The beginning of Iron metallurgy: from sporadic inventions to irreversible generalizations

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INTRODUCTION

THE BEGINNING OF IRON METALLURGY:
FROM SPORADIC INVENTIONS TO IRREVERSIBLE GENERALIZATIONS

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This volume gives an account of the scientific contributions presented at the first international archaeological colloquium on ‘Africa and the Mediterranean Basin’ held from 4th to 7th June 1999 at the Museum of Natural History in Geneva, with the theme of the origins of iron metallurgy. The meeting was organized for several reasons. To start with, commercial relations between Africa and the Mediterranean have been known by archaeologists and historians for a long time, and research of the last decades has also brought to the fore the importance of the interactions between the two continents not only in the economic field but also in the political and technical domain, as well as in the history of colonization. It seems worthwhile to approach certain topics by gathering around one table researchers from Africa and scholars specializing in the Mediterranean region. It is true that a few institutions, such as the Laboratoire d’anthropologie et de préhistoire des pays de la Méditerranée occidental of the University of Aix-en-Provence (LAPMO), have already endeavoured to organize such meetings, but they do not cover such a large geographical area as is considered here. As it happens, the archaeological research programmes carried out in Geneva focus on Africa and the Mediterranean, on topics such as the history of colonization and the palaeo-environment in Western Africa, iron metallurgy and ceramics in sub-Saharan Africa, the city of Kerma in Sudan, the funeral complex of Radjedef in the Abu Rawash in Egypt, the relationship between colonists and native populations in southern Italy at the beginning of the Iron Age, urban development in a Roman port town such as Pompeii, and early Christian architecture in Egypt and Croatia. To find a set of themes allowing the scholars involved in these projects to be brought together with specialists from all over the world seemed a worthwhile challenge.

The organizing committee included, in addition to myself as chairman, Jean-Paul Descœudres, Philippe Fluzin, Alain Gallay, Vincent Serneels, Michel Valloggia, and Jean-Louis Zimmermann and was assisted by Aline Robert. The committee hopes to organize further colloquia at regular intervals, the Proceedings of which ought to present a synthesis of a particular topic, that might serve as a reference or as a starting point for new research programmes.

For this first colloquium we decided to tackle the problem of the beginning of iron metallurgy, not only because several of the organizers work in this field (witness, for instance, the film Imagina, the last house of iron, produced by Huysecom in 1995, or the study programmes in palaeometallurgy set up by Serneels in 1993 and Fluzin in 1995), but also because a great deal of research carried out in the last decades on iron metallurgy in Africa and in the Mediterranean has generated a number of theories either founded on a diffusionist model or assuming independent centres of invention. Almost a century after the discovery in Meroë of the ‘African Birmingham’, and in Boğazköy of the letter of King Hattusili III on which the theory of the Hittite ‘secret monopoly’ of iron metallurgy is based, we seem to have reached a dead end. This is due mainly to the fact that many scholars are ill-informed, not only about the phenomenon in its wider geographical context, but also about the research in related fields, or are unaware of the last discoveries made in the different key regions. A
great number of absolute dates that have come up in the last few years have considerably changed several hitherto generally accepted ideas. Suffice it to mention as examples the new chronology for the existence of iron metallurgy in Niger and in Nigeria (in the Great Lakes region), or on the Iberian peninsula, where we can now presume the existence of centres of innovation. It has become absolutely necessary to confront the traditional views with the new evidence.

As Gallay has pointed out, we should decide, when tackling the topic of iron metallurgy, whether we are dealing with a case of invention or one of adoption—which is all grist to the mills of the theories of evolution or diffusion. Furthermore, we must avoid getting involved in politics that may use archaeology for its own nationalistic agenda, or, on the contrary, to deny certain regions and cultures any innovative capacity. It is not always easy to remain rational when discussing research topics. However, the colloquium in Geneva seems to have been a success in this respect.

To broaden our knowledge, we decided to approach the topic from a multidisciplinary angle and with the widest possible geographical coverage, and we organized a preliminary session dealing with questions of methodology. Vincent Serneels and Philippe Fluzin emphasized the importance of carrying out archaemetrical analyses on excavated metal fragments. Such analyses offer many new possibilities, especially in the reconstruction of technical procedures. Peter Crew demonstrated the important contribution made by experimental archaeology when it is closely linked to an archaeological excavation. In his talk about absolute chronology David Killick urged us to be careful when using radiometrical measures, especially in the context of the significance of coal discoveries. Some contributions concerning the higher dates now available, such as the one presented by Alain Person on the evidence in Niger, offer henceforth a solid base to researchers on the existence of independent centres of metal innovations. Eugenia Herbert analysed the relation between archaeological observations and historical scenarios, leaning on historical linguistics as well as ethnography. Finally, the contributions of Nicholas David and myself show the significant openings offered by ethnoarchaeology: it necessitates on the one hand systematic and rigorous observation of the step-by-step procedure of a skilful master blacksmith, and on the other hand awareness of the indissoluble link between technical know-how and symbolic beliefs.

The centre of discussion was, strictly speaking, the question of the beginning of iron metallurgy in Africa and in the Mediterranean. At the conclusion of the colloquium we are able to be more specific about at least three important points.

Firstly, the talks clearly revealed that the beginning of iron metallurgy cannot be considered as the fruit of invention by a single genius whose know-how spread to the rest of the world. The emergence of objects made of iron must be viewed as the result of complex situations where independent centres of innovation could be very close to or even interrelate with centres which adopted the technique from somewhere else.

Carme Rovira Hortál presented some of the best examples from the Iberian peninsula and the south of France that demonstrate the complexity of the mode of the appearance of iron. Depending on the province where it occurs, it can be dated to the 9th and 10th, or even to the 13th century, as it is related either to independent technical development on the continent, or to Mediterranean navigation during the Late or Final Bronze Age, or to the Phoenician colonies, or to Italian trade from the 8th century BC onwards. These complex situations must have been common. They may be explained by mentioning just one example from Mali, where the Dogon people used a technique of metallurgy probably adopted from a local West African centre, but their reduction furnaces contained double tuyères which were typical of the first Phoenician metallurgy. Here, however, they were just dummies, totally inoperative! This is not an isolated example: Central Africa too seems to have experienced such complex developments.
Our present knowledge allows us—putting all passionate debate aside—to envisage one or several independent centres of metal innovation in sub-Saharan Africa, interacting with other centres which acquired their know-how by adoption. Niger is among the regions likely to have discovered the process of iron reduction. Research carried out by Gérard Quéchon presents the remarkable development of the long and uninterrupted evolution of the regional Neolithic cultures. The first iron objects can be dated around 1500 BC. They were found within a context of specialized craftsmanship, notably reflected in the size of stone tools. The oldest furnaces known in this region for the time being are dated somewhat later, around 800 BC. Although this discovery has yet to be backed up, particularly in relation to the technical conditions which made it possible to obtain these first objects, it offers us new ideas on the context of the emergence of iron metallurgy, on the generalization of production, and on the use of the metal. The research of Marie-Claude Van Grunderbeek and Peter Schmidt has shown that the region of the Great Lakes could also have benefited from an early independent metallurgy starting at the beginning of the 1st millennium BC, or according to some radiocarbon datings even earlier, i.e. from the 15th century BC. Associated with the producers of a very distinctive pottery called urewe are reduction furnaces bearing witness to a well-mastered technology. Here, contrary to the position in Niger, the dates of the beginning of metallurgy have not been established. From the syntheses of Hamady Bocoum and Ousmane Sow (whose contribution could, unfortunately, not be included in this volume), it emerges that there are other vestiges of ancient metallurgy, but it is not always easy to distinguish between centres of innovation and adoption, especially when they were very close to each other. Thus, the beginning of the Nok culture in Nigeria, probably from 750 BC onwards, remains uncertain: this culture seems actually to be characterized from its beginnings by a mastery of the techniques of metallurgy, and is associated with terracotta statuary whose symbolism and artistic expression appears to break with the previous traditions. If there is innovation, then in what context does it occur? If there is adoption, where does it come from? Further south, in Cameroon and in Gabon, the archaeological facts, as Richard Oslisly and Bernard Clist pointed out, speak rather for the 'arrival' in the middle of the 1st millennium BC of metallurgists who were masters of their profession. Finally, although iron was known in Sudan since the foundation of Meroë in the 6th century BC (and even in the 9th century BC in the previous capital, Napata), Meroë can no longer be considered the 'pole of iron metallurgy', the starting point of sub-Saharan metallurgy, as the new, higher, chronology of this region and Patrice Lenoble reveal. Meroë should rather be seen as the 'unique centre of a corporation of casters and blacksmiths attached to the supreme power'.

The second lesson of the colloquium demonstrates that ancient iron metallurgy—whether associated with some 'precursor' or a 'first borrower'—remains mostly sporadic, spread across several centuries, even millennia, during which the metal is reserved either for adornments, or for prestige goods, for royal courts, and thus for some isolated objects. Iron-working can still be a 'reversible' process which may be provisionally abandoned or marginalized in such a way that it becomes imperceptible for archaeology. Other materials such as stone, copper, and bronze are mainly used for everyday objects, especially for tools and armaments. As Eric Jean and Jana Souckova-Siegelová showed, this was the case for the Hittites who had some knowledge of iron-working from the Early Bronze Age onwards (3rd millennium BC). However, iron was considered so precious as to be reserved for prestige objects, while all everyday metal wares were produced from bronze. This exceptional use of iron lasts throughout the Middle Bronze Age, as texts from the 17th century BC onwards confirm. Although a certain mastery of iron technology, especially carburization and the production of steel, can be added to the know-how of the Hittites from the Late Bronze Age (17th–12th centuries BC), iron remains very rare. However, from the 14th century, it seems to
have lost some of its value, as it was no longer reserved for the royal court and was henceforth weighed with the same units as copper, pewter, or lead.

A similar situation can be observed in Egypt. Michel Wuttman's and Michel Valloggia's contributions demonstrate that the few precious objects such as amulets, pearls, rings, or bracelets found from the Predynastic period on (end of the 4th to the beginning of the 3rd millennium BC) are mainly made of meteoric iron, a metal which does not need to undergo any reduction process. The first iron objects made with the help of ore reduction are only available in the lower valley of the Nile in the course of the New Kingdom during the 14th century BC. They are precious items, mostly imported from the Near East. At that period there exist alongside these some small ritual objects of mediocre quality which bear witness to the start of a local iron metallurgy. Its quality and quantity increase progressively up to the 8th century, at which point in time the XXVth Dynasty establishes itself. It has its origins in the kingdom of Kush in the north of today's Sudan. During all this period, however, bronze prevails for the production of everyday objects.

According to Zimmermann, a comparable scenario can also be found in the Aegean world, where iron metallurgy was known by the Minoans by the 15th century BC. As in the case of the Hittites and the Egyptians, it was used mainly in the manufacture of jewellery. The production of the first everyday objects in Cyprus and in the Aegean occurs no earlier than the 13th and 12th centuries BC.

This sporadic character of the first iron metallurgy is not a prerogative of 'precursors', as a similar phenomenon is found among some populations who adopted the technique at an advanced stage. Duncan Miller explained that iron remains are rare in Southern Africa in the 1st millennium AD. In spite of the comparatively late discovery of the technique—at the earliest in the 2nd or 4th century AD—iron is mainly used for jewellery and small objects. It was introduced by migrating farmers speaking Bantu.

Whatever the region, the period, or the context of iron metallurgy adoption, the particular ways the metal was first used stress its prestigious character, though in everyday life it is no more important than other metals. This invention is not revolutionary in itself: it is just another innovation to be added to a series of earlier ones.

The third point which emerged at the end of the colloquium is that the most significant result of the discovery of iron technology is the generalization of iron, which coincides with the realization that this metal, especially in the form of carburized steel, offers many advantages over other metals. The change—whether it is to the detriment of lithic industries or of copper or bronze tools, in Anatolia, in Southern Africa, in the Mediterranean, in the Nile Valley, or elsewhere—is rapid and irreversible. It seems always to coincide with major economic and socio-political changes. This moment of passage to the 'generalization of iron' should henceforth be the subject of careful study and specific research.

As far as we know, Cyprus and the Aegean in the 11th century seem to be among the first to have experienced the generalization of iron. It coincides with the socio-economic, political, and cultural changes associated with the beginning of the Protogeometric period. The change in Anatolia from bronze to iron manufacture occurs later, from the 9th century BC onwards. This transformation, too, is contemporary with major political changes in the wake of the fall of the Hittite Empire. Thereafter, the reduction techniques are not necessarily coming any longer from Hittite blacksmiths of the Bronze Age, but are probably the result of Phrygian influence.

Claudio Giardino's contribution shows that the spread of iron metallurgy in the Italian peninsula also took place at the turn of the 9th to the 8th century BC. It may have started as early as the 11th century BC in Sicily, Calabria, and Sardinia. Some iron mines in the Mediterranean must have played an important role at an early stage. This has been confirmed for the Italian peninsula by Alessandro Corretti and Marco Benvenuti with the example of the
island of Elba, where iron ore was probably extracted and exported from the 7th century BC onwards.

There is absolutely no doubt that in the western part of the Mediterranean the Phoenicians played an important role in the spread of iron metallurgy, even if they encountered pre-existing local traditions. Hans Georg Niemeyer's synthesis and Ingo Keesmann's analyses emphasize, therefore, the knowledge of iron metallurgy in Carthage from the 8th/7th centuries BC onwards. It is distinguished, especially in its earliest phase, by a particular type of double tuyère which occurs at the same time in a number of its Phoenician comptoirs. In Pharaonic Egypt on the other hand, the trend to the manufacture of everyday iron objects was not to take place before the XXVIth and XXVIIth Dynasties, i.e. after the invasion of Egypt by Assurbanipal in 663 BC. The metal was considered as an everyday commodity in the last century BC, when the ore was mainly imported from Meroë.

In Western Africa the generalization happened relatively early, e.g. from the 1st century BC onwards in Niger, Nigeria, and Mali. Certain regions of the Gulf of Guinea, such as Sierra Leone, however, apparently had to wait for the turn of the 1st and 2nd millennia AD to see the appearance of the first iron implements. Finally, in Southern Africa the generalization of iron for everyday objects, mostly arms and agricultural tools, dates to the 2nd century AD. It is associated with the setting up of state-controlled commercial structures and the development of trading towards the Indian Ocean.

The colloquium concluded by stressing the usefulness of working in an interdisciplinary way, especially when it comes to technical observations, taking samples for palaeometallurgical analyses, and questions of dating. The meeting also brought to bear a more global vision on iron metallurgy, placing the groups concerned in the context of socio-political evolution, and moving away from the simplifying opposition of innovation versus adoption. Finally, it allowed us to identify important gaps in our knowledge and to question results that had hitherto been taken for granted. A large part of the iron objects of the Hittite precursors, for example, has not undergone precise metallurgical analyses, and this is also true for the mines, where the reduction structures are still unknown in their cultural context. The development of iron metallurgy in the Lower Valley of the Nile and in the Maghreb has been hardly researched. This new way to tackle the beginning of iron metallurgy and comparative assessment on an enlarged geographical scale should provide a solid foundation for future research.

The colloquium, held under the aegis of UNESCO, was organized by three archaeological sections of the University of Geneva, i.e. Classical Archaeology and Egyptology in the Département des Sciences de l'antiquité of the Arts Faculty, and Prehistory within the Science Faculty's Department of Anthropology and Ecology, in close collaboration with the Department of Earth Sciences of the University of Lausanne and the French UMR 5060 of the National Centre of Scientific Research. The organizing committee expresses its deep gratitude to the various institutions that contributed financially to the event, in particular the Canton of Geneva, the Swiss National Science Foundation, the Academic Society of Geneva, the Faculty of Arts and that of Science of the University of Geneva, the Foundation of the 450th anniversary of the University of Lausanne, the Swiss Society for African Studies, and the UNESCO programme 'The Roads of Iron in Africa'. Finally, we would also like to thank the Museum of Natural History of the City of Geneva, and its director Volker Mahnert, for the warm welcome and the support we received during the four-day event, as well as the students and the technical and administrative staff of the different institutions who contributed to its success.

transl. Mireille Desceudres and Derek Harrison