

Brine-boiling and briquetage at the Villafáfila lakes (Central Iberia) during the Chalcolithic and the Bronze Age: a multi-disciplinary approach to technical, socio-economic and ritual aspects of the production of salt

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Located in the north-east of Zamora province, in Castilla y León region (north-west Spain), the Villafáfila Lake Complex is a Natural Reserve of over 32,500 ha, included in the RAMSAR Convention protection list for conservation of wetlands, with special interest for their brackish waters. The lagoons, with a surface area of approximately 500 ha during wet years, are situated on the semi-endorheic basin of the river Salado (the Spanish term for salty), on the west margin of the river Duero. The largest are represented by the Salina Grande (194 ha), Barillos (119 ha), and Las Salinas or Laguna de Villarrín (70 ha), but there are many others in the area. These lagoons are seasonal and only contain water during the rainy months (November-May). Most water comes from direct precipitation and shallow groundwaters, but there are minor contributions from runoff and deep groundwaters as well. Work by geologists of the University of Salamanca in recent years has established that the origin of the salinity of the waterbodies is related to the existence of a basement elevation that forces brackish regional groundwater flow to rise. The salinity of the waters is subject to seasonal variation, with higher concentration in summer, when it is similar to that of sea water (on average of about 3.5%, 35 g/l).

During the Middle Ages the production of salt became a thriving activity. The first mention is from the year 917 AD. According to historical records and archaeological data, salt was obtained by combining solar evaporation and brine-boiling. Written references mention the payment of salt taxes between Saint John's Day (June 24th) and Saint Michael's Day (September 29th), which suggests that salt was produced in the spring and summer months. Due to geopolitical factors by the end of the 16th century the saltworks closed down. Considering that Villafáfila landscape was intensely occupied since prehistoric times, it seemed that salt might have been a main factor attracting population to the area much earlier than has hitherto been the case. Thus, in 2007 a multi-disciplinary research project was set up to trace back the origins of the production of salt. It was initially funded by the European Regional Development Fund (ERDF) within

the Cross-Border Cooperation Programme Spain-Portugal (POCTEP 2007-2013/FEDER), and subsequently by the Regional Government of Castilla y León (Consejería de Cultura, Turismo y Deporte-Junta de Castilla y León).

Extensive field-walking surveys registered 55 prehistoric sites, the majority being less than 3 ha in extent, and revealing multi-period occupations. There is evidence for sporadic activity during the Neolithic, consisting of a few pottery sherds (Fuente de San Pedro site) and some stone axes, all isolated finds. Of the remaining 54 sites, 13 could be attributed to the pre-Beaker period, 2 to the Beaker period, 30 to the Early Bronze Age, 5 to the Middle/Final Bronze Age and 4 to the Iron Age. 36 sites show a close spatial relationship with the waterbodies, as they are situated in the immediate environs of lagoons less than 1.5 to 2 km from their edges. Geophysical prospection on some locations showed that hearths or burnt areas were widely present. 4 Pre-Beaker Copper Age sites have been identified on slight hillocks close to the pools, and a similar pattern exhibits the only site with a strong Beaker presence. The concentration on the Early Bronze Age is remarkable with a total of 26 sites situated on the lakeshores. During the Late Bronze Age a reduction in the intensity of occupation is observed, the reasons for which remain unclear, since only 3 sites have been found. This trend continues during the Iron Age: only 2 Early Iron Age sites have located. One of the main questions that remains unclear is the reason for the decline of the activity during the Late Bronze Age. Work in progress on the analysis of the landscape pattern on a long-term scale from a climatic and environmental approach is intended to provide some answers.

Archaeological excavations at four sites –El Villardón/San Pedro (Pre-Beaker Copper Age), Molino Sanchón II (Beaker period), Santioste (Early/Middle Bronze Age) and Fuente de San Pedro (Early Iron Age)– have established that salt production began at least as early as the Late Chalcolithic (Beaker) period. The core of our project are the sites of Molino Sanchón II (2 ha in extent and an excavated surface of 72 m²) and Santioste (1 ha in extent and an excavated surface of 96 m²), which have provided solid archaeological evidence for the production of salt by means of the briquetage technique. Features include wells, pits filled with clay for filtering the brackish waters, places for boiling the brine, and areas of clay burnt red, discarded pottery, ash and other remains of firing.

While similar production processes are documented at both sites, firing structures evolved over time. At Molino Sanchón II (*ca.* 2500-2000 cal BC, according to the results of seven AMS radiocarbon dates on charcoal and bone samples), the boiling areas adopt the form of circle hearths acting as trivets, as they accommodate some pedestals made of clay or stone and often grouped in threes, the function of which was to support over fires the large ceramic vessels containing the salt paste. The procedure was quite similar at Santioste (*ca.* 2400-1500 cal BC, according to the AMS radiocarbon dates on charcoal, bone and a human tooth), at least during the early stages of the occupation, because *ca.* 2000 BC more complex firing structures prevailed there. These are rectangular clay-walled kilns, possibly provided with a grid on top and openings in the shorter sides through which holm oak wood was inserted. Large pottery vessels used to boil brine have been found in some of them.

The reconstruction of the environment and the technological processes related to the salt production have brought together a broad range of researchers and disciplines. Key components of the project include Archaeobotany, Zooarchaeology,

Micromorphology, Material Culture and Chemical Analyses. Taking as a reference point the technical steps involved in the method of brine boiling, which have been archaeologically documented throughout Prehistoric Europe, the production sequence initially envisaged from a theoretical perspective for the procurement of salt at Villafáfila implied the following stages: 1) natural brine obtained from the lagoons themselves or from pit-wells was poured into large ceramic vessels placed over fires in order to facilitate the concentration of the brine; 2) the resulting salt paste was transferred to smaller ceramic moulds that stand over hearths of glowing embers; and 3) finally those moulds were broken open in order to obtain hard and transportable salt cakes. However, in view of the results obtained from the volumetric analysis of the ceramic assemblage, it seems that the production of salt might have occasionally used different methods that not always involved real briquetage.

A different *modus operandi* might have been employed at the Villafáfila in comparison to other brine-boiling sites in Prehistoric Europe. While unfired red pots or those partially fired are characteristic of the European salt factories, containers of this type are extremely scarce, representing less than 1% of the ceramic assemblage of Molino Sanchón II, and up to 20% at Santioste. In the Villafáfila sites large plain vessels seem to have accomplished the transformation of brine into salt paste. This would explain the abundant number of discarded sherds corresponding to pots of considerable quality recovered. The results of the fabric analysis (DRX, ATR-FTIR, TG/DTA) on some ceramic samples from Molino Sanchón II and Santioste indicate that the pots were produced with local clays and were fired at temperatures over 500°-600°, the great majority of them undergoing a complete firing cycle.

Besides, in view of the existence of a number of sherds displaying basketry impressions it is possible that woven baskets and textile sacks may have served to complete the crystallization process and thus obtain standardized sachets intended for salt trade. These packets may have been strung up in wooden structures acting as racks, hence the presence of a number of pit-holes in the excavated areas, the location of which, close to firing structures, is occasionally indicative of wind-breaks, although on other occasions they are not associated with fire. In order to test this hypothesis, we are currently employing ethnographic models and Experimental Archaeology.

The large accumulations of pottery at both sites (52,300 sherds recovered at Molino Sanchón II, and 7,300 sherds at Santioste) clearly demonstrate that the production of salt was not intended for the local market but for exchange. In this regard, it is remarkable to note the presence of a significant amount of the Beaker pottery (over one thousand sherds corresponding to the Ciempozuelos style) at the early phase of Molino Sanchón II, and a few sherds as well at Santioste, providing interesting insights into the socio-economic and ritual aspects of the production of salt. Apparently, Beaker pots were not directly involved in the production process, since XRF (X-Ray Fluorescence) analyses revealed a lower concentration of Cl than the percentage in the ceramic matrix of the plain pottery. What were Bell Beakers used for?

In Iberia, in recent years it has been observed a spatial association of salt resources with Beaker groups, suggesting that control over the salt circulation may have been one of the mechanisms by which these individuals reached their social prominence. Therefore, the presence of Beaker pottery at these sites may be associated to ritual ceremonies, and explained as a way to claim property rights over the most

profitable activities, acting as a symbolic marker. Evidence for feasting and preliminary results of organic residue analyses seem to validate this hypothesis. At Santioste there is also evidence of ritual activity, suggested by the presence of two pits containing the skeleton of a child with a rich grave-good assemblage (including silver and ivory adornments) and a complete calf, respectively. Ethnographical and historical accounts, as well as archaeological data, demonstrate that mining and metallurgical activities amongst preindustrial societies have symbolic and magical connotations, hence the necessity to perform ritual ceremonies there. There is evidence of the celebration of similar ceremonies at salt-works worldwide.

To sum up, beyond investigating the production of salt, this project aims at contextualizing this activity in historical perspective: the role of salt in the social dynamics of Iberia during the Later Prehistory and its association to emerging elites.

Selected works:

- ABARQUERO MORAS, F.J., DELIBES DE CASTRO, G. & GUERRA DOCE, E. (2021). Antecedentes, desarrollo y resultados de un proyecto de investigación sobre las explotaciones prehistóricas de sal en las Lagunas de Villafáfila (Zamora). *Actualidad de la investigación arqueológica en España III (2020-2021): Conferencias impartidas en el Museo Arqueológico Nacional*: 447-464.
- ABARQUERO MORAS, F.J., GUERRA DOCE, E., DELIBES DE CASTRO, G. & LÓPEZ SÁEZ, J.A. (2017). La explotación de la sal durante la Prehistoria en las Lagunas de Villafáfila (Zamora): Los cocederos de Molino Sanchón II y Santioste. *Cuaternario y Geomorfología*, 31 (1-2): 7-24. DOI: <https://doi.org/10.17735/cyg.v31i1-2.53646>
- ABARQUERO MORAS, F.J., GUERRA DOCE, E., DELIBES DE CASTRO, G., PALOMINO LÁZARO, Á.L. & DEL VAL RECIO, J. (2012). *Arqueología de la sal en las Lagunas de Villafáfila (Zamora): investigaciones sobre los cocederos prehistóricos*. Valladolid: Junta de Castilla y León, Arqueología en Castilla y León, Monografías 9. [ISBN 978-84-9718-627-8].
- GUERRA DOCE, E. (2016). Salt and Beakers in the Third Millennium BC. In E. Guerra Doce & C. Liesau von Lettow-Vorbeck (eds.), *Analysis of the Economic Foundations supporting the Social Supremacy of the Beaker Groups. Proceedings of the XVII UISPP World Congress (1-7 September, Burgos, Spain). Volume 6: Session B36*. Oxford: Archeopress Archaeology, pp. 95-110.
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Webs of interest:

<https://villafafila.com/>

<http://www.jcyl.es/jcyl/patrimoniocultural/Villafafila/01-inicio.html>

<https://patrimoniocultural.jcyl.es/web/jcyl/PatrimonioCultural/es/Plantilla100Detalle/1284393413237/Intervencion/1284220257704/Arte>