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Examining the relation between the shape/manufacture technique and the function of the pottery used for salt-making (*briquetages*)

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Abstract. *The archaeological excavations across the world provided over time abundant evidence about the 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, known as briquetage type vessels. Quite strange at first sight, regardless of age or location of salt making sites in the world (Neolithic, Chalcolithic and Iron Age in Poland; Chalcolithic and Bronze Age in Romania; Bronze Age and Iron Age in France, Germany, England; Bronze Age and Iron Age in China and Japan; even modern times in some areas of Africa), there is an affinity for the quasi-conical shape of the ceramic vessels used to obtain salt units. This paper examines adaptive convergence in briquetage-making, cases in which functional constraints result in similar forms in independent lineages.*

Rezumat. *Cercetările arheologice din diverse zone ale lumii au oferit, de-a lungul timpului, numeroase dovezi privind exploatarea apei sărate (apă din mări și oceane sau izvoare de saramură), transformată în sare solidă prin intermediul unui proces accelerat de evaporare realizat cu ajutorul focului și a unor recipiente de lut, cunoscute sub numele de vase de tip briquetage. Surprinzător, la prima vedere, indiferent de epoca sau localizarea pe glob a siturilor de producere a sării (neolitic, eneolitic și epoca fierului în Polonia; eneolitic în România; epoca bronzului și epoca fierului în Franța, Germania și Anglia; neolitic, epoca bronzului și epoca fierului în China și Japonia; chiar și în epoca modernă în unele zone din Africa), se observă o afinitate pentru forma cvasi-conică a vaselor ceramice utilizate pentru obținerea unităților de sare. Acest articol tratează această convergență adaptativă în manufacturarea briquetage-lor, urmărind cazurile în care constrângerile funcționale au condus la forme similare în linii descendente diferite.*

Keywords: salt water exploitation, briquetage, pottery shape and function.

1. Introduction

It is an undeniable fact that common salt (sodium chloride) is one of the essential nutrients, needed for human consumption just as for the rations of the livestock. The complex topic of salt exploitation over time was, for the last decades, a particularly favourite

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subject of the archaeological, ethnographical and ethnoarchaeological research. The techniques of salt extraction from seawater 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[2].

The archaeological excavations across the world provided over time abundant evidence about the 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, which, conventionally, are called *briquetage* type vessels. Quite strange at first sight, regardless of age or location of salt making sites in the world, there is an affinity for the conical or quasi-conical shape of the ceramic vessels used to obtain salt units.

Without pretending to be exhaustive, we shall try to prove the above assertion by giving several examples throughout space and time. Hereinafter, we will examine the possibilities of finding the relation between the functional constraints and the shape/sizes/manufacture techniques of the 'salt pottery'.

2. The conical and quasi-conical shape of *briquetages* across the world — archaeological evidences

To start with, one should mention the numerous Neolithic and Chalcolithic sites (Lengyel Culture) (e.g. Barycz) from the Wieliczka area (Southern Poland), which contained numerous hearths and large amounts of pottery interpreted as briquetage vessels[3]. As one can see, many belong to hand built, quasi-conical vessels with pointed or widened base, of relatively small dimensions — 5 to 10 cm in height and mouth opening (Figure 1/1). These were associated to the brine exploitation, namely to making salt forms by means of forced evaporation.

Going further south, the archaeological research of the Chalcolithic sites near the brine springs from the sub-Carpathian area of Moldavia, North-Eastern Romania provided significant evidence for the practice of the briquetage technique. The briquetage sherds were generally discovered in contexts of strong burning – hearths, ash piles, charred wood, 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. 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 (Figure 1/3). Both inside and outside surfaces are rather rough, hastily smoothed.

[2] See HARDING 2013; BRIGAND & WELLER 2015; ALEXIANU *et alii*, 2015; 2016, etc.

[3] JODLOWSKI 1969; 1971; 1977.

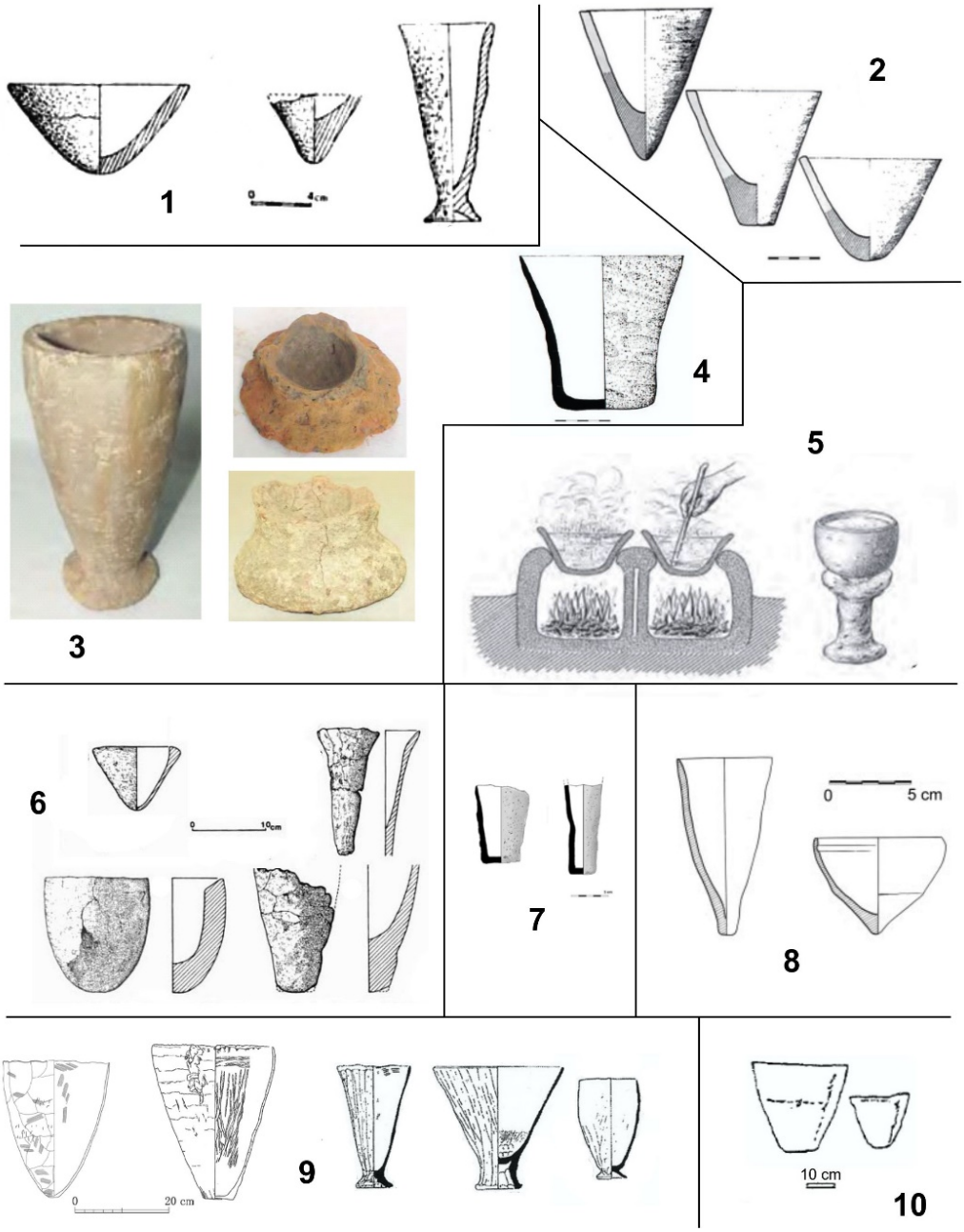

Figure 1. *Briquetage* vessels of conical or quasi-conical shape (after JODLOWSKI, 1969 – 1; SAILE 2012 – 2; CAVRUC & CHIRICESCU 2006 – 3; ARD & WELLER 2012 – 4; GUERRA-DOCE *et al.* 2010 – 5; MATTHIAS 1961 – 6; OLIVIER 2006 – 7 ; FLAD *et al.* 2005 – 8; KAWASHIMA 2015 – 9; GOULETQUER *et al.* 1994 – 10)

The clay was usually tempered with chaff and/or grog and coarse sand. Their function was also linked with the process of obtaining salt[4].

Other presumed briquetage finds from the surroundings of the rock-salt deposit at Tuzla in northeastern Bosnia have been assigned to the Vinča culture (the second half of the sixth millennium cal. BC) – the vessels are conical with rounded bases[5] (Figure 1/2).

At Provadia (Bulgaria), in the Middle Chalcolithic period, assigned to 4700–4200 cal BC the bucket-like vessels, also quasi-conical, with rusticated surface and flat base were related to salt making. Coming in three sizes, they were apparently packed into the bottom of the pits, wood added and lit, and the whole thing allowed to boil and then cool, so that brine was turned into crystals in conical cake form; the pot would then be smashed, and the cake retrieved[6].

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. The recipients are conical with flat base and straight walls, having relatively standardised dimensions: 12–13 cm in height, 13 to 16 cm of mouth diameter and 7 to 10 cm of base diameter[7] (Figure 1/4).

The archaeological site of Molino Sanchón II (Villafáfila, Zamora, Spain) is interpreted as a salt processing factory. Natural brine obtained from the saline Villafáfila Lake Complex was boiled in coarse ceramic vessels placed on supports made of raw clay, which stood over a hearth of glowing embers in order to produce hard salt cakes. Chronologically, the exploitation of salt at Molino Sanchón II took place during the second half of the 3rd millennium (approximately 2400–2000 cal. BC) – the Bell Beaker Culture[8]. Most important, most of the recipients were quasi-conical, with straight or rounded bottoms (Figure 1/5).

For the Bronze Age and Iron Age, the *briquetage* technique is attested almost throughout Western Europe, 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[9] (Figure 1/6). 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 and the valley of Somme stand out

[4] URSULESCU 2011; NICOLA *et al.* 2007; CAVRUC & CHIRICESCU 2006.

[5] SAILE 2012; WELLER 2015.

[6] NIKOLOV 2011; 2012.

[7] ARD & WELLER 2012.

[8] GUERRA-DOCE *et al.* 2010.

[9] RIEHM 1954; MATTHIAS 1961.

as major centres of salt production, with millions cubic meters of remains of salt moulds and specialized furnaces[10]. Also, we are talking about quasi-conical ceramic salt moulds (Figure 1/7).

Going far East, we meet similar techniques in Central China during the second and the first millennia BC. At Zhongba, a well-documented site of salt production, each of the three main phases of activity is represented by vessels used in a process that involved boiling brine to crystallization — large, pointed-bottom vessels, pointed bottom cups (Figure 1/8), rounded-bottom jarlets[11]. All of them present strong similarities with briquetage from archaeological, historical and ethnographic evidences from other regions of the world.

Moving to Prehistoric Japan, there are strong evidences of salt production using briquetage type vessels during the Late (c. 2500–1250 BC) and the Final Jōmon period (c. 1250–950/400 BC), as well as in the Yayoi period (c. 950/400 BC–AD 250). The recipients used were also, for the most part, conical shaped, with flat or pointed bottoms[12] (Figure 1/9).

At Minogahama site, of Late Kofun period and the beginning of ancient period, ca. 6–7th century AD, was attested the technique obtaining salt out of sea water and seagrass in ceramic recipients, through evaporation. Again, the vessels are of quasi conical shape, with rounded or pointed bottoms or even with small, elongated legs[13].

There is also some ethnographic evidence about using conical ceramic recipients for brine evaporation, for example in Niger. Here, several methods are used for obtaining the brine, including lixiviation of salty earth and washing the ash of halophytes. Most important, this brine is boiled within simple furnaces, in clay recipients of different sizes and shapes, sometimes supported on pedestals. As the water slowly evaporates, more brine is added and mixed until the clay casts are filled with hardened salt. The salt cakes are removed by total or partial breaking of the clay vessels[14]. Of course, these recipients are of a conical shape (Figure 1/10).

3. Discussion: Shape vs. functionality of the *briquetage* vessels

So, one can notice an obvious adaptive convergence in *briquetage*-making, cases in which functional constraints result in similar forms in independent lineages. In their general role as containers, pots are tools, and their shape and sizes are related to their function. Also, there are four use-related properties of a vessel: capacity, stability, accessibility and

[10] OLIVIER & KOVACIK 2006; PRILAUX 2000; WELLER 2000.

[11] FLAD *et al.* 2005

[12] KAWASHIMA 2015.

[13] KAWASHIMA 2015.

[14] GOULETQUER *et al.* 1994.

transportability[15]. Thinking about the *briquetage* type vessels, the first three properties may bring some light in explaining this convergence. To begin with, the capacity of a recipient (depending on its shape and size) may be related with standard units of volume or multiples of such units. Since the briquetages were intended probably to produce not only salt, but salt units, we may relate their simple conical shape to a simpler way of standardization, unlike more elaborated forms.

The stability of a vessel refers to its resistance to tipping or being upset, determined by shape, proportion, centre of gravity, and breadth of the base[16]. Some *briquetage* vessels had widened bases for this purpose, while the ones with pointed or rounded bottoms were inserted in other installations (pedestals, crucibles) or maybe in embers, which assured their stability during the exposure to heat.

The accessibility of the contents of a vessel—better stated, perhaps, as access to its interior—is determined by the orifice. If a vessel has a sharply restricted orifice, such as a narrow neck, it is hard to get at the contents because of the angle of access. Similarly, reaching into an especially large and deep vessel requires a certain effort[17]. Most of the *briquetages* above mentioned provided easy access to the content (salt water, salt slurry), by their relatively wide orifice and straight oblique walls.

The same characteristics of the ceramic moulds used for making salt cakes could be related also to the thermal efficiency. The conical shape (straight or slightly curved walls) with the tip down ensures the best and even exposure to heat of the entire surface of the vessel in open fire or placed on a pedestal.

Even if *briquetage* are to be broken after use to remove the salt cake, they aren't supposed to break during the use, for obvious reasons. One of the thermal reactions that can produce breakage of a ceramic is thermal stress, strain caused by uneven or unequal reactions to heat over the vessel body. Thermal stresses arise as a vessel and its contents are rapidly heated or cooled. Such stresses can be reduced by modifying the vessel shape to eliminate angles, which is the case of the ceramic recipients used for salt making[18].

Conclusion

To sum up, vessels intended for cooking (or to boil brine, in this case) would be expected to make efficient use of the heat from the cooking fire. They are generally likely to have rounded or straight walls rather than angled contours to avoid thermal damage, and also because the oblique straight contour permits greater exposure of the vessel base, walls, and

[15] RICE 1987; ORTON *et al.* 1993.

[16] RICE 1987.

[17] RICE 1987.

[18] RICE 1987.

contents to the heat. They can also be expected to be relatively thin walled, to conduct heat better and reduce the thermal gradient between the surfaces. Further, they are likely to be coarse textured, porous, and tempered with materials that have low coefficients of thermal expansion (calcined shell, crushed potsherd) to accommodate thermal stress[19]. As one can see, these are, generally, characteristics of the ceramic vessels known as *briquetages*.

The point of enumerating the above attributes is to show that, as any other tool human created, the moulds for making salt cakes quickly evolved towards the most efficient shape, independently in numerous parts of the world or eras in which this activity took place.

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