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DOCTORAL THESIS
DACIAN ARTIFACTS IN THE LATE LATENE PERIOD.
EXPERIMENTAL ARCHEOLOGY

Doctoral Thesis Summary

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Contents	p.3
Argument...	p.4
Chapter I Methodological principles concerning experimental archeology	p.11
I.1. Definitions of experimental archeology	p.12
I.2. The domains of experimental archeology	p.15
I.3. The stages of the experiment	p.17
I.4. The norms of experimental archeology	p.19
I.5. Forms and typologies	p.23
Chapter II The history of experimental archeology	p.33
II.1. Evolutions and stages	p.33
II.2. Forms of manifestation and research directions	p.39
II.3 The historiography of iron archeometallurgy	p.54
Chapter III Experimental archeology in Romania	p.59
Chapter IV Obtaining charcoal in antiquity. Practical experiments	p.79
IV.1 Preliminaries	p.79
IV.2 Theoretical considerations	p.84
IV.3 Practical experiments. Obtaining charcoal in surface kilns.	p.96
IV.4 Practical experiments. Obtaining charcoal in the "pit" system.	p.101
Chapter V Obtaining iron in antiquity: practical experiments	p.112
V. 1. Iron ores	p.114
V. 2. Reduction furnaces. Classification	p.123
V. 3. Furnace reactions	p.137
V. 4. The building of furnaces	p.141
V. 5. Fluxes	p.153
V. 6. Fuels	p.155
V. 7. Air draft	p.159
V. 8. Ore exploitation	p.165
V. 9. Ore processing. Calcination	p.169
V. 10. The reduction technology	p.173
V. 11. Aspects concerning iron making in the Dacian world	p.188
V. 12. Ironsmiths and their status in the Dacian society	p.194
V. 13. Practical experiments	p.197
Chapter VI Iron processing. Preliminaries	p.217
VI. 1. Current smithies	p.222
VI. 2. Dacian smithies	p.228
VI. 3. Forging and processing	p.240
VI. 4. Work technologies	p.252
VI. 5. Soldering	p.256
VI. 6. Thermal treatments. Quenching	p.261
VI. 7. Practical experiments	p.272
Conclusions	p.291
Annexes	p.299
Bibliography	p.310

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Experimental archaeology, Dacian civilization, Dacian archeology, bloom, iron, oven, charcoal, hardening, welding, forging, ethnography.

SUMMARY

This research has its origins in a personal scientific curiosity, born in my first years as a student, during the stages of archaeological practice I carried out on the site from Grădiștea Muncelului. This curiosity gradually became a growing interest and a constant concern for what today's specialists call *experimental archeology*. Specifically, I was interested in knowing the techniques and methods whereby the Dacian world had devised its entire set of working tools, starting from the manufacturing processes and facilities and ending with the finished products. For over two decades, I have always sought to explore artifacts in depth, to understand and reconstruct the “road” they traveled from the stage of raw materials to that of finished products. In other words, I have attempted to go beyond the “interface” offered by classical archeology, bearing in mind what is behind the objects found in the excavations, the technology and the stages they underwent up until they became functional tools.

It was not the intention of this research to be exhaustive, but to focus on one of the most important materials of Dacian civilization: iron. The problems pertaining to iron metallurgy in the Dacian world and the objects made of this metal have been discussed and analyzed in a series of specialized studies, but none of them has focused on a reconstruction of the manufacturing processes, techniques and methods. In the absence of similar studies and researches dedicated to the Dacian world, my undertaking has proved to be as challenging as it is difficult. The difficulties have derived partly from the absence of a clear working methodology, of similar types of research conducted in Romanian archeology, and, last but not least, a specialized bibliography due to the gap extant between the Romanian and the Western research in this field.

Experimental archeology is one of the newest and most recently developed directions in archaeological research, having the purpose to create and test hypotheses, conclusions or interpretations based on archaeological historical sources, such as ancient structures or artifacts. Neglected or, more precisely, little used in Romanian historical research, experimental archeology has become, in other countries, a “science” that permanently accompanies

archaeological research. A possible explanation for this lies in the relatively low interest of researchers in Romania in such a perspective, as long as there are still very many archaeological sites that have not been examined yet from the vantage point of classical archeology. The latter offers a wide field of action, while experimental archeology requires relatively high efforts and its results are not always spectacular.

In recent years, the situation has changed, and this field of research has begun to be exploited more and more, even though it is still far from fulfilling its expression potential. This is due, on the one hand, to increased contact with foreign specialized literature and to relations with researchers or specialized institutions in the West, and on the other hand, to the development of internet-based global communication, which enables easy access to bibliographic sources, the visualization of experiments, etc.

It is well-known today that iron played an overwhelming role in the progress of human civilization, given its use to produce tools and weapons that were superior qualitatively to those manufactured from other materials. Archaeological research has shown, for instance, that the area of the Dacian state's capital was one of the major metallurgical centers of antiquity in the Barbarian world. The outstanding technical achievements of the Dacian metalsmiths, under precarious circumstances from the vantage point of current technical knowledge, are well known today, and they are all the more spectacular since these craftsmen lacked state-of-the-art laboratories and equipment, but nevertheless managed to accomplish works that amaze modern scientists.

It can now be stated with certainty that the full range of iron tools, weapons and objects were processed using apparently simple methods, without special workshop equipment, but they required a set of technical knowledge gained through experience over time. The technical issues that pertain to laboratories today (temperature, malleability, hardness, etc.) were the result of the direct observation of the metal that was subjected to processing and of experience.

We know about all these achievements from the archaeological research that has been conducted and, especially, from the artifacts that have been discovered. The situation in our case is different from that of other metallurgic centers, where there have been found especially traces of smelting processes, consisting of the remains of furnaces, slag, coal and, rarely, the tools used or blooms and ingots, the finished objects being distributed in the environment. Here the findings consist of iron blooms, tools used in metallurgy, as well as finished items or objects in the

making, many of them destined for other activities. Little evidence has been found of smelting activities - slag and coal; this is due to the fact that this iron industry suddenly ceased its activity because of the war with the Romans, large amounts of iron being stored for subsequent recovery and for the continuation of this activity.

Based on these considerations and thanks to Professor Ioan Glodariu's suggestion, I undertook an approach from the standpoint of experimental archeology, in the sense that I carried out experiments meant to highlight a series of technological processes used in the Dacian world.

Methodologically, this research has used analogies extensively, as a fully validated method in Western experimental archeology, both in the case of similar experiments and of ethnographic records sometimes situated at great distances. Recourse to such a method was justified particularly because Romania still provides many examples in terms of the perpetuation of old installations and processing techniques.

It should be noted that the present research did not intend to address all the issues related to iron metallurgy, but to highlight, through experiments, a series of metallurgical processes and techniques that, consistent with the principles of experimental archeology, were most likely used by the Dacian metalsmiths. The results of the research do indicate a number of solutions to the questions regarding Dacian metallurgy, but they mostly open the way for future research.

At first, this scientific approach seemed simple, easy to conduct, given that in the technologized world of today, we believe that we can have access to knowledge or can obtain information by resorting to bibliographical sources or, more recently, to the internet. Along the way, I encountered several difficulties, whose solution required mere practical skill or a model to follow, acquired either after repeated attempts or following discussions with and the example of various blacksmiths. Other difficulties, especially those related to conducting laboratory tests, or repeating experiments under similar conditions, could not be overcome, given the limited possibilities. It should also be noted that in the future, such experiments ought to involve interdisciplinary research teams, which should have greater resources. Based on these considerations, I believe that the present work is an attempt to reveal the potential of experimental archeology to solve certain problems related to Dacian metallurgy.

From a structural point of view, the present study is divided into six chapters, the first three addressing the theoretical issues of experimental archeology and the following three being

aimed at reconstructing and restoring, through practical experiments, certain technological procedures and processes of iron metallurgy.

The first chapter is dedicated to a presentation of the methodological principles, stages, directions and areas of research, of the working methods of experimental archeology. It also presents the requirements an experiment should meet so that the results could be used in archeological research, which is an auxiliary science in the field of classical archeology. Given the absence of specialized works and for a better understanding of the domain and its requirements, I present here in detail the theoretical framework and the principles of experimental archeology, its working methods as a science, as well as its main domains, as they have been established by theorists. This chapter also presents the research directions and the history of this science, and the main types of approach conducted throughout time. I also attempt to determine the level of development of this field throughout the world, presenting some of the representative institutions, organizations, museums and research programs. In parallel, I undertake a detailed overview of the experiments conducted in Romania. All this comes to emphasize the gap that separates us from the Western countries in this domain, given that only two organizations from Romania are listed on the website of EXARC, the largest associative structure in the world in the field of experimental archeology. Lately, there has been a much greater interest in this area of research and its use can benefit archeology, given the existence, as stated above, of a number of favorable conditions. A series of experiments have been carried out, others are ongoing, but they are not sufficiently well known. Some of them fall into the so-called mainstream experimental archeology, having a prevalently educational role, while others are based on scientific principles and rules.

The next chapter is dedicated to a history of experimental archeology, starting from the earliest attempts attributable to this domain and reaching our time. The main trends in archeology and, implicitly, their influences on experimental archeology are presented chronologically, since they are connected by an inextricable link. For a better understanding of what this science represents on a global level, I opted for a detailed overview of the main research centers, directions and programs. The chapter presents examples of the most important institutes, outdoor museums, universities and organizations conducting research in this area, as well as of several representative works of experimental archeology.

The third chapter presents the experiments carried out in Romania to date. In order to assess the stage of development, I opted for a presentation of the experiments *in extenso*, to the extent that the sources of information have allowed that. In many cases, documentation was based on presentations of the experiments conducted via the websites of the organizing institutions, which often provide incomplete information.

The next chapter is devoted to charcoal - the main fuel used in ancient times in all metallurgical processes. Seemingly trivial, charcoal was the substance that ensured the power necessary for the smelting and processing of all metals known in antiquity. Experiments were conducted primarily based on ethnographic and field research in order to highlight the mode of its production, the advantages and disadvantages of its production methods.

In the fourth chapter, I attempt to perform some experiments on the smelting of iron ore under circumstances similar to those of antiquity and by complying with the conditions imposed by experimental archeology - using a technology appropriate to the historical period, of identical materials, making permanent recourse to ethnography and, to the extent that it is possible, to laboratory analyses. In the first part, the chapter presents the main iron ores, the installations and tools needed to reduce the ore. To ensure the accuracy of the experiments, I resort to the presentation of numerous analogies with similar experiments and often with remote areas and populations, which still produce iron in archaic ways. The second part is devoted to my own experiments, which were conducted by respecting the principles of experimental archeology and under conditions as close as possible to those of ancient times. The research conducted in the area of the Dacian state's capital has led to the discovery of large quantities of iron objects, as well as of metal blooms that were found in an intermediate stage of processing. To these were added the iron artifacts found during prospecting with the help of metal detectors by treasure hunters, resulting in an enormous amount of iron. The problem that arises is related to the place and manner of producing this metal, given that the specialized literature mentions, for this area, only a few smelting furnaces and traces, utterly insufficient for explaining the iron production. Based on this finding, I attempted to reconstruct some of the ancient metallurgical technologies in order to see and experiment practically the manner in which this process was carried out, the difficulties that could arise and their possible solutions. All the experiments were made in compliance with the principles of experimental archeology. To ensure the correctness of the experiments, the installations, tools and technologies existing in the Dacian workshops are

presented in analogy with the workshops that are still functioning in rural areas today. To illustrate the processing methods and procedures, an ancient bloom was subjected to these operations until a finished product was obtained. Also, an ancient axe was subjected to reprocessing operations, resulting in a tool that, after about 2000 years, has proved to be usable.

In order to showcase and highlight all the manufacturing stages and processes metal undergoes, I have included in the text photographs and images that I consider suggestive from the standpoint of this scientific undertaking. I started from the operations of collecting iron ore, the types of rocks and minerals that have an exploitable iron content, the processes of roasting and then smelting it, and I ended with aspects related to its processing through forging. By this, I aimed, first and foremost, to achieve a congruence, a similitude between text and image, which is very often more suggestive than a description. On the other hand, I believe that a work of archeology, in general, and one of experimental archeology, in particular, may lose much of their value in the absence of images that can highlight and better sustain the research results. There are numerous high quality works whose drawbacks are mainly in terms of graphical representation, perhaps due to the deficient technical conditions of the period in which they were written. Today, when the technical editing means have evolved considerably, the inclusion of suggestive images in the text is extremely easy and may be useful for those interested. I believe that in the future such works will have to include many images and, why not, in a world that is increasingly computerized, even external electronic storage media containing images and films, to be distributed together with the works. Moreover, the development of the internet and electronic media of image reception and processing, of desktop publishing and the presentation of experiments conducted in various fields on websites has led to an explosion of interest in this domain.

Regarding the sources used, I have resorted both to classical archeology works and to studies devoted exclusively to presenting some experiments. An important component in accomplishing this research, especially insofar as the analogies are concerned, has been the use of electronic sources showing such experiments. Furthermore, it should be noted that at first, the sources of information to which I had access were extremely few. Gradually, through the use of the internet, the possibilities of knowledge grew exponentially, facilitating my quick access to reference works and the presentation of experiments, which have proved to be decisive in completing this research.

In conclusion, I can say that the results of this research illustrate and reinforce the fact Sarmisegetuza Regia was one of the largest metallurgical centers of antiquity. The number of blooms found here is the largest in the entire European region. One cannot ignore the fact that this was a special situation engendered by the Daco-Roman wars. The Roman armies' drawing near the Dacian state's capital led to the iron existing at that moment, either smelted or in the process of smelting, being stashed away, possibly with the thought that it would be recovered in the future. The victory of the Roman armies in 106 AD and the dislocation of the population from this area caused the entire amount of metal extant at that moment in the capital of the Dacian state to remain *in situ*. Its discovery today is an indicator of the iron production existing in this area at that time, which ultimately points to the existence of a genuine iron smelting industry. However, this picture would be incomplete if we did not take into account the previous production, which can no longer be calculated, the iron being turned into tools and distributed throughout the area. We can imagine thus the enormous amount of metal produced and processed by the Dacian metalsmiths over decades, since the iron existing at that moment alone was so consistent, suggesting a genuine metallurgical industry. The impressive amount of iron found in the area proves that iron was one of the most important treasures of the state and one of its main economic resources.