For this reason, it remains very difficult to obtain the quantitative data on iron objects necessary to draw a detailed picture of the evolution of the consumption of the metal.

4. When, where and how was iron produced?

Evidence for Iron production can be seen in metallurgical wastes, mainly slag and furnace remains. During the late 19th century, such remains attracted the attention of the mining engineers of the industrial revolution all over Europe. After World War 1, for more than 50 years, there was little interest in these kinds of remains. It is only during the late 30 years, that the research has been restarted, first in the UK and the former eastern European countries, then in France, Germany and Scandinavia. Even today, there are very few research activities in the southern European countries (Spain, Italy, Greece and the Balkans). On the other hand,

iron production has been a very widespread activity, with hundreds of regions involved through time.

It is then a large task to provide a chronological and quantitative framework of the production of iron all over the continent. At the moment, for the southern countries, Portugal, Spain, Italy, the Balkans and Greece, there is no good archaeological record of the evidence for primary production. Very large areas are more or less completely understudied or are even without research. Spain is well known for the production of metals in Antiquity and Medieval times but little archaeological evidence has been recorded.

Italy is not as rich metallurgically as Spain, but the historical role of the iron ore of Elba and the production site of Populonia are of major importance for the understanding of the history iron, through they remain poorly documented. Evidence for iron in other Italian provinces is poorly known, especially Northern Sardinia. The mineral wealth of the Balkan Peninsula is also very well known, but we have only very superficial knowledge about ancient iron production. In Greece, several production districts have been located, but very little archaeological work has been done.

For more northern countries, the state of the knowledge is much better but is still uneven both in quality and quantity. There are very well known areas, with systematic survey, excavated sites and good chronological data, and others where archaeological investigations are still to be done. As a rule, it is possible to say that archaeological data is available for most of the major production districts, but at very different levels of knowledge. One can suspect that not all minor production districts are recorded and sporadic production is far from evidenced.

The very first production has in general not yet detected by archaeological research. Only in a few regions have sites dating back to the Early Iron Age been found. It is a crucial to be able to understand whether early production was really restricted to a small number of areas playing a major role in providing iron to neighbouring countries or if it was widespread all over Europe but not yet discovered in the archaeological record.

Late Iron Age production, contemporaneous with the development of widespread consumption, is now recorded in many places in most northern countries. This is a reflection of the increasing of consumption and the diffusion of technological knowledge. Neither the processes of in this technological diffusion or the routes taken for its general adoption, or the precise chronological framework in which this happened are fully understood. There is some conflict between claims for local technological development and a model of diffusion spreading developed techniques. At the moment, it is particularly difficult to understand the importance of technological innovation from the South.

Roman iron production leaves massive evidence in several areas. It appears that the Romans organized large scale production in a restricted number of locales and developed a solid trade network for iron. Several of these districts of massive production are known in France (Montagne Noire, Burgundy and Berry), Great Britain (Weald, Forest of Dean) and Austria (Carinthia). Other ones are suspected but not studied (Entre-Sambre-et-Meuse, Belgium). In Western Empire, this framework lasts for at least for 250 years. After the 3d c AD crisis, many things seem to change, both regarding the geographical distribution of the production districts and the technology involved. This happened in the context of a probable drop of the production.

Outside of the Roman Empire, during the initial centuries of the era, production seems to remain at a much lower level, except in a few specific areas where a significant process of concentration of the primary production took place, for example in Southern Poland.

Early Medieval production shows a much more scattered pattern. Small production units start to operate in many locations, frequently outside of the former large Roman districts. The

technological know-how seems to be shared by a large fraction of the population, relying much more on local production than on an exchange network. This low scale production allows only for low scale consumption. In this context, in the Northern part of the continent, the development of the Viking society, which relies heavily on the use of iron, remains to be explained. It is a matter of surprise that the Scandinavian archaeological record of smelting sites is not particularly rich for this particular period. During the Carolingian era and later, iron production sustains the significant economic development of the European countries and even the imperialist politics of the crusades against the Muslim world.

Regarding the technological processes, iron was produced in the solid state (direct method of reduction / bloomery process) for a long time. It is only later on (perhaps from the 12th C. AD and certainly from the 14th C. AD in several areas e.g. Low Countries, Northern Italy, Norway), that iron has been produced in the liquid state, in the form of cast iron (indirect method of reduction / blast furnace process).

During the last 20 years, the number of excavated furnaces has increased drastically, as a result of both rescue excavation and oriented research projects. There is a specific need for a systematic collection of the available evidence and the building up of an elaborated classification.

5. Who controlled production and distribution?

Archaeological evidence for the understanding of the organisation of the production is rarely directly available in the Iron Age, though some control of use and production by elites can be inferred. It is only during the Roman period though a combination of written sources and archaeological data, that a firm understanding of organisation of iron production can be modelled. There are still large discrepancies between the different types of sources. In general, the available knowledge on iron production and distribution is not sufficient to propose a very detailed interpretation of the pattern of organisation.

6. What was the impact of iron production on the environment?

Iron production is based on charcoal fuel. Large scale production as exemplified by the large Roman sites in France, England or Austria, which would have required very large amounts of wood. The written record from the Industrial era (18-19th AD) demonstrates that at that time iron production had a large impact on forests all over Europe.

The extent of environmental impact of the production of iron during the earlier periods remains a matter of debate and research on this question is only just beginning (see below).

At the moment, only local studies have been performed and the archaeological data is not sufficient to allow generalisation. To date the work done in North Wales is perhaps the most important.

7. What was the economic impact of the iron availability on agriculture, mining and quarrying, craft production, building and engineering?

The introduction of iron tools for land clearance and farming had a large impact. Not only does the introduction of iron tools make woodland clearance more rapid, it also improves the efficiency of the farmer, allowing each worker to manage a larger surface annually. Iron plough shares allow cultivation of much heavier soils than wooden tools. The introduction of iron tools therefore results in an increase of the cultivated surface and a change in the type of land used.

Agriculture using iron tools must have had a significant impact on the environment and the society at the time iron becomes a common metal, during the second half of the final millennium BC and / or during the Roman period, depending on the region.

To understand the role played by iron in the transformation of the society, it is necessary to improve the quantitative approach to the understanding of production and of the consumption.

At the moment, only local studies have been performed and the archaeological data is insufficient.

Mining, quarrying, craft production, building and engineering are economics activities which can be greatly improved by the availability of iron. In Southern Europe from the last millennium BC iron is already commonplace for such activities. In the Western area, the adoption of iron develops rapidly under the Roman rule, though in some areas there is already a significant development a few decades before the conquest.

The collapse of the Roman Empire is followed by a significant drop in mining, quarrying, craft production, building and engineering and in iron production itself. This, however, happens in the context of a global economic depression and political instability.

Iron is clearly involved in the development of the new technical system of the Medieval period

8. What was the cultural / ethnographic impact of iron (figurative presentation, folklore and tradition)?

The association of iron production with religion and ritual seems to be widespread and perhaps at first deliberately encouraged as blacksmiths and other metalworkers held a special place in mythology both in southern and northern Europe across the time span of this study. Classical writers tell us that smiths held high status within the Celtic world and throughout northern Europe there are burials which contain blacksmith's tools and weapons, though these are rare. In the Roman world the god Vulcan appears on pottery and stone artefacts, with noticeable concentrations in areas occupied by the army and in localities where there were furnace based industries.

In the post Roman period, Wayland or Volund the smith appears on stones in Scandinavia and in Britain on objects such as the Franks Casket. The Celtic, Scandinavian and Germanic folk tales of more recent times may provide a relic of past belief systems associated with the transformative powers of metalworkers. Throughout the time span, iron objects feature in ritual deposition, particularly in the north.

9. Evaluation and characterization of iron ore resources.

Iron ores are widespread throughout Europe. For decades they have been investigated by geologists for economic purposes. It is important to bear in mind that the modern conception of iron ore is not the same as it was during early period. In the past, superficial small deposits of high grade ore were much more attractive than large underground low grade deposits.

10. Location and characterization of smelting sites (including identification of technology – furnace types, etc) and quantitative approach.

See point 4

Ancient and recent archaeological work has provided much evidence for primary production of iron, all over Europe however, the actual knowledge remains very unequal from one area to another. At the basic level of simple identification of production areas (unsystematic survey and occasional finds), the general rule is that the record is much better in the northern countries

than in the southern ones. At the level of the identification of the technology and the establishment of a general chronological frame, only a few areas have been satisfactorily investigated. At the moment maps are reflecting the density of researchers much more than the real distribution of the activity. One can estimate that about 20 major districts of production are documented and about one hundred regions of lesser importance. At the level of the detailed investigation (quantification and detailed chronology), only a few areas have been investigated.

11. Location and characterization of artefacts from burials and settlements – has work been done?

For more than 200 years, iron objects have been collected from archaeological excavations but, even today, iron remains a poorly studied material. There are plenty of typological studies on well preserved “nice” artefacts that provide a lot of information for a few specific categories (weapons, jewellery), providing important chronological information. Studies for utilitarian objects (tools) or simple fittings (nails, etc) are much less numerous. It is not yet a common practice to quantify iron artefact assemblages. Very few regional surveys have been made.

All kinds of analytical methods have been performed on iron artefacts. X-ray images are frequently necessary before conservation. Metallographic microscopic investigations are a classical approach to iron-based alloys and have been performed to a large extent, but even then not in a systematic way. The available record is of very variable quality and of very unequal distribution through space and time. More recently, electronic microscopy (SEM) and chemical analyses (ICP-MS, etc) are becoming more frequently used. This has opened the way to provenance studies.

For all periods, high quality objects are known, but from the data available, it remains very difficult to understand the mean technical level of the craftsman in a given area at a given time.

12. Quantification of consumption through the study of smithing sites – has the work been done?

Smithing wastes were recognized in the 1960's but it took more than 30 years for the results of investigation to become shared archaeological knowledge. During the last 20 years, much progress has been made in the understanding of those wastes in terms of economic and technological significance. It is only recently that a few studies attempted to understand the consumption of iron through the evidence of the smithing waste.

Potential topics for new research

1. ENVIRONMENT

- Impact of the iron production on the environment in terms of fuel consumption.
- Impact of iron on the environment : use of iron tools for farming : increase of surface / change of type of soil

2. TRACABILITY

Provenance studies are one of the common targets of archaeometallurgical research. It is a three step process. The first step is the definition of a measurable signature contained by the artefact. The second step is the definition of a measurable signature for the source. To be reliable the signature must be unaffected by the production process or affected in a predictable way. Finally, it is necessary to build up data bases for comparisons.

In the case of iron, from the beginning, provenancing appeared very difficult. Fifteen years ago, no convincing study for provenancing of iron was available. With the appearance of news analytical methods and a renewed interest for iron in general, this has change consistently.

Several methods have now proposed and tested (with a certain success), including isotopic ratios measurements (Pb, Sr, Os), trace elements dispersed in the metallic phases and characterization of slag inclusions inside the metal. They contribute to the characterization of a "signature". Attempts made on experimentally produced material proved to be successful. Several archaeological case studies are available. Further research will improve the efficiency of the analytical methods.

On the other hand, it appeared possible to characterize smelting systems (ore - slag - contaminant) and provide a significant signature for sites or regions. Much data is already available all over Europe but it has been provided by many different laboratories using a wide range of techniques. It is necessary to develop common practices and to use common reference materials. At the moment, only local databases are available and no significant effort of coordination has been successful until now. There is still much to do.

3. QUANTIFICATION

The archaeological record is always incomplete but iron production and iron working are waste-producing processes. As the typical wastes (fayalite slag) are not very much affected by ageing and burial and because the amount of waste is related to the quantity of product, a quantitative approach of the iron production can be attempted.

Using field quantification of slag dumps and mass balance calculation based on chemical analysis, it becomes possible to estimate iron output for the primary production. The study of smithing wastes, although more complex, can also bring a quantitative figure.

Calculations of production and transformation must be compared with consumption figures, based on surveys of iron artefact finds.

4. ASSESSMENT OF THE RESULTS, CONTRIBUTION TO THE FUTURE DIRECTIONS IN THE FIELD

The Exploratory Workshop " Iron and Change in Europe: The First 2000 Years brought together around 30 researchers from 15 European countries and demonstrates the potential for future collaboration.

Research in the archaeology of iron has been developing during the last 30 years, both under the pressure of rescue excavations and research oriented projects. It is an interdisciplinary domain at the crossroad between human sciences (archaeology, history, economy and social sciences, etc) and natural sciences (chemistry, geology, metallurgy, environmental sciences, etc). This workshop has demonstrated the necessity for a global approach on a long term chronological scale..

The Representatives were asked to provide a synthetic overview of the state of knowledge in their country of origin, focussing on key questions. It is clear that there is great variability in the quality and quantity of research being carried out. In a few regions, due to active long term research, it is possible to provide a general picture based on a significant body of facts and observations. In many other areas, due to the lack of researchers, the general picture is not yet emerging. It is particularly obvious that much more attention has been paid in the northern countries than in the southern part of the continent, even in the North, there are still many very poorly investigated areas and the picture is far from complete.

On the other hand, for large countries, like Spain, Italy, France, Germany and UK, there is still a need for regional views more than for national ones, as in the different regions, the development of the research and also the historical development of iron are quite variable.

Dissemination:

The workshop decided that it was very important that the archaeological community was made more aware of iron archaeology by focussing on:

- why is iron important
- how to study iron
- encouraging good practice

There is an important need for dissemination of available knowledge. This is needed at different levels: the community of specialized researchers, the overall community of archaeologists and the interested public.

Dissemination inside the specialized community:

The community of the specialized researchers all over Europe can be estimated about 2-300 persons. They are in contact through personal and informal networks. The “Comité pour la Sidérurgie Ancienne” (CPSA) of the UISPP of UNESCO, played a important role in coordination and networking for more than 30 years (largely due to Radomir Pleiner). It has been organizing frequent (annual or bi-annual) meetings. It is an important task to renew the efficiency of this organisation by developing new resources on the internet.

Dissemination inside the archaeological community:

Metallurgical wastes and iron objects are frequent finds on archaeological sites and often appear in large quantities. For this reason, the small number of specialists will never be sufficient to take care of all archaeological finds and it is impossible to consider total and long term conservation. It is therefore of major importance that field archaeologists are made aware of the basics of metallurgical and metallic remains. Efficient strategies for recording and study of metallurgical wastes and iron objects have been developed by several teams. It is the role of the specialists to make this knowledge available for the whole community. This should be improved by editing practical textbooks, developing digital resources on the internet and supporting specialized summer schools. This will encourage good practice by all the community and improve significantly the quality and the quantity of the archaeological record.

Dissemination for the large public:

It is also our concern to make the results of our research available for a larger public. During the recent years, several important sites all over Europe linked to the iron production of the Industrial Revolution have attracted public attention. Older remains are not yet recognized to the same degree and an effort should be made to preserve and present sites to the public. There is an increase in replication and experiments in ancient smelting and smithing in public events. A very good way of spreading public interest in iron would be large scale touring exhibition: “**Iron and Change in Europe: The First 2000 Years**” gathering important objects from the Iron Age to the Viking period together with accompanying website, glossy catalogues and publicity. A further suggestion was for the convenors to produce an article that can be translated into various languages and published in popular archaeology magazines across Europe.

FINAL PROGRAMME:

Day one – New research

9.30 – 9.40 Official ESF Representative

A. 9.40 – 9.50 Introduction to the day

B. 9.50 – 12.30

What do we know? Short Presentations with written summary c.10mins. Each participating country gives resume on current state of knowledge based on the following research questions

| | |
|--------------|---------------|
| UK | 9.50 - 10.00 |
| Eire | 10.00 - 10.10 |
| Belgium | 10.10 - 10.20 |
| France | 10.20 - 10.30 |
| Italy | 10.30 - 10.40 |
| Spain | 10.40 - 10.50 |
| Greece | 10.50 - 11.00 |
| Coffee Break | 11.00 - 11.10 |
| Poland | 11.10 - 11.20 |
| Hungary | 11.20 - 11.30 |
| Austria | 11.30 - 11.40 |
| Switzerland | 11.40 - 11.50 |
| Germany | 11.50 - 12.00 |
| Denmark | 12.00 - 12.10 |
| Norway | 12.10 - 12.20 |

12.30 - 1.30 lunch

C. 1.30 – 2.45 PM – Focus on new research methodologies – presentations 1.

- New research on iron and the environment - leader - Tim Mighall

D. 3.00 – 4.30 Visit to British Museum (only 5 minutes away from the hotel) to look at iron objects in Prehistoric and Early Medieval Europe galleries and Romano-British galleries Rooms 52 – 41 (including Kirkburn sword and linch pins – Sutton Hoo treasures) Led by Janet lang

E. – Tea on return

4.45 - 6.00 Focus on new research methodologies – presentations 2

- New research on traceability of iron objects through examination of slag inclusions TBC
- New research on traceability of iron objects through isotopes analysis TBC

Research questions

13. Further provenance studies on artefacts (e.g. isotopes, etc)
14. Characterization of slag inclusions in iron artefacts to relate these to smelting systems defined (provenance – trace distribution) (brief resume)

Dinner 7.30

Day two - Ways forward

F . AM -10.00 – 1.00 Discussion and drawing up of proposals for future work

- Prioritise research questions to be answered based on previous day's sessions
- Establish methods of collaboration – who is best equipped to do what etc.
- Discuss scheme of PhD and post Doctoral and other researchers across European universities and research institutes to tackle these issues (independent researchers must also be borne in mind)
- Funding – ESF Network proposal and other avenues explored
- Methods of dissemination of results/publication NB HOW DO WE COMMUNICATE IMPORTANCE OF IRON TO ARCHAEOLOGISTS AND TO A WIDER PUBLIC?

Lunch and close

5. STATISTICAL INFORMATION ON PARTICIPANTS

The ages of the people represented ranged from 21 to 60.

Amongst the official delegates there were 5 females and 16 males
Guests helpers 2 males and 2 females

15 European countries were represented if one of the guests who from the Netherlands is included.

The majority of delegates were in full-time posts within Higher Education or museum/Heritage institutions. The majority were from a science/archaeology background. The majority were PhDs.

6. List of Participants

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