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Water management in pre-Roman Dacia

with special insight on *Sarmizegetusa Regia*

Summary

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Cuvinte-cheie : Dacia, *La Téne*, water, landscape, hydrography, spring, tube, pipe, teracotta, cistern, *opus signinum*, mortar, vault, arch, wood, barrel, basin, catchment, storage, distribution, management, channel, fountain, architecture, monumentality, archaeometry, religion, workshop, civil, social.

Summary

The proposed study contains the results of my doctoral research regarding water management in pre-Roman Dacia (with special insight on *Sarmizegetusa Regia*). In the ***introduction*** I mentioned the reasons that made me choose this subject. Firstly, the decision was influenced by the fact that I have started studying this matter while I was writing my MA thesis and I wanted to follow up on it. Secondly, the familiarity with the local landscape and archaeology of the Orăștie Mountains played an important part as well. Thirdly, the lack of interest regarding this subject in the Romanian historiography, even more so for the period of pre-Roman Dacia, convinced me that such a study would be useful. In the same introduction, I emphasized the limitations I stumbled upon during the research and I also discussed the research perspectives this type of study can generate. In this sense, I pointed out the possibilities of expanding this research in an interdisciplinary manner, as I have tried to do in this thesis, by creating GIS representations of the landscape or by including the archaeometrical analysis of the pastes of the teracotta pipes.

Regarding the research methodology, I was not able to relate it to a research model, mainly because of the particularity of the water management systems present in the Dacian antiquity in the Orăștie Mountains and the associated landscape, besides other criteria. I have chosen to follow a relatively classical methodology, based on the systematization of the relevant published archaeological data and of the complementary data resulted from the analysis of the material remains kept in the deposits of the National Museum of Transylvanian History in Cluj-Napoca. Besides, where it was possible and the information was relevant, I included data extracted from the archaeological documentation resulted from the excavations. In addition, I visited many of the places in the Orăștie Mountains where water management systems had been discovered and in some cases I was able to check and complete the documentation of the archaeological contexts in question. I have also tried to give this study an interdisciplinary allure by emphasizing the geographical and hydrographical aspects of the Orăștie Mountains area and by including the results of an archaeometrical analysis of ten probes coming from teracotta pipes kept in the deposits of the same museum.

Therefore, the scope of this study is the systematization of the data regarding water management systems from the Dacian antiquity in the Orăștie Mountains. I have done this by collecting the published information, by referring to the documentation resulted from the

archaeological excavations, by inspecting, on the ground, the places where they were found and by re-documenting some of the conserved archaeological contexts and by including the data resulted from the analysis of the archaeological materials kept in the deposits of the museum. The locations had been mapped on GIS cartographical support and correlated with the mountainous landscape. I tried to interpret the water management systems by corroborating them with similar, better known examples from the Graeco-Roman world, as well as from Temperate Europe. In addition to this, I compared the contexts from the Orăștie Mountains with those from contemporary Getic and Dacian fortresses and settlements. I hope that this research would represent a starting point for a more thorough interdisciplinary approach, that might highlight other aspects of the Dacian culture and civilization present in the Orăștie Mountains, by exploring the physical conditions which allowed it to flourish. Such an approach could offer new details regarding the chronology of the structures and of the material culture, which would alleviate some older dilemmas regarding the archaeological remains in the Orăștie Mountains.

In the second chapter I discussed the ***geographical features***. I presented the physical characteristics of the larger Parâng group of the Meridional Carpathians, focusing afterwards on the smaller area from the north-western part of the Șureanu Mountains (that is known, in the archaeological literature, as the Orăștie Mountains). I provided a detailed physical description focused on the sources of the Grădiște valley, which is home to the main settlement of the Orăștie Mountains, identified with the ancient *Sarmizegetusa Regia*. I emphasized geographical aspects such as geomorphology, hypsometry, geology, landspace and landscape fragmentation, climate and vegetation, surface erosion, the character of the valleys and of the hydrographical network, starting with the general area and highlitghting towards the end the microregion represented by the Grădiște valley and its source area. Such an approach allowed me to observe the geographical and environmental features that had made the Grădiște valley and, to a larger extent, the Orăștie Mountains, prone to habitation during the antiquity. These physical aspects made me reconsider and reinterpret the water management systems in a new perspective. For example, the rainfall can explain the localisation and the nature of such systems. I have resorted to recent meteorological data, because my assumption is that the paleoclimate was similar to today's conditions and also because specific paleoclimatological studies regarding the area in question are lacking. In some cases, I tried to correlate data regarding wind direction or landscape features to landscape occupation (in the final chapter), and to emphasize the relationship between the

local geomorphology and the process of embankment of the anthropogenic terraces (in the fifth chapter). However, in most cases I have discussed geographical features simply because it was necessary to understand the reasons why a certain water management system was established in a place or another, and perhaps why a specific technical solution was adopted in each case. A relevant example in this sense is the case of the karstic environment of the Platoul Vârtoapelor, where, in the place called „Sub Cununi", an installation for tapping a spring was found (in the third chapter). I consider that a geographical approach can provide new data regarding the environment chosen for habitation in antiquity, an environment that presented both advantages and limitations to the occupation, a fact that can be even more discernable in a clearly defined space such as that of the Șureanu and Orăștie Mountains.

The third chapter, called ***Archaeological contexts and references regarding water management in south-western Transylvania and the Orăștie Mountains***, represents the core of the proposed study. I described, in detail, the elements and the water management systems discovered during archaeological research in the area of south-western Transylvania, focusing on the Orăștie Mountains because that is the region where most of the installations had been identified. I have based the description of the systems on the published data, on some information kept in the documentation resulted from archaeological research, on data resulted from the analysis of material remains kept in the deposits of the National Museum of Transylvanian History in Cluj-Napoca and on the observations I had made while re-checking (and completing the documentation of) some of the places where water management systems had been found in the Orăștie Mountains. I have organized the data in relation to the settlement/fortification where the systems or disparate elements had been found. Therefore, I started by presenting the situation in the area where the Grădiște valley leaves the mountainous area, around the fortress of Costești-Blidaru and in the fortress of Costești-Cetățuie. I continued by describing the systems found in the nearby fortress of Piatra Roșie and, afterwards, in the fortresses from Căpâlna and Tilișca. After describing the situation in the above-mentioned fortresses, I returned to the Grădiște valley, following its course back to its sources. Having reached that point, I began by discussing the isolated elements of water management systems identified on the course of the valley, reaching, towards its sources, the settlements of Fețele Albe and Dealul Grădiștii – *Sarmizegetusa Regia*, where complex water management systems had been found. I related each settlement and fortress were water management systems had been found with the landscape which they occupy, based on cartographical models of GIS type, that emphasized the landscape and hydrography in those

specific areas. I described, based on the above-mentioned sources, the water management systems or the isolated elements that could be associated with such systems, identified during archaeological excavations. In this description I tried to envisage the situation attested at the time of the initial discovery, based on published and/or unpublished data. In order to achieve this I approached each case from a historiographical point of view, to better understand the proposed interpretations for each system and the reasons behind those proposed interpretations. Besides the systematization of the data and the restoration of the archaeological contexts as close as possible to the initial state of conservation, I tried to find analogies for these systems or elements that were part of them, by comparing them with examples from other cultural areas of the ancient world, such as the classical Mediterranean world or the temperate, northern European area. Such comparisons brought to light new data regarding the use of air vents on the pipe lines or the use of specific mortars and insulating layers in the Costești-Blidaru cistern besides other details.

In the fouth chapter, entitled ***Material culture – the teracotta pipes***, I presented the results of the archaeometric analysis of a number of ten probes coming from teracotta tubes kept in the deposits of the same museum, discovered in the Orăștie Mountains. The results were limited by a number of factors, but I managed to observe some intrinsic characteristics that demonstrate the existence of a number of tube types that were, probably, produced locally. Besides, I have observed some details regarding the production technology of the tubes. Nevertheless, I must stress the fact that a typology of the tubes, with chronological relevance, has not been achieved, and they can be dated only by the context in which they were found.

In the fifth chapter, called ***The appearance of the water management systems in south-western Transylvania***, I have focused on the main features of the water management systems that can be related to a Mediterranean technical origin. I started by enumerating the main clues regarding such a technical import, as they were already discussed in the historiography. Besides this, I tried to compare the distribution of double-sided walls in pre-Roman Dacia with the distribution of the water management systems in south-western Transylvania. I have undertaken this task in order to highlight the nature and direction of the technological import, as well as its adaptation to the local conditions. At the same time, I discussed the chronological aspects that can be related to the water management systems, suggesting their early association with the monumental architecture in ashlar stone that appeared in south-western Transylvania sometime in the middle of the Ist c. BC.

In the sixth chapter I analyzed the ***water management systems from other areas of pre-Roman Dacia***. I synthesized the archaeological discoveries that can be related to water management, discovered in contemporanous Geto-Dacian fortresses and settlements. Most of the possible cisterns and wells found through archaeological excavation cannot be easily interpreted. That is mostly because of the quality of the published data, but also because of the strained interpretations that were imposed upon them by their discoverers, who did not take into account the limited state of research regarding such structures. Nevertheless, it can be observed that in other parts of pre-Roman Dacia the communities had been preoccupied with supplying themselves with water, although in most cases such preoccupations had manifested themselves differently than in the Orăștie Mountains.

The last chapter was dedicated to some ***final considerations***. In the first part of this chapter I summarized the discussion regarding the types of material structures related to water management, identified in the area of the Orăștie Mountains. Next, I discussed the relation between the landscape and its occupation during antiquity, an aspect that seemed to be approached differently in the civil and the military areas. If in the civil quarters/settlements one can notice an interest in water supply via teracotta pipes, as well as in water drainage, especially through channels, in the military areas it could be observed that the watertight cisterns were associated with fortresses and other defensive elements (especially towers), which they were supplying. I suggested, at the same time, the problems faced by the communities in achieving this, given the landscape, as the fortresses were placed on hilltops, where usually no direct water source was available. I have compared this with the situation of the Roman *castra* present in the same geographical area, that encountered, because of the same reasons, similar problems regarding water supply. Last but not least, I presented the contexts which indicate the use of water in specific areas or activities. For example, the water was supplying workshops or the public and sacred spaces. I suggested (as a hypothesis) the existence of social motivations that could explain the presence of water management systems in the Orăștie Mountains area. Their hight number, together with some indications regarding the internal planning of the settlements, may bring into discussion the possible existence of a public organism that had responsabilites in the implementation and management of the water resources, at least in the main settlements identified in the Orăștie Mountains. However, such a hypothesis is far from the scope of this research, that was to collect and synthesize the data regarding water management systems resulted from archaeological research in the Orăștie Mountains. This came together with their

contextualization in a larger area and with the scope to offer a general view, starting from specific details, upon a somewhat exotic subject linked to the late *La Téne milieu* of pre-Roman Dacia, sometimes invoked in the literature, but never treated as a stand-alone subject.

Selective bibliography:

Adam 2005 – J.-P. Adam, *Roman Building. Materials and Techniques*, London and New York, Routledge.

Boyd 1978 – T. D. Boyd, The Arch and the Vault in Greek Architecture, în *American Journal of Archaeology*, vol. 82, 1, p. 83-100.

Camp 1984 – J. Camp, *Ancient Athenian Building Methods*, American School of Classical Studies at Athens.

Crouch 1993 – D. Crouch, *Water Management in Ancient Greek Cities*, New York – Oxford, Oxford University Press.

Daicoviciu 1972 – H. Daicoviciu, *Dacia de la Burebista la cucerirea romană*, Cluj, Ed. Dacia.

Daicoviciu *et al.* 1989 – H. Daicoviciu, Ș. Ferenczi, I. Glodariu, *Cetăți și așezări dacice în sud-vestul Transilvaniei*, București, Ed. Științifică și Enciclopedică.

Daicoviciu, Ferenczi 1951 – C. Daicoviciu, Al. Ferenczi, *Așezările Dacice din Munții Orăștiei*, București, Ed. Academiei Republicii Populare Române.

Drăguț 2003 – L. Drăguț, *Munții Șureanu. Studiu geomorfologic*, Teză de doctorat, Cluj-Napoca, *ms*.

Florea 2011 – G. Florea, *Dava et Oppidum. Débuts de la genèse urbaine en Europe au deuxième âge du Fer*, Cluj-Napoca, Academia Română. Centrul de Studii Transilvane.

Gheorghiu 1997-1998 – G. Gheorghiu, Cisterne descoperite în zona capitale Regatului Dac, în *Sargetia*, XXVII, 1997-1998, p. 177-189.

Glodariu 1983 – I. Glodariu, *Arhitectura Dacilor. Civilă și Militară (sec. II î.e.n. – I e.n.)*, Cluj-Napoca, Ed. Dacia.

Glodariu *et al.* 1996 – I. Glodariu, A. Rusu-Pescaru, E. Iaroslavschi, F. Stănescu − *Sarmizegetusa Regia. Capitala Daciei pre-Romane*, Deva, Acta Musei Devensis.

Hill 1964 – B. H. Hill, *Corinth I, pt. VI. The Springs*, American School of Classical Studies at Athens, Princeton, New Jersey.

Iaroslavschi 1995 – E. Iaroslavschi, Conduits et citernes d'eau chez le daces des Monts d'Orăștie, în *Acta Musei Napocensis,* 32/1, p. 135-143.

Lewis 1999 – M. Lewis, Vitruvius and Greek aqueducts, în *Papers of the British School at Rome*, vol. 67, p. 145-172.

Mateescu 2012 – R. Mateescu, *Istoriile unui templu*, Cluj-Napoca, Ed. Mega.

Nikolić *et al.* 2015 – E. Nikolić, D. Rogić, B. Milovanović, The role of brick in hydraulicity of Viminacium mortars: decorative mortars from the thermae, în *Archaeology and Science,* vol. 10, p. 71-92.

Oleson 2008 – J. P. Oleson, *The Oxford Handbook of Engineering and Technology in the Classical World*, Oxford University Press.

Siddall 2011 – R. Siddall, From kitchen to bathhouse: the use of waster ceramics as pozzolanic additives in Roman mortar, în A. Ringbom, R.L. Hohlfelder (ed.), *Building Roma aeterna: current research on Roman mortar and concrete*, The Finnish Society of Sciences and Letters, 128, p. 152-168.

Stefan 2005 – A. S. Stefan, *Les guerres Daciques de Domitien et de Trajan. Architecture militaire, topographie, images et histoire*, Ecole Française de Rome.

Teodorescu 1930 – D. M. Teodorescu, Cetatea dacă de la Costești. Rezultatele generale ale săpăturilor arheologice, în *Anuarul Comisiunii Monumentelor Istorie. Secția pentru Transilvania pe 1929*, Cluj, Tipografia „Cartea Românească", p. 265-298.

Tölle-Kastenbein 1994 – R. Tölle-Kastenbein, *Das archaische Wasserleitungsnetz für Athen und seine spätere Bauphasen,* Mainz am Rhein, Ed. Von Zabern.

Trufaș 1971 – V. Trufaș, *Hidrografia Munților Sebeș*, Teză de doctorat, Cluj-Napoca, *ms*.

Wikander 2000 – Ö. Wikander (ed.), *Handbook of ancient water technology*, Leiden-Boston-Koln, Ed. Brill.