



HAL
open science

The Vall Salina: More than 6500 years of Halite Exploitation. Cardona, the Salt of History

Alfons Fíguls Alonso, Olivier Weller, Thomas Schumacher, Mireia Martinez,
Raul Segarra, Rosa Lanaspá, Marc Cots, Aitor Henestrosa

► **To cite this version:**

Alfons Fíguls Alonso, Olivier Weller, Thomas Schumacher, Mireia Martinez, Raul Segarra, et al.. The Vall Salina: More than 6500 years of Halite Exploitation. Cardona, the Salt of History. Mirrors of Salt, Archaeopress, pp.169-180, 2023. hal-04193400

HAL Id: hal-04193400

<https://hal.science/hal-04193400>

Submitted on 1 Sep 2023

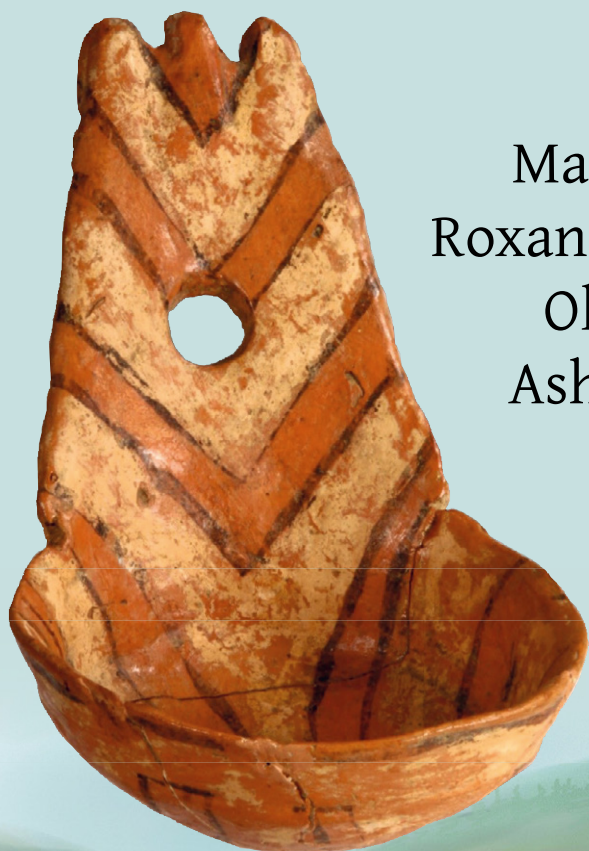
HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Mirrors of Salt

Edited by

Marius Alexianu
Roxana-Gabriela Curcă
Olivier Weller
Ashley A. Dumas



Mirrors of Salt

Proceedings of the First International Congress on the Anthropology of Salt

20-24 August 2015, 'Al. I. Cuza' University, Iași, Romania

Edited by

Marius Alexianu
Roxana-Gabriela Curcă
Olivier Weller
Ashley A. Dumas



ARCHAEOPRESS PUBLISHING LTD
Summertown Pavilion
18-24 Middle Way
Summertown
Oxford OX2 7LG

www.archaeopress.com

ISBN 978-1-78491-456-1
ISBN 978-1-78491-457-8 (e-Pdf)

© the individual authors and Archaeopress 2023

Cover: Cucuteni typical ladles, Romania (photo: C. Preoteasa).
The production phases of salt crystallization in Cacica, the Cucuteni culture (Mugur Andronic).

Acknowledgments: This work was supported by a grant of the Romanian National Authority for Scientific Research, CNCS-UEFISCDI, project number PN-II-ID-PCE-2011-3-0825, 219/5.10.2011, The ethno-archaeology of the salt springs and salt mountains from the extra-Carpathian areas of Romania.



This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License. To view a copy of this license, visit <http://creativecommons.org/licenses/by-nc-nd/4.0/> or send a letter to Creative Commons, PO Box 1866, Mountain View, CA 94042, USA.

This book is available direct from Archaeopress or from our website www.archaeopress.com

Contents

Foreword	v
(Marius Alexianu)	

Theoretical Approaches

Salt: Anthropology of a Quasi Amethodic Topic. Some Thoughts	3
Marius Alexianu	

The ‘Sapientia’ of Salt	11
Michele Zuppi, Paolo Zuppi, Elisabetta Rossi	

Archaeology

The Qraya Salt Experiment. Reenacting Salt Production Processes of Protohistoric Mesopotamia	17
Beatrice Hopkinson, Giorgio Buccellati	

Research on the Use of Hallstatt’s Stone Axes: Study of Mechanics	33
Alfons Fíguls, Kerstin Kowarik, Hans Reschreiter	

Considerations on Salt Exploitation in Bukovina, from Prehistory to Modern Times	47
Mugur Andronic, Bogdan P. Niculică	

Unique Cucuteni Artefacts Used in the Salt Recrystallization Process	55
Constantin Preoteasa	

The Exploitation and Control of Salt Sources from the Early Neolithic to Late Antiquity. Case Study: Oglinzi - Băi Area (Neamţ County, Romania)	65
Vasile Diaconu, Gheorghe Dumitroaia(†)	

A Tiny Story about Salt, Herding and Landscape in Chalcolithic and Late Bronze Age Eastern Romania	73
Neculai Bolohan, Luminița Bejenaru	

A Technological Approach to the Production Sequence at the Beaker Brine-Boiling Site of Molino Sanchón II (Villafáfila, Zamora, Spain): Some Hypotheses about the Moulding of Salt using Organic Containers	85
Elisa Guerra-Doce, Francisco Javier Abarquero-Moras, Germán Delibes-de Castro	

Assessing the Role of Salt in the Spread of the Beaker Phenomenon across Western Europe during the Third Millennium BC	97
Elisa Guerra-Doce	

‘Reddish <i>olle</i>’ and Production and Use of Salt: an Open Question	107
Tomaso Di Fraia	

Salt in Southwest Germany at the End of the Iron Age	117
Martin Hees	

Salt Control and Distribution in the Southern Part of Eastern Carpathians. A Story of a Lost Dacian Hillfort	127
Dan Ștefan, Bogdan Ciupercă	

Geophysical Prospections in the Area of the Salt Mine at Sânpaul	135
Alexandru Popa	

Salt Production as a Reflection of Inter-Ethnic Contact and Culture Change during Late Prehistory (AD 800-1100) in South Alabama, United States	143
Ashley A. Dumas	
Recent Archaeology of Salt in Southeastern North America	151
Ashley A. Dumas	
Towards an Archaeology of Salt Production in Ireland	161
Wes Forsythe, Rosemary McConkey, Colin Breen	
The Vall Salina: More than 6500 Years of Halite Exploitation. Cardona, the Salt of History	169
Alfons Fíguls, Olivier Weller, Thomas Xaver Schuhmacher, Mireia Martínez, Raül Segarra, Rosa M. Lanaspá, Marc Cots, Aitor Henestrosa	
Where the Salt ‘Kerns’: Historical Archaeological Investigations at the Saltpans of the Venezuelan Islands, 17th–19th Century	181
Konrad A. Antczak	

History

Salt Outlets: Which Statistical Profiles in the Roman Empire?	197
Bernard M. Moinier	
Underground Waters as a Source of Salt: Reflections on the Technological Variations of their Use in the South of Mexico	207
Blas R. Castellón Huerta	
Salt ‘Roads’ in Moldavia by the 18th Century: Production, Transportation and Consumption	221
Mihai-Cristian Amărieuței, Ludmila Bacumenco-Pîrnău, Luminița Bejenaru	
A Less Known Practice: Making Salt Cakes in Wooden Vessels. The Testimony of a Foreign Traveller to Moldavia	247
Vasile Diaconu, Roxana Diaconu	
Organization and Functioning of the Salt Extracting Industry in Bessarabia (1812-1850)	253
Andrei Emilciuc	
From Blessing to Punishment: The Salt Issue within the Romanian Landscape in the 19th Century as Seen by Foreign Travellers	267
Mircea-Cristian Ghenghea	
Use of Salt in the Christian Church of Late Antiquity: Literary and Archaeological Evidence	271
Ioan Iațcu	
The First Systematic Research on the Salt Springs of Bukovina: an Austrian Report from 1783	281
Vasile Diacon	

Ethnography, Ethnoarchaeology, Ethnohistory

Anthropological Studies of Salt in Mexico in the Last 20 Years: An Overview	297
Blas R. Castellón Huerta	
Huixtocihuatl. Goddess of Salt	313
Martha Monzón Flores	

Making Salt in Maras (Cusco, Peru): Traditional Salt Production Systems in the Context of Heritage Economy	325
Oriol Beltran	
Salt: a Crucial Feature of Mongolian Nomadism Success	337
Francesca Lugli	
The Role of the Oasis of Selima (Sudan) in the Long Distance Trade of Salty Rocks in the Sudanese Western Desert in the 19th and 20th Centuries	343
Franck Derrien, Coralie Gradel	
Usage of Salt in Therapy and as a Magical Cure among Mongolian Ethnic Groups	351
Dulam Sendenjav	
Salt in Georgia	357
Manana Odisheli	
Salt, History and Culture in the Western Grasslands of Cameroon	363
Henry Kam Kah	
Unity of Sacred and Profane in the Traditional Salt Industry of the Okposi Igbo of South-Eastern Nigeria	371
Peter-Jazzy Ezeh	
Salt in the Traditions of the Romanians. Notes for the Intangible Heritage in Dâmbovița County	375
Ana Ilie	
Traditional Use of Natural Brine. Ethnoarchaeological Research in the Subcarpathian Area of Romania ...	389
Felix-Adrian Tencariu, Andrei Asăndulesei, Marius Alexianu	
Salt Symbolism in the Work of Elena Niculiță-Voronca	401
Mihaela Asăndulesei	
Ukrainian Traditional Salt Traders ('Chumaks') in the North of the Sea of Azov (Case Study of Berdyansk Area)	407
Igor Lyman, Victoria Konstantinova	
Linguistics	
Germanic Lexical Evidence that Clarifies the Multiple Meanings of the Old European Root *sal-	419
Adrian Poruciuc, Norbert Poruciuc	
Imagery of Salt in Romanian Phraseology. Cultural Aspects (Romania)	423
Petronela Savin	
The Morphosyntax of Salt-Related Words, Idioms, Similes and Proverbs in English and Romanian	429
Ileana Oana Macari	
Morphonyms Related to 'Slatină' and 'Slătioară' in Eastern Romania	435
Mihaela Asăndulesei	
The Biography of the Romanian Expression <i>a făgădui marea cu sarea</i> (Romania)	443
Petronela Savin	

Literature

Black Sea Salinity as a Reflection of Environmental and Climate Conditions in Ovid's Poems During the Exile Period in Tomis (SE Romania)	449
Roxana-Gabriela Curcă, Alin Mihu-Pintilie	
Salt in Ancient <i>Opsartytikón</i> Literature	457
Mihaela Paraschiv	
Latin Testimonies on the Exploitation of Salt in 17th–18th Century Moldavia	461
Claudia Tărnăuceanu	

The Vall Salina: More than 6500 Years of Halite Exploitation. Cardona, the Salt of History

Alfons Fíguls¹, Olivier Weller², Thomas Xaver Schuhmacher³, Mireia Martínez¹,
Raül Segarra⁴, Rosa M. Lanaspa¹, Marc Cots¹, Aitor Henestrosa¹

¹Institut de recerques envers la Cultura, Cardona, ²CNRS, Paris

³Deutsches Archäologisches Institut, Berlin, ⁴Universitat Autònoma de Barcelona

Abstract

This paper is a synthesis of the work done in the Vall Salina, especially the excavations in 2007 and 2008, which shows that the exploitation of the salt of Cardona has been uninterrupted for 6500 years, from the Neolithic today. This work is the result of the participation of archaeologists, historians, geologists, geographers, biologists, physicists and architects. The Vall Salina is located in the town of Cardona (Catalonia), a space of almost 2 km long and 0.2 to 0.7 km wide. The valley is oriented from southeast to northwest. It is located between the Castle and the village to the north and the “la Serra de la Sal” in the South. To the southwest is located the diapir of the salt mountain. This diapir is unique in all of Western Europe. The outdoor exploitation (terraces exploitation system) was the system that was used until the early twentieth century, when underground exploitation (exploitation wells and galleries) began. In this paper, we analyse the evolution of the production system running from exploitation of common property resources 6500 years ago to a controlled operation from the final Neolithic-Chalcolithic.

Keywords: Contemporary history, Medieval period, Modern history, Prehistory, Roman Empire.

Introduction

Surprisingly, salt, a natural resource so important to man, has not attracted the interest of historians and archaeologists Catalans until relatively recently. The *raison d'être* of Cardona is not the medieval castle but the salt that was exploited five thousand years before its construction, and the lords of Cardona were not the only ones who have controlled this valley of salt. We are facing a problem on the conception of the importance of history, the positivism and the lack of historical perspective.

We must remember that the history of events was consolidated in the nineteenth century and its influence lasted over time (Carr 1987: 57). Obviously, the absence of salt in the material means that there is no empirical knowledge of the topic. This results in empiricism denying any source of knowledge different from the sensitive knowledge. Therefore, it is the historian who decides the facts belonging to history (Carr 1987: 58), and the easiest solution is not always the most correct. What disappears irreparably are the unexpressed thoughts and the intentions not carried out (Childe 1982: 11) and not anything related to the exploitation of salt; all we have to do is looking for it and knowing how to interpret it.

However, how do we build history? From what data do we build history? These questions have conditioned much of the history of Cardona. Depict means to interpret (Carr 1987: 78). Understanding is not a passive attitude

(Bloch 1988: 112). As noted by V. Gordon Childe, written history involves a very fragmented and incomplete story about what happened (Childe 1985: 19). Therefore, archaeology begins as a classificatory science; once data are classified we can begin to interpret them (Childe 1982: 14). It is the historical analysis where the historian must understand but not judge. (Bloch 1988: 108). So far, the treatment of the history of the salt of Cardona has been biased and incompletely analysed. The data provided by documentation, whether textual, graphical or archaeological have not been interpreted.

Moreover, we come up against the problem of the historical perspective, the most recent knowledge as the most important for understanding the current reality. Thereby, we can fall into the trap of understanding that the nearly 70 years of exploitation in galleries of the Saline of Cardona are the most important in the history of Cardona and, therefore, abandoning the historical impartiality and giving judgment (Bloch 1988: 108).

Since 2004, a research project has analyzed the activities carried out within the Salina Valley and the dynamics generated by this exploitation over time.

The project is promoted by the Institut de recerques envers la Cultura (IREC) with the cooperation of the Laboratoire Trajectoires CNRS (Paris). It was established by an interdisciplinary team of Archaeologists, Architects, Biologists, Engineers, Geologists, Physicists, and Historians.

Why such a diverse team? Because the working competence of an interdisciplinary team is necessary to provide a wide variety of data which enable us to deal in greater depth, and an historian is not a specialist in other sciences (Carr 1987: 163).

The communication presented is a first approach to the historical evolution of the exploitation of the rock salt of the Salina Valley. „History is an endless dialogue between past and present” (Carr 1987: 86). We begin to overcome the problem of historiographical synchronization between a reductionist and positivist history which is the past with a conception centered in the study of the relationship between the socio-economic activity and the socio-economic system. This is the first publication focused on emphasizing the importance of salt as an economic driver of the communities and population settled throughout history in the surroundings of the „Salí”, at present the municipality of Cardona.

With regard to Cardona, there is a concentration of rock salt, sylvinitic, carnallite and plaster which, depending on the historical period, have attracted an intrinsic economic interest. Nevertheless, we depart from the assumption of the theory of value-utility, in which is centered all the economic analysis around the phenomenon of exchange, this being the mechanism by which economic needs are met and goods are exchanged as useful items to meet them (Mochón, 2005). „One of the few undisputed laws of history is that the luxuries tend to become needs and generate new obligations” (Harari 2015: 133).

Situation of the Saline Valley

The municipality of Cardona (Bages) is located in the extreme NE of the Iberian Peninsula, in the centre of Catalonia, in the NW of the Bages region, in the Cardener Valley. On the right side of the Cardener, salt and potassium sediments emerge in a landslide south of the village, which is located in an anticline.

The Saline Valley (Figure 1) is located in an area of almost 2 km long and 0.2 to 0.7 km wide. The Salí is oriented southeast to northwest. The valley is enclosed between the Castle and urban area to the north and Tresserres to the south. The salt diapir of the Muntanya de Sal is located in the southwest. The altitude of the Vall Salina ranges between the 391 and 533, the lowest point being the Pla de la Sal near the river Cardener and the highest point the top of the diapir. The mining rock salt deposit presents a dense layer of halite, sylvinitic and carnallite sinking and located between 700 and 1200 m. The upper layers are sandstone and marl.

Geographical situation: 31 T 390101 4639985 (Salt Mountain) and 31T 391056 4640649 (Saint Onofre east).

Peculiarities of the Saline Valley

The morphology of the Saline Valley is a very peculiar result of natural and anthropogenic action. The solubility of the materials is the cause of the extraordinary transformation of the landscape of both the Salt Mountain and the valley (Fíguls et al. 2007a: 201). This transformation is due to, on the one hand, the surface erosion (favoured by the solubility), causing a clay waste, forming a “cap” above the salt formations (cap rock to seal rock in geological terminology). On the other hand, there is an underground erosion, with the formation of cavities that, when sinking, make up sinkholes (cops in local parlance). These two circumstances (the superficial and the underground) have contributed to the continuous transformation of the landscape throughout the Quaternary period, the historical times or the present.

These changes affect actively in the deposition and preservation of archaeological remains. Thus, the hill of Saint Onofre is a cap rock covering the rock salt of the hill, being very fluffy sediments with no stratigraphy (neither archaeological nor geological). Any human activity (agriculture) or natural (settlement pins) exacerbates the effects post depositional movements (vertical movements, horizontal movements, conservation...), which are another difficulty to overcome.

Prehistoric exploitation of salt in Cardona

Inside

Salt outcrops and Middle Neolithic

The beginning of salt exploitation in Cardona is situated around 4500 BC, during the Middle Neolithic. The spatial distribution of Neolithic settlements in Catalonia, between Pre-Pyrenees and Central Highlands, shows a concentration of communities in the vicinity of Cardona and the river Segre (c. 4500-3500 BC).

Through 12 collections, more than 200 stone tools have been analyzed from the Vall Salina. Eight are private, two public (Salt Museum of Josep Arnau and Municipal Museum of Cardona) and two come from our surveys in 2007 and 2008 (Figure 2).

86% are extraction tools and 80% are axes, adzes, chisels and picks. They have been gradually used in percussion on the salt outcrops in order to obtain salt blocks. These stone tools present conchoidal fractures, crushed areas, splinters areas and scars. The cutting edge is thick with rounded distortion. All these tools are recorded directly at the foot of the salt emergences. Six percent of these extraction tools lack a handle. The use-wear traces indicate direct percussion (lenticular splintering and regular fracture) and indirect (irregular splinters).

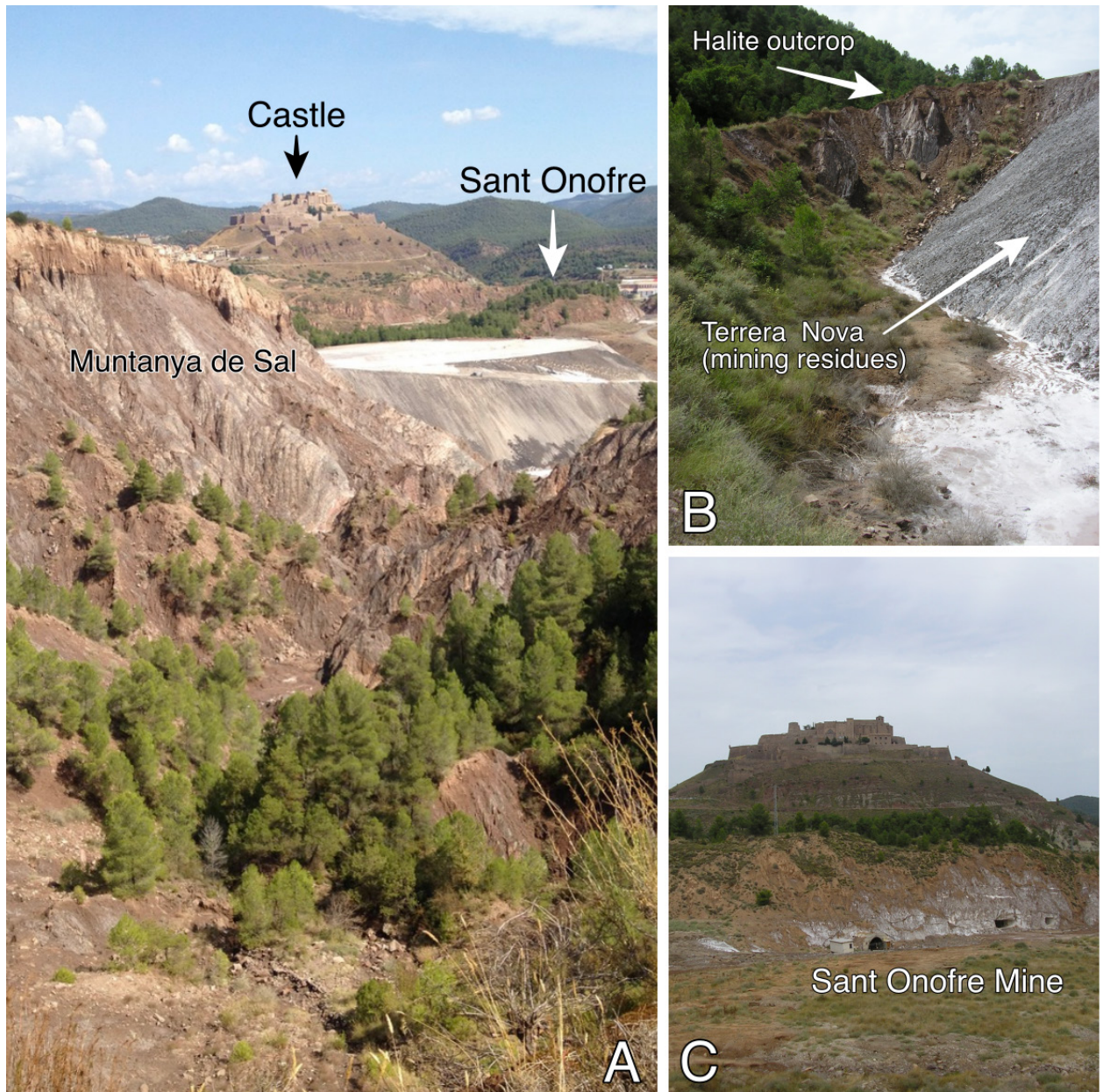


Figure 1. (A) View of Vall Salina from Bòfia Gran. (B) Halite outcrop and mining residues. (C) View of the Sant Onofre Mine. (Photographs: Alfons Fíguls).

There is only 6% of the full set, mostly pestles, involved in the transformation and the preparation of salt. They come from ancient tools, about 50% reused (stone axes). The use-wear analysis suggest direct percussion (uniform and homogeneous crushed and splintered areas) produced by shredding, grinding or/and shaping the amorphous salt blocks.

The 7% remaining correspond to woodworking tools (felling and shaping). This low rate suggests a disinterest in forest felling and must be connected with the wood pieces for mining.

In all the Catalan Central Depression there are no igneous and metamorphic rocks. Therefore, except

the sedimentary material, the raw material and/or the stone tools, completed or half-finished, come from the border or outside this territory occupied by the “Solsonià” communities. Probably not all artifacts come to Cardona as a finished product; two axe preforms and two bush hammers have been registered in the collections.

With this earliest rock salt extraction, the communities living around Cardona were able to attract and import exogenous material and specific values (variscite pearls, shells bracelets, flint from the Provence-Vaucluse, alpine axes). The rock salt production involves the intercommunity connections and reaches the major axes of privileged exchanges, at least at the regional scale.

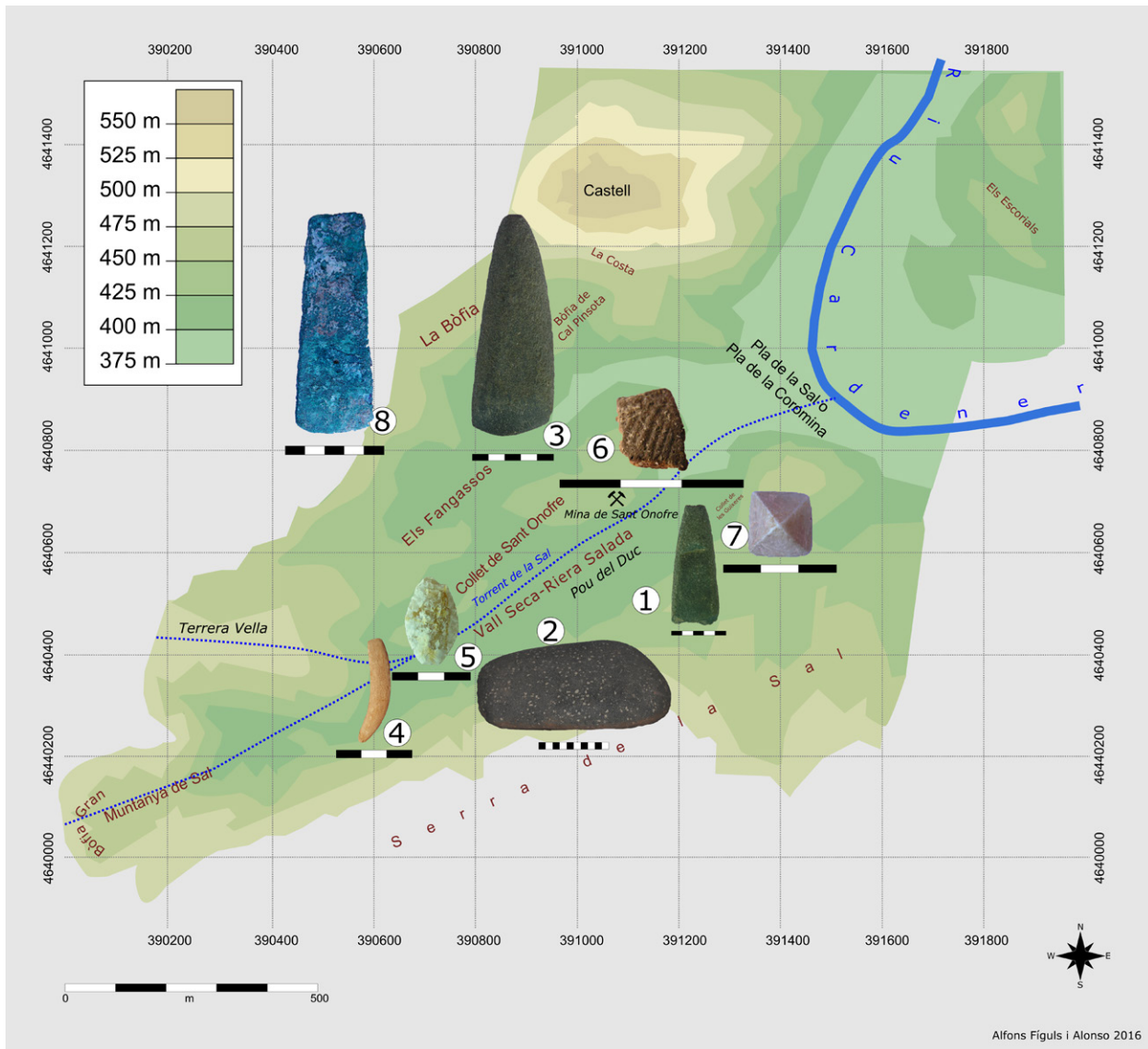


Figure 2. Distribution of the most significant prehistoric findings in Vall Salina: (1) Stone axe reused for salt extraction. (2) Large mining hammer weighing 11 kg. (3) Stone axe used in wood-related work. (4) Glycimeris bracelet. (5) Leaf-shaped arrowhead, typical of the late Catalan Neolithic. (6) Campaniform pottery fragment. (7) Pyramidal bone button. (8) Flat bronze axe. (Map and photographs: Alfons Fíguls).

Late Neolithic

In the extreme south-western part of Sant Onofre, we have a flint foliaceous arrowhead, typical for the Late Neolithic (3500-2500 BC) associated with some sherds. Unlike the Middle Neolithic, where there was no evidence of control in the Salt valley and around, one community settled directly in the Vall Salina dominating the anticlinal, probably to control the salt exploitation (Figure 2).

Chalcolithic and Bronze Age

In the campaign of 2007 a fragment of a Bell Beaker (Figure 2) was documented in Turó de Sant Onofre together with bone fragments. Bell Beakers are considered to widely exceed their utilitarian dimension; a ritual element and a symbol with a strong key role

in funeral ceremonies and at the same time a status symbol only available for privileged individuals or social groups (Delibes et al. 2007: 55). In that sense, the model studied in Molino Sanchón could be repeated in Salí. It is possible that the Bell Beaker fragment, related to the elites of power, reflects the elites who controlled the salt from Cardona. Furthermore, the position of this ceramic in a visual point of control over the territory reinforces the interpretation in this sense.

In the upper part of the valley a flat bronze axe and the fragment of the cutting edge of another one have been found, both related to the rock salt exploitation (Figure 2).

Between little depressions in the salt outcrops produced by the flood of rain water, a pyramidal button with perforations in a V and manufactured in bone was found (Figure 2).

Outside

Jade axe

Inside the municipal district of Cardona an axe made of jade has been documented. It should be pointed out that the nearest outcrops of this rock are situated in Monte Viso (Italy) more than 400 km away from Cardona. We have to insist that Cardona is able to attract an economic prestige good that does not exist in its neighborhood and where salt plays an important role as an exchange good.

The spearhead from La Roqueta

The site of La Roqueta, where a fragment of a spearhead with long socket, following the classification established by Coffyn (1985: 386, map 7), was found, is situated about 5 km away from Vall Salina (Schuhmacher and Fíguls 2007). The presence of this element, which is only available by privileged individuals or social groups, can only be understood by the existence of a resource, which allows this exchange, a resource able to generate wealth.

It should be pointed out that we do know three similar pieces from Catalonia, one in the Cueva de Can Sadurní (Begues, Barcelona), one in Pla de Gibrella (Capsec, Garrotxa, Gerona) and another one in the hoard of Ripoll (Garrotxa, Gerona).

From the three spearheads in the hoard of Castromucho (Palencia), two belong to the type treated here. In both cases the blade is short, leaf-shaped and flat. Both have a long socket of circular section and show a hole to fix the shaft.

The spearhead of La Roqueta keeps most of the blade, only the tip is missing, and a large part of the start of the socket. The thin blade with a flat section, today fragmented, originally was quite short and leaf-shaped. The hafting socket extends itself in a very pronounced midrib of the circular section along the whole of the blade and which originally ran until the end of the tip. At the start of the socket we can see two circular perforations for a peg, aligned alongside the cutting-edge of the blade. At no point has the proximal end of the hafting socket been preserved, therefore this should have been a little bit longer than what is seen today (Figure 3).

Iberians

The presence of remains of Iberian time in the Cardona's castle hill is known from the early decades of the twentieth century, mainly from the collection of materials of this chronology conducted by Reverend Joan Serra Vilaró. It is unclear whether it was simply a superficial collection or if there were some polls. The archaeological material

recovered included ceramic made with potter's wheel, Campanian pottery A and B and basaltic masses. At the beginning of the nineties, explorations were carried out in the castle area which did not allow to document any associated archaeological remains and simply could corroborate, with the superficial collection of Iberian ceramics, the existence of the settlement pointed by Serra Vilaró (Solé et al. 1992).

These evidences suggest the most likely occupation of at least one part of the top of the hill of the castle. One hill that dominates the whole Sali and will be occupied from the High Middle Ages onwards, as it confirms one first Population Letter granted by the Count „Guifré el Pilós”, approximately in 888.

Occupation and Roman exploitation

A series of written sources, quoted below, are documented during the Roman period regarding the description of a mountain of salt, related to its possible identification with the salt mines of Cardona.

The first written documentary sources which refers to a „Salt Mountain” or the extraction and use of salt in Cardona date from s. I AD

- Columella (4-70 AD) Lucius refers to a salt mountain in Hispania in his work *Res Rustica*, written around the year 42 AD:

“sive album in oculo est, montanus sal Hispanus vel Ammoniacus vel etiam Cappadocus, minute tritus et immixtus melli vitium extenuat” (Columella, *Rust.* 6, 17, 7)

- Pliny (23-79 AD), who was sent to the Hispania Tarraconensis on 73 AD, describes some of the features of the salt in the Hispania Citerior in his *Naturalis Historia*:

“in Hispania quoque citeriore Egelestae caeditur glaebis paene translucentibus cui iam pridem palma a plerisque medicis inter omnia salis genera perhibetur. omnis locus in quo repperitur sal sterilis est nihilque gignit. et in totum sponte nascens intra haec est. facticii varia genera, vulgaris plurimusque in salinis mari adfuso non sine aquae dulcis riguis, sed imbre maxime iuvante ac super omnia sole multo, aliter non inarescens” (Plin., *HN*, 31, 80-81).

- Aulus Gellius (125-180 AD), in his work *Noctes Atticae*, dated on 159 AD, includes information on various topics that had attracted his attention, among which is the Salt Mountain:

“Nam cum de Hispanis scriberet, qui citra Hiberum colunt, verba haec posuit: “Set in his regionibus ferrariae,



Figure 3. Map of the spread of long-handled spears. Pla de Gibrella; Can Sadurní; Ripoll; Cardona; Castromucho; La Represa; Valdevimbre; Sobrefoz; Fonsagrada; Maltravieso; Castro San Bernardo. Salt route: Cardener historic path to the north. Main communication channels of peninsular Southeast. Secondary communication channels of southeastern Iberian Peninsula. (Map: Alfons Fíguls, base map: Wikipedia)

argentifodinae pulcherrimae, mons ex sale mero magnus; quantum demas, tantum adcrecit” (Gell., NA, 2, 22, 29).

- Sidonius Apollinaris (c.430-488 AD) refers to the salt from Tarraconense. Several authors have mentioned that salt Tarraconense used to be exported to Italia and Gallia (Blázquez 1970: 148; Martínez Muñoz 2001: 140; Meniz 1978: 30):

“Venit in nostras a te profecta pagina manus, quae trahit multam similitudinem de sale Hispano in iugis caeso Tarraconensibus. nam recensenti lucida et salsa est, nec tamen propter hoc ipsum mellea minus, si sermo dulcis et propositionibus acet: sic enim oblectat eloquio quod turbat imperio, quippe qui parum metiens, quid ordinis agam, carmina a nobis nunc novat petat. primum ab exordio religiosae professionis huic principaliter exercitio renuntiavi, quia nimirum facilitati posset accommodari, si me occupasset levitas versuum, quem respicere coeperat gravitas actionum.” (Sid. Apoll., Epist. 9, 12, 1).

This documentation has been a matter of controversy because there is no unanimity in recognizing Cardona these descriptions (Martínez Muñoz, 2001). There is

some agreement in accepting that Aulus Gellius and Sidonius Apollinaris describe the Salt Mountain of Cardona; however, Gaius Plinius Secundus, despite not being yet identified, may refer to La Higuera (Albacete) (Carusi, 2008: 116) or to a mine near Linares (Jaén) (Blázquez, 1970: 148). Without entering into sterile debates leading to nowhere and only generating speculation, we would like to ask two rhetorical questions:

- How many piles of salt had Hispania?
- How many salt mines prove archaeologically a Roman presence?

Throughout Western Europe, there is only one mountain of salt, the one of Cardona.

There is no doubt that archaeological data demonstrate the Roman presence around the valley salt and the valley itself. In Cardona there are 11 Roman archaeological sites, among which it is possible that there were establishments of the Republican era (Solé et al., 1992), corresponding to 10 room locations and 1 oven.

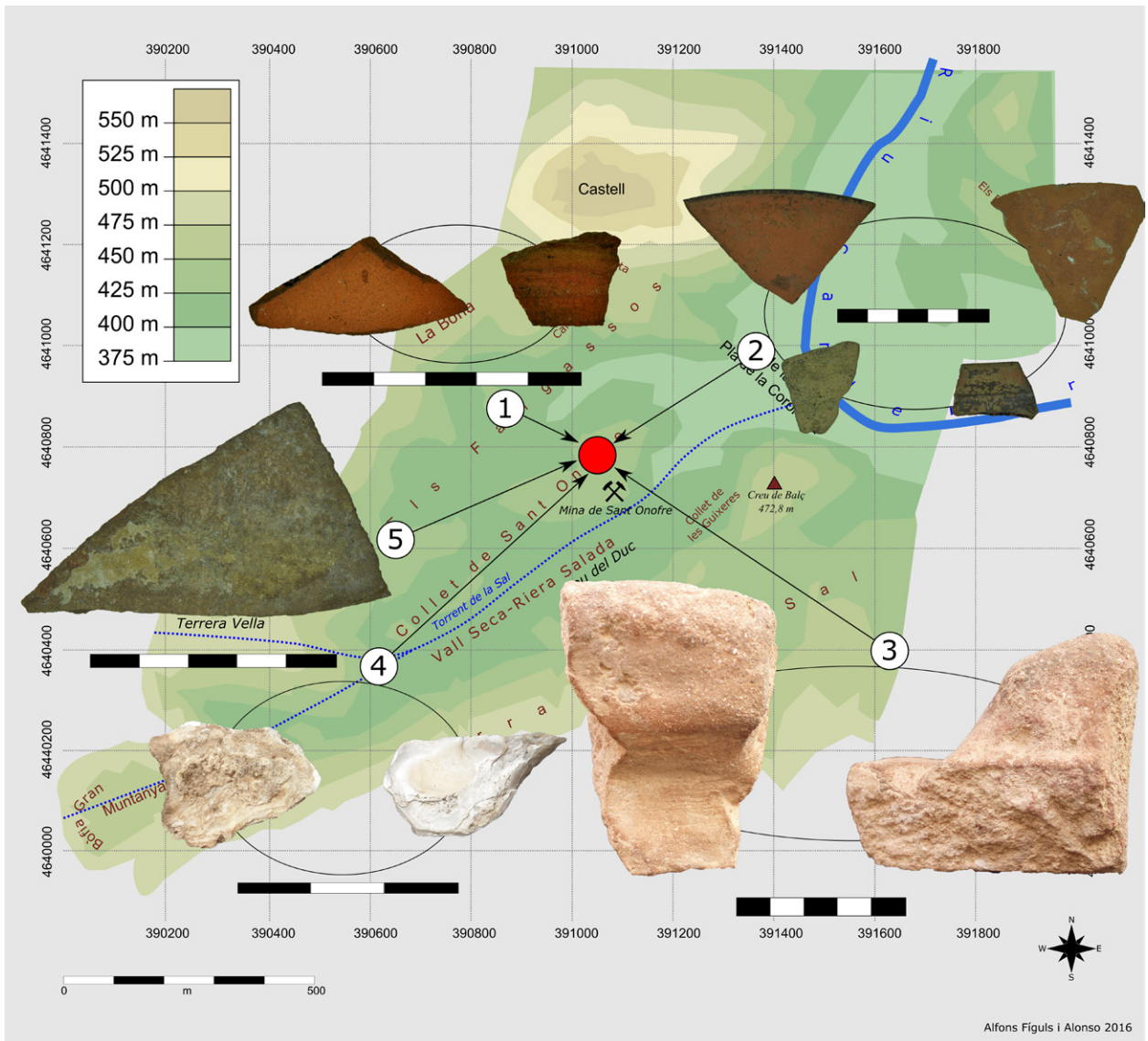


Figure 4: Distribution of Roman findings in Turó de Sant Onofre. (1) Fragments of luxurious domestic ceramics. (2) Fragments of common domestic ceramics. (3) Tegulae. (4) Oysters. (5) Amphora fragment. (Map and photographs: Alfons Figuls)

Evidences of Roman presence in the valley salt come to light since 1991, when ceramic rests, from the I century to V AD were found on the “Collet de Sant Onofre” (Daura 2001: 93-97). In the campaigns of 2007 and 2008 on the top of San Onofre remains from the same period were documented (Figure 4).

The presence of construction material such as *tegulae* suggests the existence of a permanent establishment in the hill, specifically on the head entrance to the valley (Figure 5). Lacking of a new excavation among the remains of structures documented a virtual reconstruction of a watchtower has been made. The results show that this is a point of control and domination of the valley, that is to say, of any place with outcrops of halite.

Ceramics for daily use have documented the existence of two completely antagonistic groups: on the one

hand, household items of common use, that even could be called vulgar, and on the other, ostentation ones. A clear division that could be a sogn of cohabitation in a small area of Sant Onofre of those who represent the command and coordination of the operation of halite and of those who control productive activities.

We would like to emphasize, among the remains of San Onofre, the presence of *ostrae edulis*. The collector center nearest to Cardona was Barcino, which, besides being a center of production of garum, stood out for the quality of its oysters: “*ostrifero super addit a Barcino ponto*”, so Ausonius highlighted in his work *Epistulae* (Ep. XXIII, 69-70) (Beltrán 2007: 281). Should be noted that the base of garum consisted of a maceration in salt of the bowels of the fish (eggs, blood, guts, guts, etc.) often mixed with small whole fishes (Beltrán 2001: 58). It should not be discarded that the south-north traffic

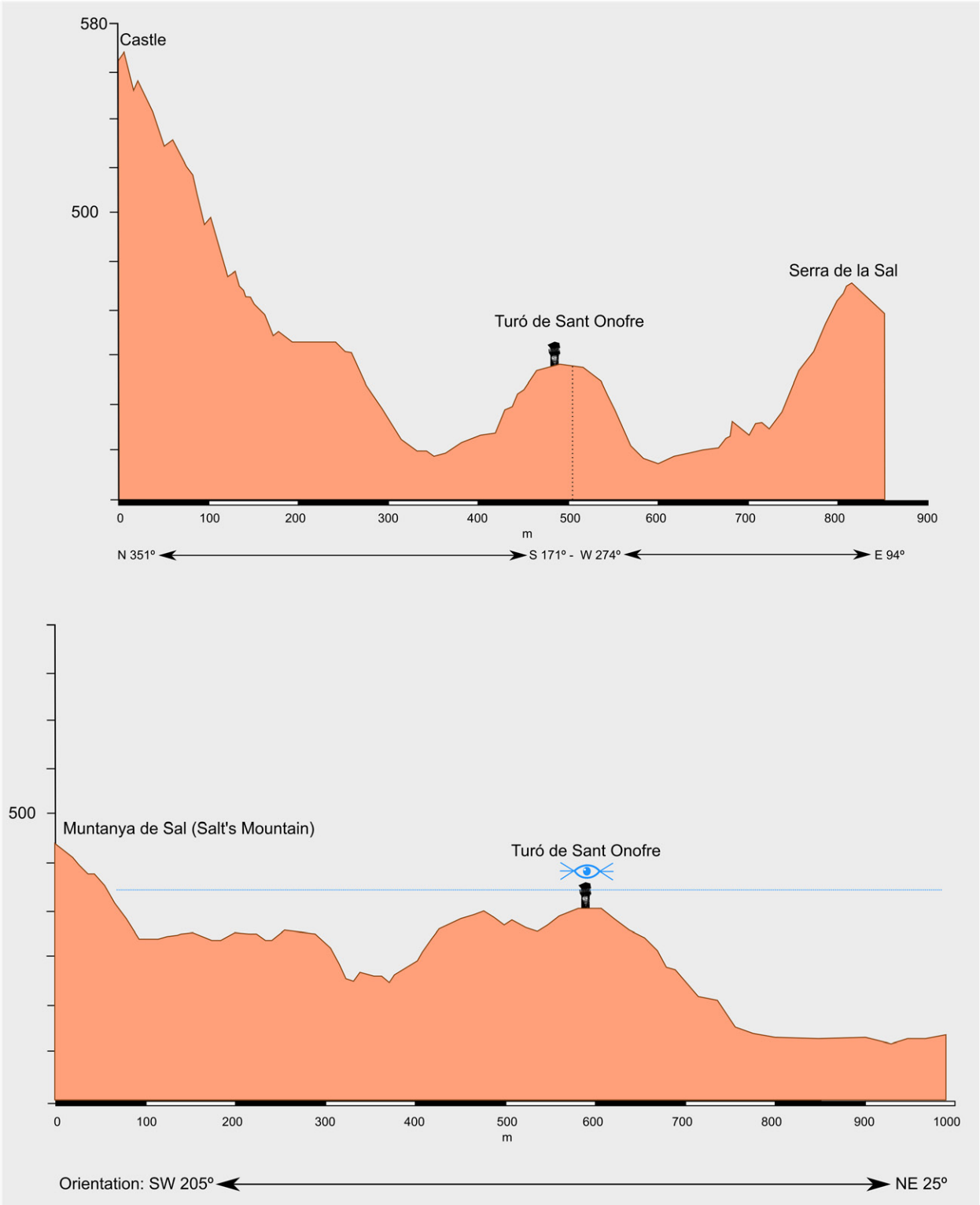


Figure 5: Interpretation of the domain at the valley entrance from the summit of Sant Onofre (Alfons Fíguls).

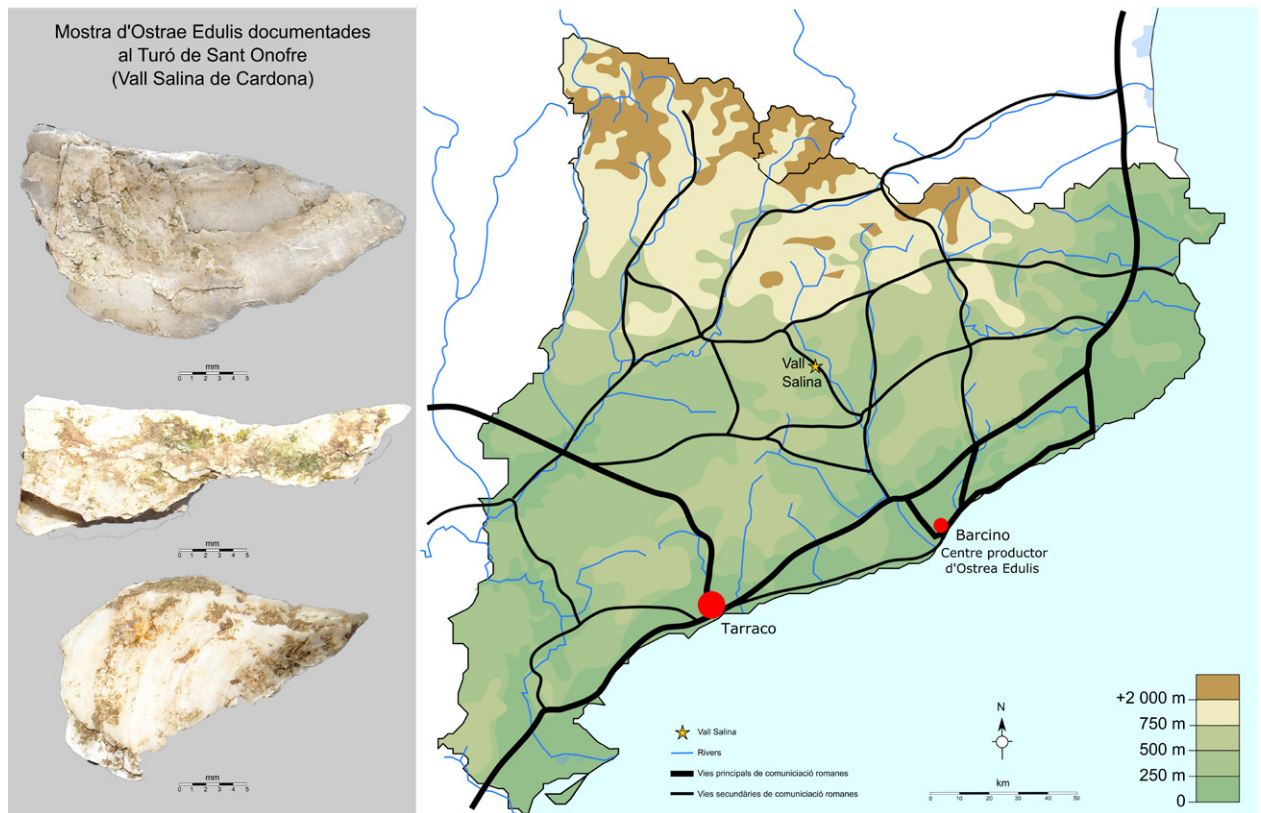


Figure 6: Main Roman roads in Catalonia in relation to Vall Salina and Barcino, a center for oyster production. (Map and photographs: Alfons Fíguls).

of oysters had a reciprocal north-south flow of salt; which was necessary in the work of salting and garum production in Barcino (Figure 6).

“Et ipse die lovis semper illa vestrum de illa sale in omni tempore, sicut fuit ab initio”

Cardona, in the Middle Ages, according to Pierre Bonnassie (Bonnassie 1979: 66), was a «mercatum perfectum», from which the populations of central and southern Catalonia were supplied; It was not a market aimed at satisfying the needs of a wealthy clientele, but was linked to the production and diffusion of salt, a mass-market product, being introduced by an important communication network, such as the Strata Cardonensis from the late 10th century. The profits from the exploitation of salt were shared between the viscount, the monastery of Sant Vicenç and the urban community. In 986, Borrell II, in the Letter of Repopulation, gave to the one who populated Cardona the privilege of: «Et ipse die lovis semper illa vestrum de illa sale in omni tempore, sicut fuit ab initio» (Gaya 1935) and the rest of the week the factory of «Salí» was in the hands of the power of the viscount. As of the 12th century, there was an increase in the production of salt, as a result of an increase in urban consumption and the need for livestock. Cardona was an obligatory stopover for the flocks of the Cistercian monasteries of Poblet and Santes Creus in their transit to the summer pastures of Berguedà, Cerdanya and Pirineus. Cardona

was the market for salt in central Catalonia and the importance that the salt market acquired led to the Via Salinaria or «camí de la Sal» (Galera 2007: 574). Inside the valley, pottery has been documented from the Middle Ages to the Low Middle Ages (Figure 7).

The name of “gentlemen of salt”, with whom the lineage of the Cardona was known, clearly denotes the significance of the Salí and explains the economic power of the viscount. The power of Cardona turned them into one of the most influential lineages in Catalan politics of the Middle Ages and were the kings without a crown.

The Lords of the Salt: The uncrowned Kings

In the Modern Era, the traditional method of extracting salt was open pit using picks and hoes. Before opening cuts, preparation works consisting in removing lands covering the salt were made. Once cleaned the ground, the extraction of salt was made by steps or benches of the height of a man, and stairs and access ramps were set up. Since the late 18th century, gunpowder began to be used to extract salt in order to save labour and reduce production costs.

During this time, it continued the exploitation of salt intended for transhumance (April-September) and the preservation of meat (November and December) (Galera 2007: 566-567).

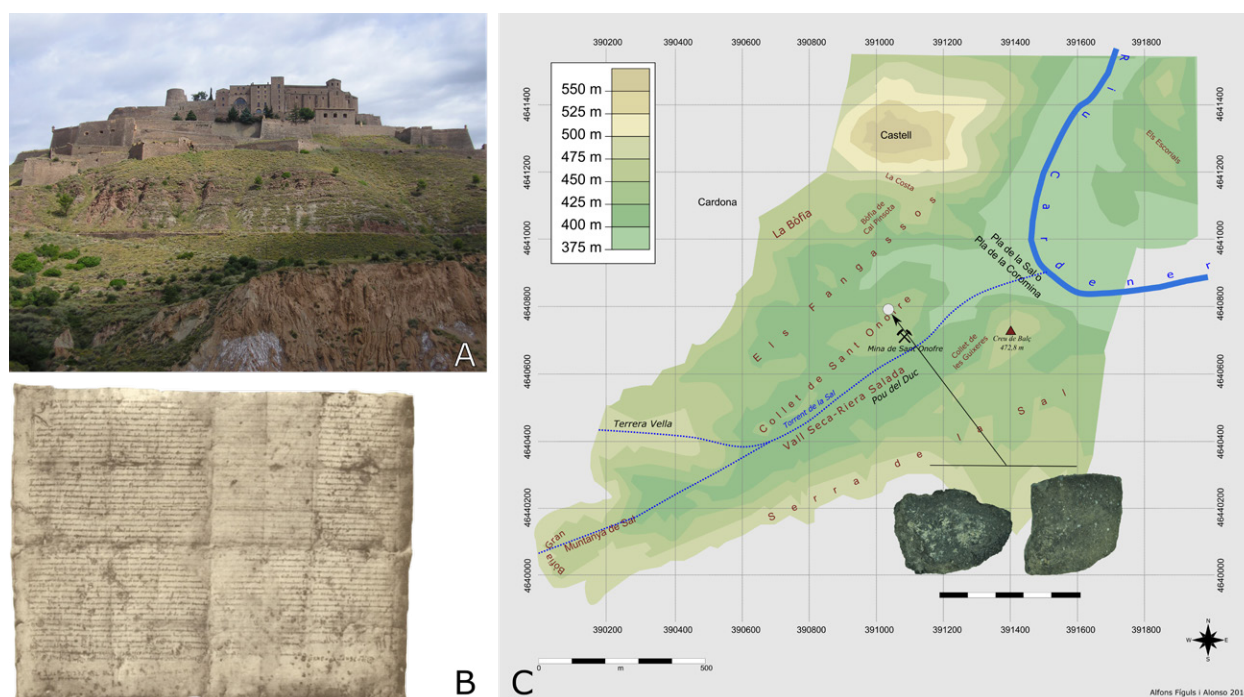


Figure 7: (A) Cardona Castle dominating Vall Salina. (B) Municipal charter of Cardona. (C) Findings of medieval gray pottery in Sant Onofre. (Photographs and Map: Alfons Fíguls, Municipal charter: Cardona Historical Archive).

In 1716, Felip V imposed the “Decret de Nova Planta” and established the salt monopoly putting an end to the free commerce of salt. With this royal monopoly, the salt from Cardona was distributed to the main towns situated at a distance of eight hours away, altering all the dynamics of the previous market (Galera 2007: 564). But, since 1870, the Dukes of Cardona, owners of the salines, were authorized to freely extract and sell. It was the time when it was made a big effort to commercialize again the salt from Cardona.

It is estimated that in the XIXth century 4000 tons of salt from Cardona were destined for human consumption.

From NaCl through KCl

The open-pit system of exploitation remain unchanged over time until the introduction of gunpowder, at the XVIIIth century, and the opening of the “Pou del Duc”, the first underground salt mine, opened between 1902 and 1905.

The discovery of potassium salts (1912) transformed Cardona both economically and socially. Doubled the population and there were significant changes in its urban and social landscape.

In Cardona, the exploitation of sylvinit for obtaining potassium chloride (KCl) began in 1929 and lasted until September 1990.

The mining activity of Cardona allowed to obtain un 22% of potassium chloride, the remaining was sodium

chloride, carnalyte, anhydrite and other elements (Arnau 2001: 79). This potassium chloride was obtained through the dissolution system (from 1929 until 1972) and then with the flotation system (from 1967 to 1990) where the potash was separated from the rest of the mineral obtaining a law of 95% KCl. The remaining waste was sent to the deposits of salt (larks) and one part was purified to obtain industrial salt destined mainly to the chemical industry to obtain chlorine for the production of plastics.

When the exploitation of the potash started, rock salt went to second place. From 1929 to 1990, about 28 million tons of halite were extracted.

From 1929 to 1990, more than 17.215.00 m3 were extracted, i.e., 37,874,843 tons of mineral, and the exploitation reached the 1,308.7 meters deep, being the deepest mine in the country.

Capitalization

With this article, we would like to help put an end to the idea, among economic historians, that preindustrial societies failed to meet their most basic needs (Cipolla 1983: 77-78).

If the exchange operations play a strategic and dynamic role, which allows the specialization and the best use of available resources (Cipolla 1983: 78), the vision we have of the prehistory of Cardona, based on objective data, is that salt has played a fundamental role in meeting the needs of productive activity: capital goods

(metamorphic and bronze stone axes) and social needs, such as the ax of jadeite and the spearhead of La Roqueta.

We believe that the need of salt for human and animal consumption and as „useful-value” was an economic and demographic catalyst. The analysis of the population from the Neolithic and the network of exchanges shows that the demographic and economic levels were more significant around the Salt Mountain than in other parts of the interior of Catalonia.

Of the two interventions carried out, until now, 2007 and 2008, we have been able to begin delimiting the area of exploitation of the valley and the chronological sequence that covers from the Neolithic to the present, almost uninterruptedly.

It has been prospected in 3 salt cuts, where there has been documented the presence of remains of mining tools for the extraction of metamorphic rocks (axes and slices corresponding to single-sided and cut pieces), big tools, silex outbursts and a Glycymeris bracelet fragment.

Inside the Mont of Saint Onofre, where it has been excavated and prospected, two prehistoric spaces corresponding to the final Neolithic (west of Saint Onofre) and the Chalcolithic (east of Saint Onofre) have been delimited.

It is in the eastern part of the hill where Roman *tegulae* and cooking materials were documented, so it would confirm, in the absence of room structures, the occupation and possible Roman settlement, with a chronology dating from the 1st to the 5th century AD.

In this same place, it has been documented the presence of bone remains, remains of ostreas, indeterminate prehistoric handmade ceramics, Paleo-Christian ceramics, high-medieval ceramics, medieval gray ceramics and modern and contemporary construction material.

The remains localized in the eastern part of Sant Onofre are located in a privileged and strategic place, a point that allows to dominate the Salí entrance and control the two valleys (Pla dels Fangassos and Seca-Riera Salada Valley).

The Salina Valley is an exceptional site where 6500 years of salt mining run. It represents simultaneously the only gem deposit in Western Europe accessible directly from its own surface, as well as the oldest exploitation of halite in Europe.

The exploitation in the open air (terraces exploitation system) was the system that was used from its

beginning to the early 20th century, when the underground operation began (operating wells and galleries).

The production system ranges from the exploitation of common property resources 6500 years ago to a controlled operation system from the end of the Neolithic-Chalcolithic to the present. The presence of non-mining, kitchen and construction elements would confirm, in the absence of room structures, the occupation and control of the exploitation of halite by certain communities from the final Neolithic, as evidenced by the findings of the 2007 and 2008 campaigns.

Finally, we consider that the productive activity and exchange / commercialization activity was important from the Neolithic period until 1716, when with the New Plant Decree the royal salt monopoly was established. The productive and commercialization activity was reactivated from 1870 to 1991; being the highest point in the last 61 years with almost 38 million tonnes of mineral.

Ancient literary sources

Aulo Gelio: Noches áticas, A. Gaos Schmidt (ed.), Tomo I. Libros I-IV. Introducción, traducción, notas e índice onomástico. Mexico City: Universidad Nacional Autónoma de México, 2000.

Ausonius, H. G. Evelyn White (ed.), 2 vol. Loeb Classical Library, Cambridge, MA: Harvard University Press, 1919-1921.

Columella, On agriculture, E. S. Forster, E. H. Heffner (eds.), Books 5-9. Loeb Classical Library, Cambridge, MA: Harvard University Press, 1954.

Pliny. Natural History, Volume VIII: Books 28-32. Translated by W. H. S. Jones. Loeb Classical Library 418. Cambridge, MA: Harvard University Press, 1963.

Sidoine Apollinaire, t. II et III. Lettres (livres I-V et VI-IX), Texte établi et traduit par André Loyen. Les Belles Lettres, Paris, 1970.

References

Arnau, R. 2001. La sal com a producte de la fabricació de la potassa. In E. Barrera and A. Serena (ed.), *La sal. Cardona*: Patronat Municipal de Museus de Cardona: 79-82.

Beltrán de Heredia Bercero, J. 2001. A garum and salt fish factory in Barcino. En *From Barcino to Barcinona (1st to 7th centuries) The archaeological remains of Plaça del Rei in Barcelona*. Barcelona: *Museu d'Història de la Ciutat. Ajuntament de Barcelona*: 58-63.

Beltrán de Heredia Bercero, J. 2007. *Cetariae bajo imperiales en la costa catalana: el caso de Barcino*.

- In L. Lagóstena, D. Bernal, and A. Arévalo (ed.), *Cetariae 2005. Salsas y salazones de pescado en Occidente durante la Antigüedad. Actas del Congreso Internacional Cetariae (Cádiz, 7-9 Noviembre, 2005)*: 277-284. Oxford, Archaeopress.
- Blázquez, J. M. 1970. Fuentes literarias griegas y romanas referentes a las explotaciones mineras de la Hispania romana. In L. Carnicero (ed.), *VI Congreso Internacional de Minería: La Minería Hispana e Iberoamericana. Contribución a su investigación histórica. Estudios, fuentes, bibliografía*: 116-150. León: Catedra de San Isidoro.
- Bloch, M. 1988. *Introducción a la Historia*. México: Fondo de Cultura Económica.
- Bonnassie, P. 1979. *Catalunya mil anys enrera: Economia i societat feudal*. Barcelona: Edicions 62.
- Carr, E. H. 1987. *¿Qué es la historia?* Barcelona: Ariel.
- Carusi, C. 2008. *Il sale nel mondo greco (Vi a.C.-III d.C.). Luoghi di produzione, circolazione commerciale, regimi di sfruttamento nel contesto del Mediterraneo antico*. Bari: Edipuglia.
- Childe, V. G. 1982. *Introducción a la arqueología (4a ed.)*. Barcelona: Ariel.
- Childe, V. G. 1985. *Que sucedió en la historia (1a ed.)*. Barcelona: Planeta-De Agostini.
- Cipolla, C. M. 1983. *Historia económica de la población mundial*. Barcelona: Crítica.
- Daura, A. 2001. Troballes de restes arqueològiques romanes al Salí. In E. Barrera and A. Serena (eds.), *La sal*: 93-97. Cardona: Patronat Municipal de Museus de Cardona.
- Galera, A. 2007. Sal, ganadería, cañadas, trashumancia, salazones y economía de montaña en el caso de la villa ducal de Cardona (Barcelona), la Cataluña central y los Pirineos siglos XII-XVII . In N. Morère (Ed.), *Las salinas y la sal de interior en la historia, economía, medio ambiente y sociedad*: 561-590. Madrid: Universidad Rey Juan Carlos i Dykinson.
- Gaya, R. 1935. *Carta de població de Cardona, donada por Borrell II, Comte i Marquès de Barcelona, a 23 d'abril de l'any 986*. Cardona: Ajuntament de Cardona.
- Harari, Y. N. 2015. *Sàpiens. Una breu història de la humanitat (7a ed.)*. Barcelona: Edicions 62.
- Martínez Muñoz, D. 2001. Una aproximació a la bibliografia de la Muntanya de Sal i de l'explotació minera a Cardona. In E. Barrera and A. Serena (eds.), *La sal*: 139-164. Cardona: Patronat Municipal de Museus de Cardona.
- Meniz, C. 1978. *Aportación a la historia de la sal. Minas de Cardona*. Madrid: Universidad Complutense de Madrid.
- Mochón, F. 2005. *Economía, teoría y política (5a edició ed.)*. Madrid: McGrawHill.
- Schuhmacher, T. X., and Fíguls, A. 2007. Una punta de lanza de Cardona (Bages, Barcelona). In A. Fíguls, and O. Weller (Edits.), *Prehistoric and Protohistoric Workshop. Cardona 6 de desembre del 2003*: 19-36. Cardona: Institut de recerques envers la Cultura (IREC).
- Solé, X., Galera, A., Juan, M., and Aguilar, A. 1992. *Prospecció arqueològica del municipi de Cardona (Bages, Barcelona)*. Cardona: Ajuntament de Cardona (5 volums).