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Research paper

Briquetage and salt cakes: an experimental approach of a prehistoric technique

Felix-Adrian Tencariu [a, *], Marius Alexianu [b], Vasile Cotiugă [c], Viorica Vasilache [b], Ion Sandu [b]

[a] Interdisciplinary Research Department – Field Science, Alexandru I. Cuza University of Iași, Romania
[b] Arheoinvest Platform, Alexandru I. Cuza University of Iași, Romania
[c] Faculty of History, Arheoinvest Platform, Alexandru I. Cuza University of Iași, Romania

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ABSTRACT

The paper describes the background, objectives, progress and results of a series of field experiments concerning the production of salt cakes using ceramic vessels known as briquetage, conducted within the framework of a larger research project concerning the ethnoarchaeology of the salt springs from the extra-Carpathian areas of Romania. The approach was based on the existing archaeological data – description of briquetage sherds and their discovery contexts, as well as on ethnoarchaeological accounts and previous experimentations. The experiments allowed some valuable observations on the distinct aspects of this *chaîne opératoire*: modelling and firing the briquetage vessels; exposure to fire of the recipients filled with brine or a salt slurry of varied concentrations; the amount of time needed for crystallization and hardening of the salt, dependent on the fuels used and temperatures reached; ways of extracting the salt cakes from the ceramic coat; assessment of the effort (i.e. labour and raw materials) involved by the whole process. All the failures, challenges and eventual successes encountered during the experiments granted an insight into an ancient technique, described mainly *a priori* in the archaeological literature. Also, it gives a hint in understanding the appreciable importance and value of salt in times when this essential mineral was not available as it is today.

1. Introduction

The complex topic of salt in prehistory was, for the last decades, a particularly favourite subject of the archaeological research. The techniques of salt extraction from sea water or brine springs, the mining of the rock salt, the transportation and trade of salt, and the social and spiritual symbolism of salt are just a few issues addressed by archaeologists (for a comprehensive review and literature, see Harding, 2013). One of the prehistoric techniques of salt production, worldwide attested, consisted of using ceramic vessels known as briquetage for the artificial evaporation of salt water. This method, quite laborious, served for obtaining solid salt cakes, transportable to medium and large distances, most likely for trade with various types of goods (Monah, 1991).

Although this technique seems at first sight very tempting for experimental approaches, the number of attempts of this kind are relatively low, and the results often seem inconclusive. Previous experiments were mainly focused on the construction and use of complex installations like furnaces and other special structures, which are primarily characteristic of the briquetage salt production of the Iron Age in Central and Western Europe (Mesch, 1990, 1991; Daire, 1994; Hees, 2002a, 2002b; Chaidron, 2002). Archaeological data underlying the experiments, the nature and quantities of raw materials used, the methods, steps and timing are clearly exposed. Regarding the results, accurate and valuable observations were made, but, though not always clearly stated, it seems that the experimenters did not managed to achieve solid blocks of salt.

Taking as premises the archaeological evidences from prehistoric sites of the sub-Carpathian area of Moldavia (Romania), the previous attempts and some ethnoarchaeological data that describes the modern use of ceramic recipients as moulds for obtaining salt cakes, a series of experiments were initiated that tested the technological chain of making solid salt blocks out of natural brine. For this purpose briquetage vessels were used, in which the evaporation of brine was achieved using an open fire, as

* Corresponding author. Tel.: +40 748 458908.
E-mail address: adifex@gmail.com (F.-A. Tencariu).

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suggested by the archaeological discoveries. The objectives of the experiments were as follows: observing the effects of an open fire on such recipients filled with salt water, or a salt slurry of various concentrations; observing the amount of time necessary for the crystallization and solidification of the salt, depending on the fuels used, and the temperatures reached; testing methods of extracting the salt core from the ceramic coating; the (subjective) estimation of the effort made along this *chaîne opératoire*.

2. The briquetage technique – archaeological background

2.1. Milestones of the prehistoric exploitation of salt water in Europe and the Romanian briquetage discoveries

The archaeological excavations across Europe provided over time abundant evidence about the prehistoric exploitation of salt water (sea water or inland brine), transformed into solid salt by means of a forced evaporation process involving the use of fire and clay containers. One should mention the numerous Neolithic and Chalcolithic sites (e.g. Barycz) from the Wieliczka area (Southern Poland), which contained numerous hearths and large amounts of pottery interpreted as briquetage (Jodłowski, 1969, 1971; 1977). At Provadia-Solnitsata (Bulgaria, Middle Chalcolithic), huge quantities of sherds, also interpreted as briquetage, were found in pits – the heating installations, according to the authors (Nikolov, 2011, 2012; Weller, 2012). The "Champ-Durand type" vessels found in several sites of the Late Neolithic in Central-Western France were recently taken into consideration as proves for the artificial evaporation of brine, hypothesis sustained also by technological and chemical analysis (Ard and Weller, 2012). For the Bronze Age, the briquetage technique is attested almost throughout Europe (Harding, 2013), though at a significantly smaller scale than in later periods. It is worth mentioning the outstanding quantities of briquetage fragments from the sites of the Halle (Saale valley) area – the technique consists in placing over the fire clay recipients of various shapes and sizes, filled with brine, sustained by clay pedestals (Riehm, 1954; Matthias, 1961). A major expansion of salt exploitation and production, including the briquetage technique, can be noticed in Central and Western Europe during the transition to and through the Iron Age. The industrial exploitations from the valley of the Seille River (Olivier and Kovacik, 2006) and the valley of Somme (Prilaux, 2000; Weller, 2000a) stand out as major centres of salt production, with millions cubic meters of remains of salt moulds and specialized furnaces.

The archaeological research of the sites near the brine springs from the sub-Carpathian area of Moldavia, North-Eastern Romania (Fig. 1) provided significant evidence for the practice of the briquetage technique. The earliest briquetage fragments are assigned to the Early Neolithic (Starčevo-Criş Culture), at Solca-Slatina Mare (Ursulescu, 1977; 2000; 2011). Much more numerous are the briquetage sherds found in Chalcolithic sites (Cucuteni Culture): Cacica, Solca (Nicola et al., 2007), Răuceşti-Munteni, Lunca, Oglinzi (Dumitroaia, 1994), Ţolici (Dumitroaia et al., 2008). The briquetage sherds were generally discovered in contexts of strong burning – hearths, ash piles, charred wood (Cavruc and Dumitroaia, 2006), but there are no complex installations (furnaces) used for the firings and neither moveable supports to raise these containers above the source of the heat (as in the case of later exploitation from the Bronze and Iron Ages in France, Germany, UK etc.).

Regardless of the space and the time to which it belongs, the briquetage function was linked with the process of obtaining salt. The process was achieved either by boiling directly the brine and gradually refilling the vessels as the water evaporates or by heating a thick paste of salt, previously concentrated of liquid brine. By the complete evaporation of the water, the salt became solid and compact, taking the conical shape of the container. Finally, the recipients were removed from the fire and broken to release the blocks of salt. This hypothetical technological chain is found, with slight variations, in numerous works devoted to prehistoric salt, becoming almost axiomatic (Déchelette, 1913; Brunn and Matthias, 1958; Matthias, 1961; Jodłowski, 1969; Ursulescu, 1977; Weller, 2000b; Olivier and Kovacik, 2006).

2.2. Technological and chemical characterization of the briquetage vessels from the sub-Carpathian Moldavia

According to the rather superficial descriptions in the literature, the briquetage fragments belong to hand built, quasi-conical vessels with widened base. The wide bases were designed to prevent accidental overturning of the recipients when heated, which makes perfect sense, in the absence of supporting installations (furnaces, supports etc.). In terms of sizes, they vary between 10 and 20 cm in height, 12–15 cm for the rim diameter and 7–12 cm for the base diameter. Both inside and outside surfaces are rather rough, hastily smoothed. The clay was usually tempered with chaff and/or grog and coarse sand (Ursulescu, 2011; Nicola et al., 2007; Cavruc and Chiricescu, 2006).

The only archaeometric analysis (mineralogical composition by XRD, chemical composition by SEM-EDX and FTIR) realized for Romanian briquetage – Ţolici (Neamţ County) and Cacica (Suceava County) indicated the use of local clays for this type of recipients. Also, the presence of chlorine and high concentrations of sodium were interpreted as additional proves for their use as moulds for salt cakes (Sandu et al., 2012).

For a better technological understanding of these ceramic recipients, we paid special attention to a few Chalcolithic briquetage fragments from Ţolici (Neamţ County).[1] The sherds belong to the bases of six briquetage vessels (Fig. 2). The sandy clay, with good sorting, seems hastily prepared, as well as the shaping and the smoothing of surfaces. The fragmentation could indicate the shaping of the base from a lump of clay, the body being formed subsequently using the coiling technique. The surfaces were only superficially flatten with the fingers while the clay was still wet. Examination of fresh, ground breaks of three fragments (Fig. 2) showed significant amounts of vegetal fibres (~10–15%) as tempering material. The voids created by the burning of the organic material (up to 2 mm) made the fabric fairly porous, technological choice that could be related to the heating effectiveness and the thermal shock resistance of the vessel (Skibo et al., 1989). Other temper (grog, coarse sand etc.) was not observed; some fine (<0.5 mm) and rounded grains of quartz are undoubtedly natural inclusions of the original clay. The colours revealed by the fresh breaks are dark grey (2.5YR4/1) for the core and light red (10R7/8, 10R6/8) for the exterior margins, hence for the exterior surface. This could indicate that the recipients were initially fired in a reducing atmosphere, and the subsequent exposure to fire in the presence of oxygen, when boiling the brine, led to the re-oxidation of a shallow (1–3 mm) exterior layer.

Samples of the three briquetage sherds were investigated by scanning electron microscopy, primarily to capture possible traces of salt. The analysis was performed with a scanning electron microscope, model SEM VEGA II LSH (TESCAN), combined with a QUANTAX QX2 EDX detector (BRUKER/ROENTEC) for qualitative and quantitative micro-analysis. The microscope, controlled entirely by computer, has an electron gun with a tungsten filament, which can achieve a resolution of 3 nm to 30 kV A, with

[1] The analysis of the briquetage sherds was possible by courtesy of Dr. Gh. Dumitroaia (Neamţ County Museum).