First International Congress on the Anthropology of Salt

20–24 August 2015
"Al. I. Cuza" University of Iași
Iași, Romania

Programme and Abstracts

Edited by

Ștefan Caliniuc, Mihaela Asăndulesei,
Roxana-Gabriela Curcă, Marius-Tiberiu Alexianu

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Editura Universității „Alexandru Ioan Cuza" din Iași

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FIRST INTERNATIONAL CONGRESS ON THE ANTHROPOLOGY OF SALT

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Anthropology of Salt: challenges of a new discipline

Marius Alexianu

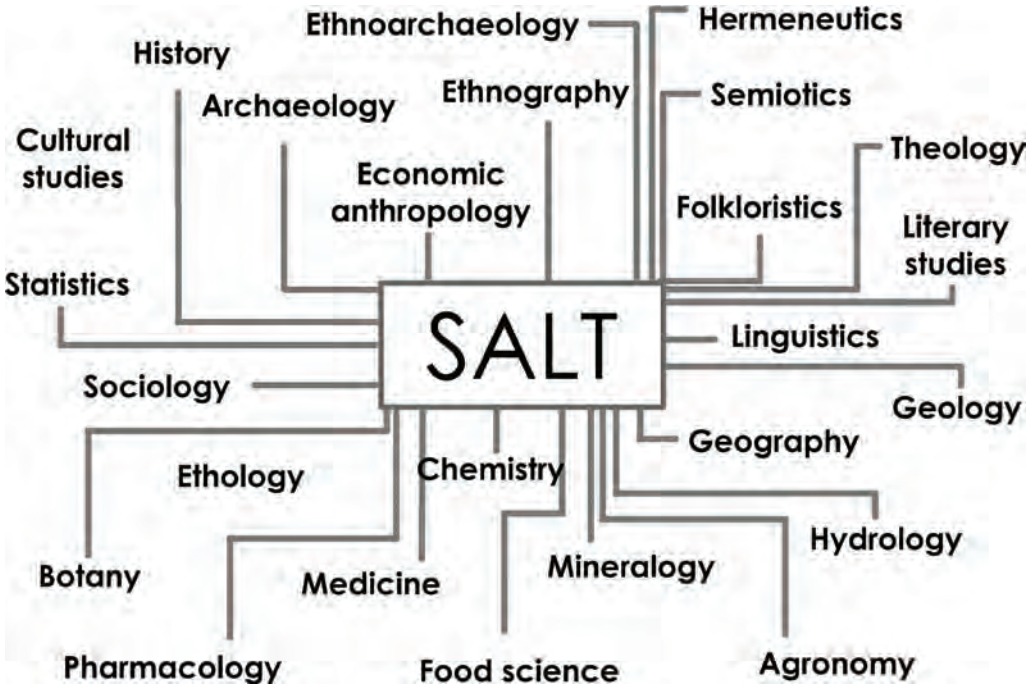
In a first approach published in 2012, the author made the first step towards establishing a new discipline, the anthropology of salt. A symposium organized in Iasi in the same year, in the framework of the EthnosalRo project, sought to test at the national level the validity of this proposal, the results of which have been encouraging. On that occasion it became clear that, respecting the disciplinary rigours, the anthropology of salt *stricto sensu* (archaeology, history, ethnology, linguistics) has strong chances to establish itself as a recognized discipline. But, as it is well known, there are countless other disciplines or sciences whose object of inquiry is NaCl. The natural outcome is to ask ourselves: how far can we extend, *lato sensu*, the anthropology of salt? Which sciences and disciplines can and cannot be brought under the same umbrella of the anthropology of salt?

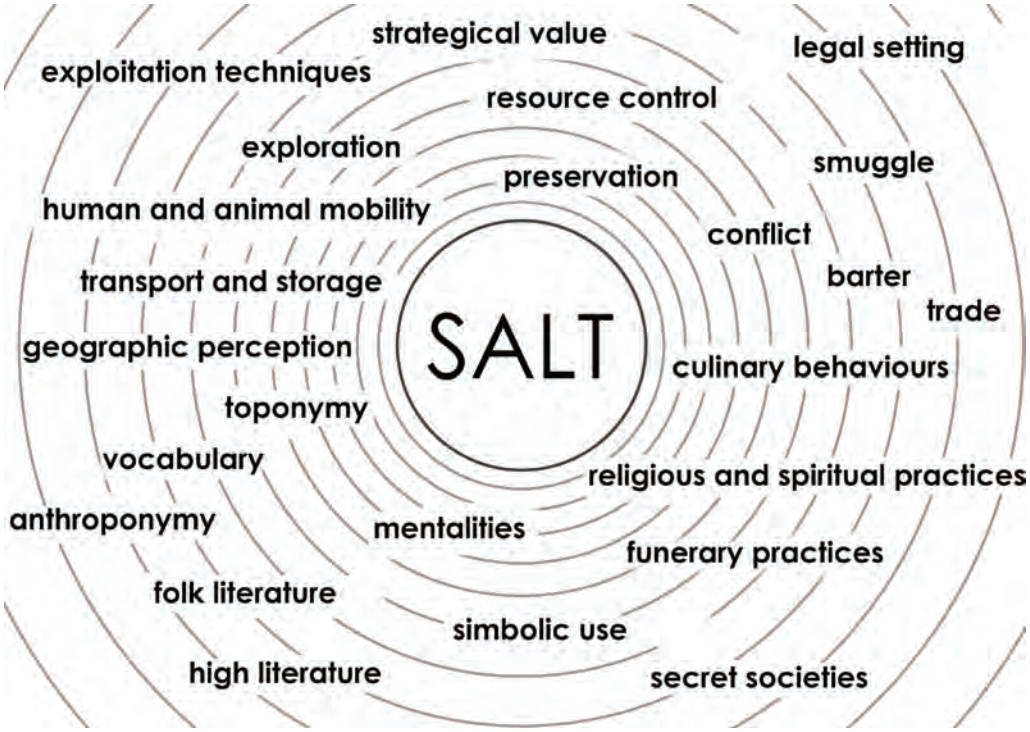
A hackneyed observation is—to limit ourselves to just two related humanity fields—that archaeologists are not generally interested or even reject *ab initio* the historians' trials on this topic; the opposite is likewise true. And should I even mention the reactions towards other disciplines/sciences more or less associated to the humanities! My behaviour was exactly the opposite, and from personal experience I can state that contact and dialogue with representatives of other disciplines/sciences (*e.g.*, geography, geology, chemistry, medicine) were particularly stimulatory, sometimes engendering some genuinely new research directions. Not once have I found that the reactions were reciprocal. We are referring, of course, to personal initiatives that veer from the usual practice within a discipline. The current situation, which is paradoxically due to scientific progress, and which presuppose increasingly abstruse specialisations, reveals a critical impasse: the scientific communities no longer communicate with each other!

Returning to our research object, I take full responsibility for the statement that researching man's reactions to salt, along the diatopic and diachronic levels and from a perspective as wide as possible, is not an *ex cathedra* exigency, but a necessity generated by a incontestable reality: salt is the mineral that left the strongest mark on human life, from the material aspects to the spiritual reflexes. Obviously, the anthropology of salt cannot be conceived as a simple, mechanical listing of all the disciplines/sciences (with their specific principles and methods) that have NaCl as study object. In my opinion, the anthropology of salt would gradually individualise as an autonomous field, dealing with such diverse research themes, only if the mono- and multi-disciplinary approaches will be replaced by inter- and trans-disciplinary ones.

For the near future, we must overcome a major obstacle for consolidating this discipline: even though it has a birth certificate, the anthropology of salt still lacks a definition! This is why I don't hesitate in stating that the anthropology of salt is rather a discipline of the future than of the present. I can only entertain the hope that the

second congress on the anthropology of salt will mark a new step towards the autonomisation, the individualisation of this discipline.





EthnosalRo project. Work in progress

Marius Alexianu, Olivier Weller, Ion Sandu, Gheorghe Romanescu, Robin Brigand, Roxana-Gabriela Curcă, Vasile Cotiugă, Felix Tencariu, Andrei Asăndulesei, Ștefan Caliniuc, Radu Balaur, Mihaela Asăndulesei

The multidisciplinary studies related to salt (either in a solid or liquid state of aggregation) have underlined its overwhelming role for alimentation, human and animal health state, food conservation during unproductive seasons (before the era of refrigeration), the stability and development of human habitat. This function subsequently determined the tendency to control (inclusively in a military way) this natural resource, irreplaceable to human life The sub-Carpathian area of the Eastern Romania, characterized by a high density of the salt springs (over 200 that we know so far), holds the record for the most ancient traces of salt exploitation all around the European area, beginning with the Starčevo-Criş culture. To this essential aspect for the whole European prehistory we should also add that the most distinctive aspect which clearly set apart and distinguished the sub-Carpathian Moldavian area from similar European ones (or maybe worldwide), where diachronic methods of salt spring exploitation were attested, is the continuity of these methods to an intensity difficult to imagine up to the present, regardless of any sort of mechanization, economic organization or legal regulation, hence in similar conditions to those of pre-industrial societies. This unique situation in Europe represents the ideal framework for the development of complex ethnoarchaeological researches even within the European Union. Nowadays, researchers resort to the ethnographic analogies regarding remote areas unrelated to salt springs, in order to understand the archaeological phenomena related to salt springs, which drastically reduces the adequacy degree and the credibility of the ethnographic analogy.

The approach of the Romanian-French team so far, which completely observed the exigencies specific to the ethnoarchaeology, underlined the huge cognitive potential of this area on a global level. The idea to compare a Neolithic (and of other historical eras) situation, despite the succession of different archaeological cultures around salt springs, to the present day situation gains a solid ground in the fact that traditional brine supply methods and their intensity, the distribution and use networks of salt springs are practically identical. This is proven by the mediaeval and modern documents that cover a period of half of a millennium. Thus, the methodological novelty consists in the substantiation of applying current models to prehistoric archaeological contexts, beginning with the ascertained fact of the continuity—during the second half of the millennium—of the economic patterns and social contexts generated by the existence of salt springs. This occurred despite the major changes in the social, political, and administrative organization of the communities within the sub-Carpathian Moldavian area, inclusively the fact that Romania joined the European Union. An essential impediment in the setting of

ethnoarchaeological researches was the lack of ethnographic studies related to the phenomenon of exploiting brine from salt springs. As we already know, ethnographers do not deal with the same issues as archaeologists; as consequence, most of the situations that could be interesting for the archaeology are never recorded. Due to this fact, an original ethnographic questionnaire related to the subject of salt springs exploitation from an archaeological perspective was elaborated. By successfully testing this useful instrument on the whole Eastern sub-Carpathian Romanian space, we elaborated a complex database that has already enabled the first modelling processes. The results of spatial analyses provide solid arguments to accept/reject several working hypotheses related to the role of salt springs in prehistory, especially in the Cucuteni-Tripolye cultural complex. Given the fact that the salt spring exploitation in Mexico, America, etc., even though it presents very interesting aspects, it does not have enough amplitude for complex modelling. Our 1992 study caught the attention of O. Weller (CNRS France) who obtained several successive series of financing since 2003 in order to carry on ethnoarchaeological investigations in the salt springs area, whose importance we have apprehended. Since 2007-2010 the researches have intensified within the CNCSIS Idei no. 167/2007 project, entitled *The salt springs of Moldavia: the ethnoarchaeology of a polyvalent natural resource* (Alexianu, M., Weller, O. 'The Ethnosal project. Ethnoarchaeological investigation at the Moldavian salt springs', *Antiquity*, vol. 83, Issue 321, September 2009, antiquity.ac.uk/projgall/weller321).

Because each campaign provided new and often unexpected aspects concerning the exploitation, uses, distribution networks, social contexts related to salt springs, we need to extend the ethnoarchaeological research framework to the entire Romanian extra-Carpathian area in order to build a saturated model (cf. G. E. Sacks,

Saturated model theory[2], World Scientific Publishing Co., Singapore, 2010). We need to continue this type of research, taking into account also the imminent disappearance of the older generations, who have first-hand information regarding the non-industrial salt exploitation during the last century. We underline the fact that, for the first time in the field of ethnoarchaeology, the correlations between the exploitation of salt springs and that of salt mountains/cliffs will be systematically analyzed. We thus create the premises to fully substantiate interpretative models impossible to achieve anywhere else in Europe. It is obvious that the modeling based on such a consistent database maximizes the credibility of using the ethnographical analogy to understand the various contexts on the archaeological time. Therefore, the different sub-models provided by this project will undoubtedly be used as reference for the areas—anywhere in the world—with evidences of salt exploitation in the archaeological, but not in the ethnographic time. We also mention that the tendency to build potentially universal models will not exclude the emphasis on the idiographic aspects illustrating the intelligence of human behaviours in particular situations. On the other side, the complexity and diversity of ethnographic data of such a large area is the ideal information support to theoretically substantiate the concept of anthropology of salt, that we have recently put into circulation (*Archaeology and Anthropology of Salt: a diachronic approach*, (eds. M. Alexianu, O. Weller, R.-G. Curcă), BAR 2198, Archaeopress, 2011, Oxford).

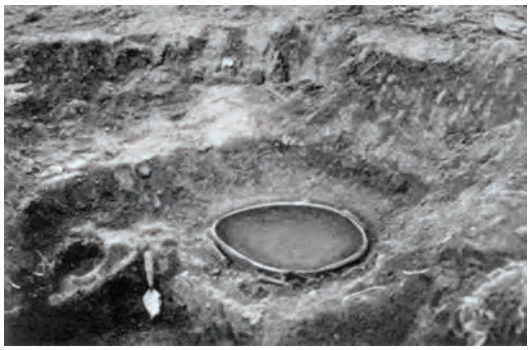
The project proposed aims to apply the spatial method in the field of ethnoarchaeological researches on salt springs. This top, innovating orientation in the field of ethnoarchaeological researches will be extended to the whole extra-Carpathian region, and, in the future, to the intra-Carpathian area. It is obvious that the Romanian-French ethnoarchaeological researches on salt springs will impose a pattern of scientific behaviour for all future European and international researches on the ethnoarchaeology of salt springs and salt mountains/cliffs and on ethnoarchaeology in general.

The saturated model of non-industrial salt exploitation, developed as a result of the project's implementation, will undoubtedly represent an inevitable referential for the ethnoarchaeological researches on salt worldwide. The theoretical substantiation behind the concept of anthropology of salt will definitely inspire and potentiate the interest of specialists from other fields of knowledge (especially, medicine, biochemistry, linguistics, philology, hermeneutics). It is our firm believe that the original features of this Romanian project will entice the interest of both students and young researchers, specialized in exploring the past of Romania, Europe and other continents. The proceeding stages of the project will also feature a highly important cultural significance through the safeguarding intangible heritage regarding the universe of salt. A few important involvements must be underlined concerning the public health care within the investigated areas (detecting the toxic elements of brine from salt springs), the sustainability of rural economy, through supporting this parallel non-quantifiable economy, medicine (traditional halotherapy). The future results of this project developed in the extra- Carpathian area of Romania can be used successfully used within the archaeological and ethnographical tourism programs.

Recent archaeology of salt in the eastern United States

Ashley A. Dumas

This presentation draws largely from recent syntheses of salt-making in eastern North America and provides the latest information on prehistoric and historic salt production sites from the southeastern region. Excavations and analyses in Louisiana, Tennessee, and Alabama have expanded our understanding of the scale and variety of production technologies. Of particular interest is the near complete reliance on salines springs and that, despite widespread geographical and chronological studies of salt production in the region, evidence for the use of briquetage, so commonly associated with salines elsewhere, is rare.



Archaeology of salt production in the Three Gorges region: focus on the Zhongba site

Shuicheng Li

At the end of the last century, extensive rescue excavations were conducted in connection with the Three Gorges Dam Project. In the process, a number of ancient sites with deeply stratified cultural deposits that contained large numbers of artifacts of uniform shape were discovered in the area that has been flooded as the result of the construction of the dam. The most representative of these sites is Zhongba, which was occupied from the late Neolithic period to modern times, and which comprises cultural deposits of more than 12m in depth. The excavation of this important site was the starting point of research on salt archaeology in China.

During the excavations at Zhongba, a very large number of features and artifacts were found, including remains of salt-production workshops, brine-storage basins, clusters of circular storage pits, trenches covered with clay, and furnaces. They belong to different time phases, ranging from the late Neolithic to the Tang dynasty. At the same time, large quantities of briquetage vessels were found, including three main types of clearly separated chronological distribution: vats (*gang*) with scalloped rims and pointed bottoms from the late Neolithic; pointed-bottom cups (*bei*) from the

transition from the Shang to the Zhou period; and jars (*guan*) with scalloped rims and globular bottoms from the Eastern Zhou period.

Through careful analysis and comparative research, we have been able to prove that the Zhongba site was a major salt-production center in the area extending from the eastern part of Chongqing Municipality to the Three Gorges region. The typological changes of the salt-making pottery vessels show the development of salt-production techniques and improvements in production management and increasing specialization. From the Han dynasty onward, as briquetage was replaced by metal salt-boiling pans, the scale of production rapidly grew. By the Tang and Song periods, the salt workshops in this area already possessed some of the basic characteristics of modern salt factories.

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First salt making in Europe: an overview from Neolithic times

Olivier Weller

This paper deals with the origin of salt production and discusses different approaches ranging from technology, ethnoarchaeology and paleoenvironmental studies to chemical analyses. Starting from the current research on the Neolithic exploitation of salt in Europe, we examine the types and nature of the salt resources (sea water, salt springs, soil or rock), the diversity of archaeological evidence as forms of salt working. We also scrutinize the types of production for these early forms of salt exploitation, with or without the use of crudely-fired clay vessels (*briquetage*). Finally, we contextualize the socio-economic dimensions and highlight both the diversity of salt products, as well as their characteristics, which go well beyond dietary roles.

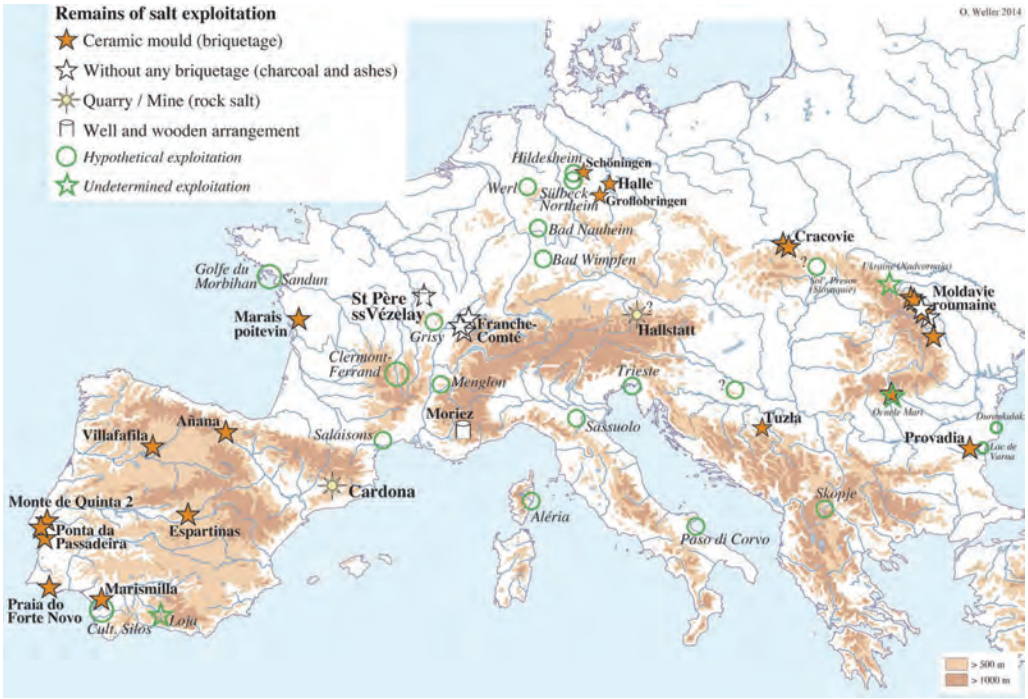


Figure 1. An European assessment for the Neolithic and Chalcolithic periods (6000–2300 BC): the various archaeological evidences for salt production (Weller 2015 in Brigand & Weller (eds), *Archaeology of Salt*. Leiden: Sidestone).

Archaeology and ethnology of salt in Japan

Takamune Kawashima

Salt in Japan has been produced by seawater since the last stage of the Jōmon period (3400 BP), except some salt producing examples in the inland areas using salt spring. After the Middle Yayoi period salt pottery was invented in the central Inland Sea, and spread to west and east. During Kofun period, salt producing areas were distributed from central Japan to Kyūshū Island. These areas have kept producing salt till the Late Heian period. As seen in the literature "*Suōnokuni Shōzeichō*", iron pan was introduced in some areas, such as Yamaguchi prefecture where salt pottery for boiling brine would have disappeared and only briquetage existed. By the 10th century salt pottery including briquetage disappeared in most areas. Ancient literature suggests that sea grass was used to obtain high salinity concentration. In the Medieval period clay salt-pan was introduced, which could be accompanied with exploitation of sandy beaches for making brine by the banked salt-terrace method. This method was replaced by the channeled salt-terrace method in the Early Modern period. While the channeled salt-terrace was flourished in the Inland Sea area, other areas with small beaches kept the banked salt-terrace method or simply boiled down seawater. In this paper I will describe a summary of the history of Japanese salt production and introduce some ethnographic examples and historical literature of salt production and consumption in Japan.

Anthropology of salt in Mexico in the past 10 Years. An overview

Blas Castellón

In this presentation is outlined the background of research on salt in Mexico, as well as its major projects in the past ten years. The main trends have been defined based on the studies of regional history, and other efforts have started from archaeology and ethnographic and anthropological studies. However, almost always the issues related to the exploitation and use of salt, have been complementary to other initial interest with which it is related, such as gastronomy, social organization, agency studies, landscape, exchange, symbolism, tradition and social change. There is no yet a specialization on this subject despite the extensive number of vestiges of exploitation in different periods of the past that exist practically in all the territory. Here is a summary of the major studies about salt anthropology in Mexico, and the current perspectives for these studies.

‘Salt in Prehistoric Europe’: the challenges and perspectives of a general book on ancient salt

Anthony Harding

My book *Salt in Prehistoric Europe*, published by Sidestone Press in 2013, arose from a long-standing interest in the importance of salt in the ancient world. In the 1990s, when this interest started, there were few people working on ancient salt, and

little interest in the topic among mainstream archaeologists. This has changed markedly over the last 20 years.

In a Bronze Age context (my special field), the only certain production methods were by means of briquetage, as known especially from the Halle area, and deep mining, as at Hallstatt. Large parts of Europe had no evidence at all for salt production, even where salt was naturally present in large quantities. It was my interest in this problem that led to fieldwork in Romania starting in 2002, followed by extensive campaigns of excavation and visits to neighbouring parts of the Carpathian Basin.

The spectacular finds from Transylvania, while important in their own right, needed to be set in context, both geographically and chronologically. This was the background to the production of the 2013 book. In this presentation I will present some of the problems and results that emerged from that enterprise.

Usage, therapy and magical cure of salt among Mongolian ethnic groups

Dulam Sendenjav

Salt Mountain, Myth of the origin of Salt Lake

In the myth, Salt Mountain, located in Torkhilog bag, Davst soum, Uvs province in a remote western edge of Mongolia, was originated by an old man and woman who were keeping their treasures with salt in the sacks under the ground while waiting their son from the war and the salt was melt by the sunshine, rain and humidity and became salty hill, whereas Salt Lake, situated in remote eastern Dornod province, was said to have been originated by the creation of To wang or Togtokhtör, a wise man, who brought salt from China and planted it on a hollow place.

The uses of Salt

The usage of salt is quite different among Mongolian ethnic groups. People of Dornod steppe don't use salt in their teas but much salty food whereas western Mongolians don't use salt in their food, but much salt in their teas. The Torguud people among western Mongolians use the salt too affluently, while the Ööled people use it sparingly, which may have been caused by the distance of salt mining. Because of this, Torguud people say that "we are not Ööled, not sick and will use salt affluently" and Ööled people say that "we are not Torguud, not a camel and will use salt scarcely".

1. Salt Therapy

If human bone fractures, use melted salt applying on camel wool and put it on a broken bone then swelling will be gone down. If man freezes, then use salt applying on whole body and it will be thawed. Horse salt or blue salt will be used when joint pain occurs. There is a myth that some people suffering from gastric disease lick salty stones afterwards will be healed up.

2. Salt as a Magical Cure

While infant cries excessively for no apparent reason, all Mongolian ethnic groups use same custom to use salt for magical cure. For example, the Ööled people of the 'Mongol circle' of Shinjaan put seven pieces of salt and some infant's food down on wood charcoal and turn infant's head clockwise three times and vice versa. And make a child spit out on infant's face three times then face him to the north or sun setting direction. Finally the infant stops crying and 'bad thing' will be disappeared. The Ööled of this region take an oath while two people argue on truth value, "If I said false I would pee on salt". The reason is that if someone pees on salt, there will be happened bad things for his children. Swearing by his children means that he told the truth. They also consider that when salt is on fire, the eyes of cattle will be blinded. When salt is in yoghurt, it will be soured. Central Khalkhs consider that if someone looking for his lost thing on the way holding seven salts, then it will be found.

Depressed classes of Madigas and its culture reflects in using of salt in tanning and traditional buried the body in South India

Jayaram Gollapudi

The traditional Indian society was based on *varna* and *jati*. This system is very ancient in origin and through the passage of time it has undergone profound changes, but caste still a very powerful institution in our socio-economic, religious and political organization. The most disquiet tuning and disturbing feature connected with the caste system has been the concept of untouchables. The Untouchable majorly in Depressed class now Scheduled caste, in this caste Madiga or Chamar related sub castes like Mochi, Mang and Gondari etc., are followed leather works, those people are followed traditional occupation is leather work and tanning. In this continuation these communities are using lot of salt in making of raw skin to leather goods.

Types of tanning system they are mainly two methods. Vegetable tanning and chrome tanning preserves the skin by the use astringent substance found in the barks of many trees. If the process of tanning is through chemicals and enzymes it is called chrome tanning. In both the process is different. But chrome tanning is a modern method whereas the vegetable tanning is considered to be primitive. The process was adopted by the depressed caste of Madiga sub-castes. The tanners are not aware of chrome tanning. There is also any other method of tanning called aluminium tanning which is used only for particular kinds of skins.

Vegetable tanning process with salt and other plant materials: tannic acid, an astringent substance used for tanning is found in many barks. Karakkaya (Myrobolan) is also very commonly used for tanning. Local traditional Madiga caste tanners use 'tangedu chekka' (*Cassia articulate*), salt and Myrobolan in the process. The raw skin arrives at tannery they will be in different conditions. Among them, four kinds of skin

found some are fresh skins called green stock. Some others are called salted skins and dried up in the sun before they are sold to the tanners. They are called dry salted skins. The last varieties are those are dried in the sun without applying any salt which are called simply dry skins. In the leather making process with the skin lot of the different methods, salt is the useful nature made. With the continuations in the communities are follow traditional of the community when the person died, the dead body crimination time in the burial uses Salt as traditionally and medically especially in the South India Group of Chamar community, Depressed classes/ Scheduled castes are using the Salt.

Clay, fire and salt. Experimental approaches on the prehistoric briquetage technique

Felix Tencariu, Marius-Tiberiu Alexianu, Vasile Cotiugă, Viorica Vasilache, Ion Sandu

This paper describes the background, objectives, progress and results of some 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 shards 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 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. The experiment at Cucuteni is the first successful attempt to get solid salt cakes in briquetage vessels type by crystallizing brine, in an open fire, using only raw materials and fuels available in prehistory.

The archaeological evidence for salt production in Romania

Valeriu Cavruc

Salt sources accessible for pre-industrial exploitation in Romania

The sources of salt in Romania available for pre-industrial exploitation are among the richest in the region. The most consistent of them—rock salt outcrops and

deposits at shallow depth, brine springs, salty lakes and streams—are spread in the *Carpathian Saline Province* that includes Transylvania, Maramureș and sub-Carpathian areas of Lesser Poland, Galicia, Bukovina, Moldavia, Wallachia and Oltenia. The salt sources in the rest of Romania are much less consistent. Soils with high salinity are present in the Romanian Plain, Moldavia and Great Hungarian Plain; limans, salt lakes and brackish water springs are available north and west of the Black Sea — in eastern Wallachia, southern Moldavia and Dobrudja. The archaeological evaluation of these sources has been carried out just partially. Mostly the brine springs were studied, especially in Moldavia, and to a lesser extent in Transylvania, Wallachia and Oltenia. Also, in Romania has yet not been carried out the researches concerning the dynamics of the saline landscapes from prehistory to modern times.

Ancient salt production evidence in Romania

The substantial archaeological salt production evidence is known in western Moldavia and Transylvania. Less conclusive evidence comes from Wallachia and Oltenia.

The archaeological evidence for salt production in Moldavia

Up to this moment, six sites with reliable archaeological traces of salt production have been researched in Moldavia. They are located in the northwest and west of the province, along the eastern slope of the Eastern Carpathians. All of them are located close to brine springs. The first researches concerning ancient salt production in Moldavia have been carried out in 1968 in the *Solca-Slatina Mare* site. After that, in 1980–2010, the researches were carried out in the salt production sites of Cacica–*Salina*, Lunca–*Poiana Sărată*, Cucuieți–*Slatina Veche* and Țolici–*Hălăbutoaia* by the Piatra-Neamț Museum of History, University of Iași, Iași Institute of Archaeology, French National Centre for Scientific Research, and Durham University. The researches in these sites have revealed the Neolithic, Eneolithic, Bronze Age, Iron Age and medieval evidence for seasonal exploitation of the brine springs.

The Neolithic (ca. 6050–4600 BC) evidence for salt production was uncovered in the Lunca–*Poiana Slatinei,* Țolici–*Hălăbutoaia* and Cucuieți–*Slatina Veche* sites. They are in the form of consistent deposits of ash together with common pottery of Starčevo-Criș, Precucuteni and LBK cultures.

The Eneolithic (ca. 4450–3500 BC) evidence was researched in six salt production sites. In Lunca–*Poiana Slatinei*, Țolici–*Hălăbutoaia,* Oglinzi–*Băi,* Cacica and Solca*,* the Eneolithic traces of salt production are in the form of massive deposits consisting of successive clay lenses, charcoal and ashes together with the pottery specific to the Cucuteni culture (A_2, AB and B stages). In these deposits, together with the common pottery specific to the Cucuteni culture, the coarse pottery and *briquetage* are present. The coarse pottery (the so-called Cucuteni C-type pottery) is made of clay porous fabric mixed with crushed shells. It is present in relatively high proportion in the sites – up to 40%. The second ceramic category includes hundreds of fragments of *briquetage* – small cone-shaped vases with disk-shaped piedestal. The only Eneolithic salt production site in Moldavia without briquetage is the *Cucuieți-Slatina Veche* one.

Sometimes, fragments of briquetage were found in common Cucuteni culture settlements, for example in the Adâncata–*Dealul Lipovanului* site, located far from

the brine springs. Such findings highly suggest that salt was “traded” together with briquetage.

The *Bronze Age* salt production evidence was uncovered in 2 sites in western Moldavia: in Lunca–*Poiana Slatinei* and Cucuieți–*Slatina Veche*. In both of them the deposits formed from successive lenses of ash and burnt clay, together with common pottery, have been researched. In the site of Lunca–*Poiana Slatinei* the Bronze age pottery is of the Trzciniec-Komarow (ca. 1800–1600 BC) and Noua (ca. 1500–1100 BC) cultures. Most Bronze Age shards found in the Cucuieți–*Slatina Veche* site is of the Trzciniec-Komarow culture, also there are present some ceramic "imports" from Transylvania (shards specific to the Wietenberg culture) and from southern Moldavia (a few shards specific to the Monteoru culture). The pottery done especially for brine boiling was not identified in the Bronze Age deposits of the sites.

The Iron Age salt production traces are present in two sites: Cucuieți–*Slatina Veche* and Lunca–*Poiana Slatinei*. The traces of a heavily damaged structure made of burned clay, as well as the pottery specific to the Canlia group were uncovered in the Slatina Veche site. The predominant pottery types in this site are bowls and dishes which presumably were used for brine boiling.

The remains of *medieval* salt production in Moldavia, as compared with prehistoric evidence, are less known. One of the most prominent medieval salt production evidence was the 11th century AD well researched in the Lunca–*Poiana Slatinei* site.

The archaeological evidence for salt production in Transylvania

First, the archaeological evidence for ancient salt production was discovered in Transylvania by chance at the very beginning of the last century. Thus, two votive altars with inscribed texts referring to the Roman officials responsible for the administration of salt in Dacia were found between the Domnești and Sărățel villages in the northeast Transylvania and near the Sânpaul village in east of the province, both not far away from the local Roman forts. Three shafts dug in rock salt, with many Bronze Age mining tools and implements inside them were uncovered in 1938 in the Valea Florilor village, in western Transylvania.

The systematic archaeological researches concerning ancient salt production have started in Transylvania in 2000. These were carried out in south-eastern, eastern and north-eastern parts of the province by the joint Romanian-British team (The National Museum of the Eastern Carpathians and the University of Exeter), and in southern Transylvania by the Brukenthal and Făgăraș museums. The non-intrusive research methods (landscape, topography, geophysics, geology, sampling, etc.) were predominant during this projects. In this way several new salt production sites in northeast Transylvania: Caila, Săsarm, Băile Figa and Domnești-Sărățel, as well as two fortified settlements located among them—Coldău and Beclean—were uncovered and investigated. At the same time, in 2007–2014, the salt production site of *Băile Figa* was excavated. This site has provided the most consistent Bronze Age and Iron Age salt production evidence in whole of southeast Europe. In eastern Transylvania, 3 salt production sites were uncovered: Sânpaul, Comănești and Orșova. In southeast Transylvania the possible evidence for ancient salt production were uncovered in

Zoltan and *Olteni*. In southern Transylvania—in Țara Făgărașului—the works were less successful, but they managed to map most of salt springs in the area, as well as the archaeological sites around them.

The researches carried out in the last 15 years in Transylvania, as well as the previous findings, have shown that the archaeological evidence for ancient salt production in this province is spread over the areas rich in deposits of rock salt and salt water springs, as well as in the salt-poor areas. Thus, the traces of salt production were documented in two sites in Brașov Depression (Zoltan and Olteni, Covasna county), in two sites in the Homorod Depression (Sânpaul and Comănești, Harghita county), one site in the Superior Mureș valley (Orșova, Mureș county), one site in the middle Mureș valley (Ocna Mureș, Alba county), one site in the Arieș valley (Valea Florilor, Cluj county), four sites in the Someșul Mare Basin (Băile Figa, Săsarm, Caila and Sărățel-Domnești, Bistrița-Năsăud county).

The salt production evidence uncovered in Transylvania dates from the Later Copper Age to the pre-modern period—i.e. from ca. 3300 BC up to ca. 1900 AD. The most consistent evidence dates from the Late Bronze Age (c. 1600–800 BC), the second Iron Age (400–180 BC) and the Roman Dacia period (106–271 AD). Apparently, during the above-mentioned periods, salt was exploited on an industrial scale and was intended for more or less remote salt-poor territories. Also, there are some chronological sequences, for which in Transylvania has not yet been discovered the evidence for salt production: Middle Bronze Age (ca. 2000–1600 BC), the first Iron Age (ca. 800–400 BC), the pre-Roman period (ca. 180 BC–100 AD), post-Roman period (ca. 271–420 AD) and early medieval period (c. 540–1400 AD). Though according to written sources, since ca. 900 AD to ca. 1900 AD salt has been exploited and traded very intensively in Transylvania, the archaeological evidence for salt production from that period is still very poor. That is probably caused by the destruction of them by the modern salt mining. To what extent, these gaps are due to the past or to the current state of research, it is difficult to assess.

The *Bronze Age* salt production evidence in Transylvania was found in Băile Figa (ca. 3300–2800 BC and 2400–2000 BC, and most from ca. 1600–800 BC), in Săsarm (ca. 1550–800 BC), in Caila (ca. 1300–900 BC), Comănești (ca. 1800–1400 BC), in Zoltan and Olteni (ca. 1500–1100 BC). In most cases, the available Bronze Age evidence in Transylvania does not allow safe reconstruction of the scale and methods of salt production. However, in the current level of knowledge, one can conclude that during Bronze Age both the rock salt and brine have been exploited. The production scale varied depending on natural and cultural environment. Certainly, most Bronze Age communities have practiced "domestic" salt production, in order to satisfy their own needs in salt. However, it seems that in the time span between ca. 1600 and 800 BC, in the major navigable river valleys like Someșul Mare (Caila, Băile Figa and Săsarm) and Mureș (Valea Florilor, Ocna Mureșului) the "industrial" rock salt exploitation has been practiced, with complex technologies, management and control of the trade routes. The most consistent salt exploitation traces of this type have been investigated in north-eastern Transylvania, in the Someșul Mare Basin, in three sites—Băile Figa, Caila and Săsarm—concentrated in the area of ca. 15×5 km. Many

wooden structures (galleries and enclosures), installations (troughs, ladder, gutters etc.), as well as various mining tools and utensils—stone hammers, wooden sledge hammers, wedges, shovels etc.—have been uncovered in these sites.

The *Iron Age* salt production evidence in Transylvania was uncovered just in the northeast of the province: in the Baile Figa and Săsarm sites. The box-like timber structure (ca. 400–180 BC) uncovered in Băile Figa seems to have been the top of the shaft. Close to it, the wooden ladder and pre-Roman Dacian pottery was found. In Săsarm, among the many wooden structures visible on the surface, Celtic pottery was found.

From the period of Roman province Dacia (106–271 AD) dates four votive altars found in Veţel-Micia, Sânpaul, Sărăţel-Domneşti and Boia Bârzii. These show the inscriptions mentioning high officials responsible for the administration of salt in Roman Dacia. Romans exploited the richest deposits of rock salt for the maintenance of the military units in Dacia and other Danubian provinces. During medieval and modern times, most traces of Roman salt exploitations seem to have been destroyed. In some of them—in Praid, Ocna Mureş, Ocna Sibiului, Sânpaul—just some isolated artefacts of Roman age were found, without relevant archaeological contexts. The only Roman salt production site in Dacia—Sărăţel-Domneşti—seems to have not been badly destroyed. The recent non-invasive researches performed in this site have attested marks of the shafts visible on the terrain surface as well as some Roman age artefacts.

The post-Roman period (ca. 420–900 AD) salt production evidence was discovered at Băile Figa, the Middle Age evidence (ca. 1400–1700 AD) was attested in Băile Figa, Sânpaul and Săsarm. The pre-modern period (1700–1900 AD) evidence was found at Baile Figa and Săsarm. In the current stage of research, the archaeological data on salt exploitation in the post-Roman, medieval and pre-modern periods in Transylvania are inconclusive.

The archaeological salt production evidence in Wallachia

There are *four* known possible salt production sites in Wallachia. Three of them are located in Bărăgan (steppe zone in eastern Muntenia, Ialomiţa county) and one in the Prahova Subcarpathians (Predealul Sărat, Prahova County). The three sites in Bărăgan—Stelnica-Grădiştea Mare, Ţăndărei-Cherhanale, and Bucu-Pochină, all in Ialomiţa County—are located in the salt-poor area in which just brackish water springs are present here and there. The massive pans with tall legs made of coarse porous clay fabric were found in these sites, in the context of the Late Bronze Age Coslogeni culture (ca. 1300–1100 BC). Based on the analogies in other salt production sites and taking into account that such pans were found just in the areas with brackish water springs (Bărăgan and southeast Transylvania), it was assumed that they were used for brine evaporation.

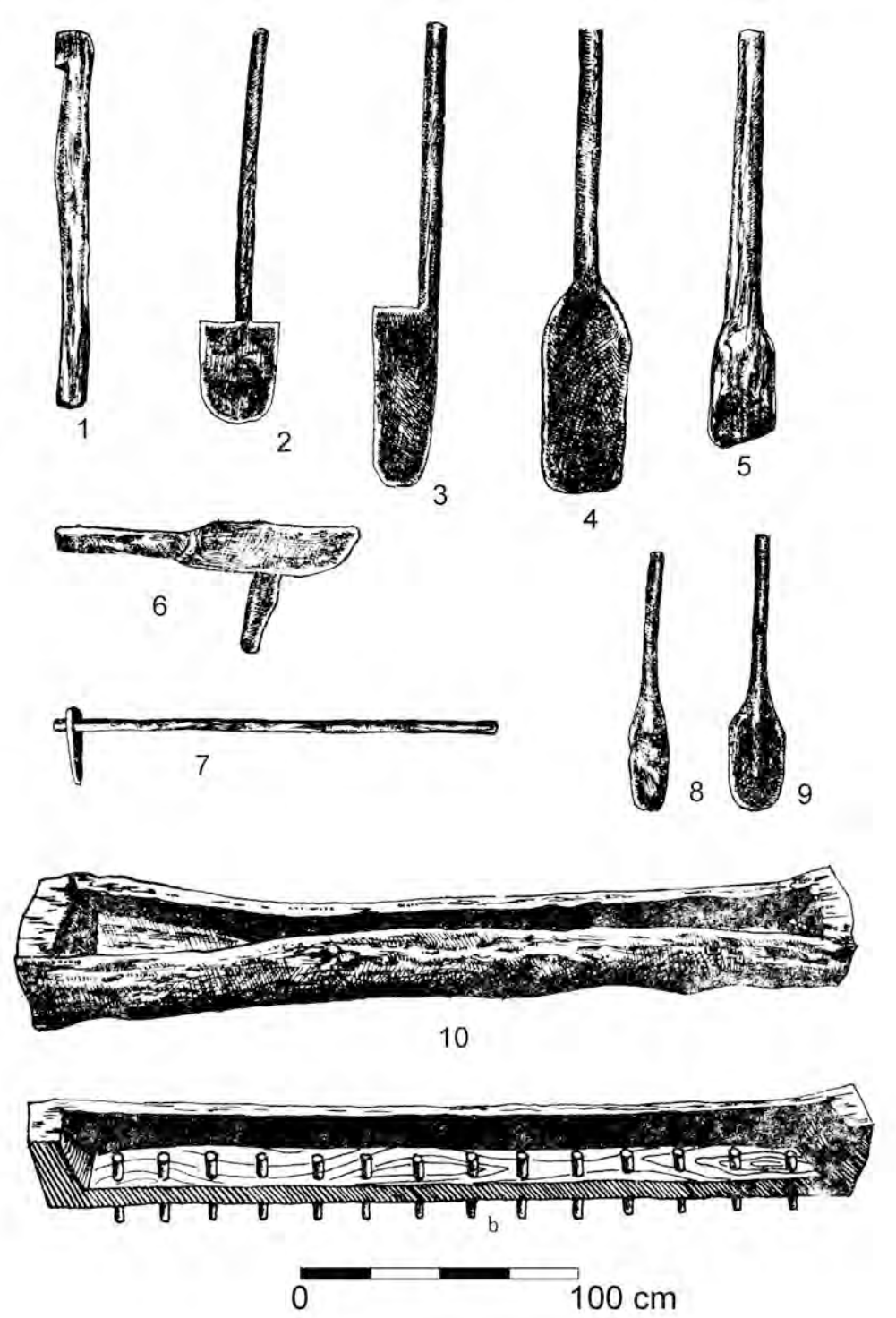
Wooden tools used in salt extraction were discovered in the salt-rich area near the Predeal Sărat village in Prahova Subcarpathians. Their age has not yet been established.

The archaeological salt production evidence in Oltenia

The Subcarpathian zone of north-eastern Oltenia is rich in rock salt deposits and brine springs. Here, around the brine springs in Ocnița-Valea Sărată, Ocnele Mari-Ștrand and Căzănești, several clusters of prehistoric sites were researched. In four of them, in the Coțofeni culture (ca. 3300–2800) context, a few *briquetage* were found. In addition, several stone mining tools were found in the area. However, in the present state of research, the archaeological traces of salt production in Oltenia are still less consistent.

Some conclusions

The archaeological evidence for salt production in Romania is among most consistent in Europe. The researches in Moldavia and Transylvania are among most important in Europe. At the same time, the evidence is researched unevenly, both chronologically and geographically. The present stage of research does not allow reliable reconstruction of the production technologies, scale and cultural, economic and political implications of ancient salt exploitation. Most of salt production sites do not benefit of protection and effective management. The priorities in the archaeology of salt in Romania for next period have to be the protection of the sites and non-invasive analytical, landscape and ethno-archaeological researches.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“Cum grano salis” — a model of Man's complexity

Michele Zuppi, Andrea Zuppi, Paolo Zuppi, Elisabetta Rossi

Salt is an object studied from many fields of knowledge, such as biology, medicine, anthropology, sociology, economy, etc.

The various sciences, are based on their own paradigms and beliefs, and approach the subject with differing methodologies and objectives

Scientific evidence coming from such numerous disciplines, so dissimilar between them, is difficult to integrate, and the insights of each discipline remain distant from each other. These fragmentary pieces of knowledge endure as a lifeless mixture.

Human being would indeed disappear if the aggregates that compose it (60% of water and 0.00000081 % of sodium) suddenly dissociated from each other.

By reducing the object of study to the simple level of studying it from a precise disciplinary viewpoint, scholars are likely to lose that very object which they set to study. A single bidimensional layer cannot contain and does not allow for complexity. The human being is a complex unit, who is not representable otherwise, nor is he reducible to numbers and percentages, and he cannot be defined by a linear logic. The human being is a relational being, continuously recreated engaging with the living world, a present indissoluble unit of genetic and cultural inheritances, which are shaped by personal experiences.

The study of man-sodium relationship reveals the need for a different approach, not a mixture of scientifically correct percentages and values, but a complex system from which new and unpredictable properties can finally emerge.

“Sapientia” and salt

Andrea Zuppi, Michele Zuppi, Paolo Zuppi, Elisabetta Rossi

The intake of sodium is essential to life. The daily requirement for a human being is of 230–460 mg / day, corresponding to less than 1.5 g of sodium chloride, the common kitchen salt. The amount of salt present in natural foods is modest. The human being is endowed with cognitive systems that lead to the assumption of salt and to an endocrine/renal regulation which tends to avoid losses.

In industrialized countries, the daily salt intake is around 10 grams per day; this excessive intake causes high blood pressure and thus cardiovascular diseases. State governments try to reduce this excessive intake by promulgating laws and promoting information campaigns.

The powerful mechanisms of survival in an environment low in salt, under current conditions, lead to an excessive inflow of sodium. The ancient "divina sapientia humani corporis" (sapientia etymology: to have taste) has become disadvantageous in the new modern world built by human beings. The physiological homeostatic mechanisms, adjusted to the minimum amount of salt present in natural foods, lead to salt abuse and fail to counter its effects. The exaggerated salt content in processed foods, requires a mind control based on mental knowledge.

A clear and concrete separation between different types of wisdom is here at play. The mind/body dichotomy is expressed in orthorexia: food is a poison that only the mind can recognize.

“Nova sapientia” harmonizing corporal, cultural, technical and institutional knowledge, need to be developed.

The role of salt in the fame and prosperity of Ancient Pompeii

Ralph M. Rowlett

Ancient Pompeii, covered over with volcanic debris in A.D. 79, is renowned for its many art works, the sumptuous residences in Northwest Pompeii, its gladiatorial excesses, salacious erotica, and even its *garum* fish sauce, but its close relationship with salt ecology is not widely appreciated. Relatively few of the modern voluminous books about Pompeii even mention salt and its contribution to the prosperity and fame of Pompeii. But salt was an essential ingredient in the preparation of the *garum*, which underlay both the ancient fame and prosperity of the doomed city. The most sumptuous residences of the city lay in the Northwest quadrant, Regio VI, toward the Porta Herculaneum. This ward was assigned to the urban "Tribe" of the Salinienses. Herewith we elaborate on the significance of salt in ancient Pompeii and impending archaeological problems.

An insight into the use of salt in the Aboriginal culture in Australia

Tasha Vasiliki Athena Maroulis

In ancient times, salt (or the lack of it) could drastically affect the health of an entire population of species. This important element is habitual for animals and humans equally. The process of obtaining salt from around the world differs according to the local conditions (climate, soils, and water). Trade in salt was very important, and salt was valuable enough to be used as currency in some areas (Roman Empire). As civilisation spread, *salt* became one of the world's principal trading *commodities*

and is still used on a large scale to this day. Some first European explorers organised Aboriginal hunts and when caught, they were chained by the neck and fed salt to get them to show the explorer where the waterholes were, which they would then access and exploit. Some research conducted in the early 90's suggested that salt had no part in the aboriginal culture. Recent research has shown that salt had an important part of the aboriginal's diet, though they did not have to extract it from water or ground rock; it was naturally occurring in salt flats of desert regions, salt was also readily available and collected from a variety of different parts of the plant. Examples being the leaves of sodium-rich Karkalla or Native Pigface (*Carpobrotus rossii*) which were roasted and eaten. Certain Rushes and Sedges contained reasonable amounts of sodium, as well as the seeds from the Golden Grevillea (*Grevillea chrysophaea)*, an assortment of figs, Nonda Plum (*Parinari nonda*)*,* and Bush Tomato (*Solanum central*). Water Chestnuts (*Eleocharis dulcis*) contained more than 4500 mg of sodium/100 grams. Animal foods were also an important part for supplying sodium, especially blood and certain organ meats (goanna, shellfish, snails and worms). Different aboriginal tribes as the Kaurna people would trade large rafts of the salty plant Karkalla or Native Pigface (*Carpobrotus rossii*) from the coastal dunes with the Peramangk people of the Mt Lofty Ranges in return for Red Ochre (used for Aboriginal Rock Art), as naturally occurring salt plants are in low supply in the Mt Lofty Ranges, and Ochre is rare on the plains/coast.

The use of salt in Mongolia. An example of Mogod region (Bulgan Aimag)

Francesca Lugli

Pastoral nomadism is a multi-millennial culture, a treasure of mankind, which can help us better understand the past and present, and even to build a sustainable future. Pastoral nomadism is still a fundamental part of Mongolian economy, even though it is critically threatened by cultural and economic changes.

Mongolian pastoral nomadism is a complex world. Many features, such as pasture areas water sources, dogs, herd management and salt are undoubtedly crucial for the survival of animals and nomads and are indispensable for its existence. Similarly, the abundant availability of salt certainly allowed the spread of nomadic pastoralism in Mongolia in prehistoric times.

In 2002, the Italian Association for Ethnoarchaeology, with the financial support of the Italian Ministry of Foreign Affairs, and in collaboration with Prof. Dulam of the National University of Ulaanbaatar, began an ethnoarchaeological project concerning nomadic camps in different regions. Since 2009, the project has especially concerned winter and spring camps in the Mogod region (Bulgan aimag). The cold season's camps are usually fixed camps, frequently located in the mountains and can be owned by one family who returns every year to the same camp, therefore their study is also very important in the archaeological perspective.

The ethnoarchaeological project documented locations of roaming, camps and resources in the Mogod area. The data relating to salt supplying and its use for animals is interesting in order to better understand the salt world and even the economic dynamics of Mogod and Mongolian nomadism, both past and present.

The pastures locations are dependent on a safe, secure and abundant salt supply. In summer and autumn, when the camps are located in the valleys, livestock can usually obtain salt by drinking directly from the nearby salty rivers and lakes or by eating the salty grass which grows around them. But for the winter and spring months nomads usually create salt-licks by carrying the salt to the camps at the beginning of each season.

It is also important to remember that from the 15th century Mongolia has been crossed by caravans of Russian, Kazakh and Mongolian/Chinese traders, who also carried salt from the West to the East. This "salt road" was interrupted in the 1920's as an aftereffect of the communist revolution.

Some nomads still remember the ‘salt road’ and its importance.

Salt, history and culture among the western Grasslanders of Cameroon

Henry Kam Kah

This paper examines the socio-cultural value of salt among the people of the western grasslands of Cameroon from the pre-colonial era to contemporary times. Salt was and has remained an important condiment used in households, in marriage, treatment of the sick, and in initiation ceremonies and other cultural ceremonies. It was a priceless and rare commodity in the past and explains the high value that was attached to it by all and sundry. Young people travelled very long distances on foot for days and weeks to sell other commodities like kernels and mats and then buy this condiment. Mainly important notables stored it in locally made containers. Salt is somehow in abundance today and one does not need to travel very long distances to procure it. Many *njangi* or local spent thrift societies buy and distribute it to their members during the end of year festivities like Christmas and New Year. Family heads also keep and share out salt to their kith and kin whenever the need arises. Through a content analysis of existing literature, interviews and observations, this paper probes into the history and cultural meanings and uses attached to this important condiment in a region of Cameroon known for its very rich and diverse cultural practices.

Unity of sacred and profane in traditional salt industry of the Okposi Igbo of South-eastern Nigeria

P-J Ezeh

An important rite of passage for a woman in Okposi, a community of the Igbo of south-eastern districts of Nigeria was the establishment of a family salt industry, which she afterwards takes charge of. Salt making is an all-woman affair that excludes men, and unmarried women. No one knows the exact date that this industry began. Literacy is relatively nascent here, dating back to only late 1920s. What is clear is that social and economic life here is traditionally intertwined with the indigenously produced salt. The community's cognomen reflects this fact. It is called Okposi, *Epa na-esi Mmahí* (Okposi, They that Make Salt). The industry has its shrine where male priests officiate but cannot themselves make the salt. Besides economics, the aspects of social life that are traditionally mediated by this industry include religion, chronometry, and marriage rites. For the anthropologist, adaptations of the salt customs in reaction to social change in the Nigerian nation-state and the global community may provide insight into morphology of culture in general. During the

World War II when the import of salt was disrupted in the British colony, the colonial authorities turned to the Okposi local salt. The customary industry's reaction to nation-state's needs was even more pronounced during the Nigerian civil war when the lack for the rest of the Biafran side was all the more acute. But with the direct pressure of globalisation, the industry has now seriously declined in preference to imported salt. Decline in the industry was only possible after demonization of the indigenous culture as inferior and retrogressive, and the concomitant projection of the Western-style practices as modern and desirable. I relied on participant observation of the complete participant variety to conduct the study, which has spanned 10 years from 2005 to 2015.

The role of the Selima oasis in the salty rocks trade in the western desert in Sudan

Franck Derrien, Coralie Gradel

Selima is an oasis located in the Sudanese western desert 120 km from the Nile Valley, at the latitude of Sai island, and 70 km south of the Egyptian-Sudanese border (Figure 1). It was a milestone in the network of paths throughout the Western Desert in Egypt and Sudan, particularly because of the presence of water. This oasis was a stopping place by the nomads who roamed the *Darb al-Arbain*, the Forty days' Road, which connected Assiut, a town in the Nile Valley in Egypt, to Koubayh, a town in Darfur (Sudan) today disappeared, but remained for a long time the starting point for the annual caravan composed of hundreds of slaves and precious goods. Selima was also a step between the Nile Valley and Libya.

This site occupied and/or used from prehistory to nowadays have been described by many ancient travelers and foreign explorers who halted there. If these stories reveal very interesting information, no comprehensive study in archaeology, anthropology and geography had been conducted there. The importance of this oasis in the network of tracks of the western desert encourage us to reactivate the research.

The "Selima Oasis Project" is headed by Coralie Gradel, former researcher at the French Unit of the Sudanese Antiquities (2010–2014). Begun in 2011, it is still ongoing and has been awarded by the Schiff Giorgini's Foundation Prize in 2012. The team is deliberately multidisciplinary. The presence of prehistorians, archaeologists, historians and geographers aims to better understand the occupation of the oasis during the Holocene. These researches are part of a larger project on the movement of goods and people in East Africa during the Holocene and the place of the oases in ancient and modern economy.

Untill now, the team conducted three fieldwork missions. The first, in November 2011, allowed us to map the oasis and identified several archaeological sites in Selima and the vicinity. The portion of the track between Selima and Laqiyat Arbain located 200 southwest has been surveyed; many archaeological sites have been recorded. The second and the third, in November 2013 and October 2014, were intended excavation of two sites identified two years earlier, namely a Neolithic site and the building now known as *Beit al-Selima*. The latter was described by many travellers. Different hypotheses have been proposed about the supposed function of this structure: monastery, convent, hostel .... or any other function, perhaps in connection with the trans-Saharan trade.

Apart from the presence of water and dates in Sélima, the literature mentions the salty rocks extraction and trade by Egyptian and Sudanese nomads. We located the deposits. Samples were taken for XRPD analysis. Ancient travellers wrote that the caravaners were from Sukkot, the Mahass and Argo, three northern regions of Sudan. Our ethnographic study conducted us to interview the participants of the latest caravans in Dal area, on the western shore of the eponymous cataract, not far the border with Egypt (Figure 2).

If Selima was the final destination of the salt caravans from Dal, this oasis was a long awaited step, in both directions, the natrun caravans that went from Kharga, an oasis in the Egyptian western desert, to Bir Natrun, in Darfur. The ethnographic study allowed us to determine the geographical and ethnic backgrounds of members of salt and natrun caravans that have persisted until the end of the last century. We also specified the routes (Figure 3), travel arrangements in the desert and the salt extraction techniques in Selima. The role of the Selima oasis in the trans-Saharan trade of salt and natrun gradually accurate. Ultimately, it will be possible to establish a map of the occupation of Selima by nomads.

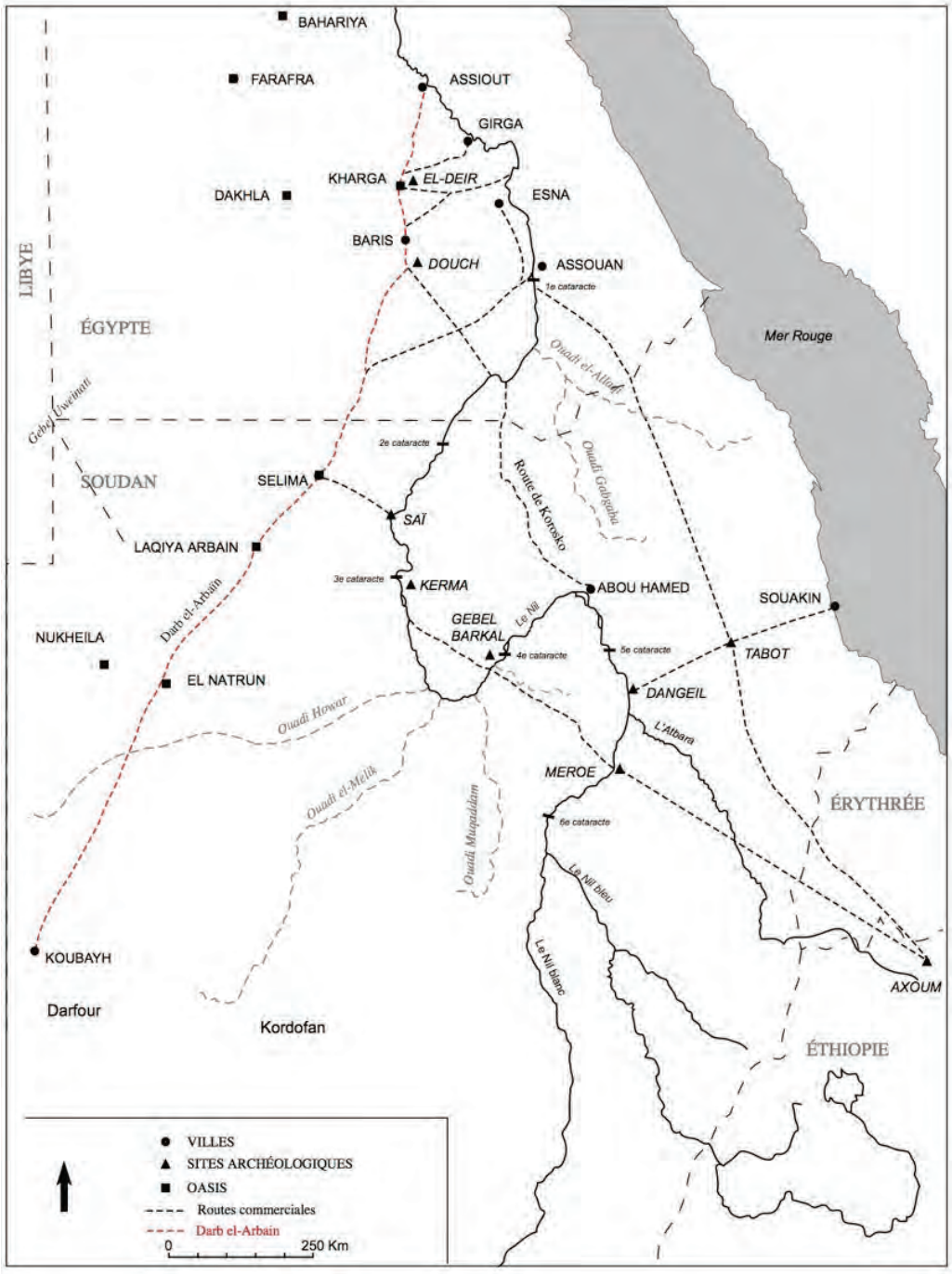

Figure 1. The network of the tracks in the western and eastern desert in Egypt and Sudan
© Coralie Gradel (July 2014)

Figure 2 : Ethnographical fieldwork in Dal (Sudan) © Coralie Gradel (October 2014)

Figure 3 : Hassan Salem Messaoud drawing the itinerary on the sand between Kharga and Bir Natrun © Franck Derrien (January 2013)

Two examples of unusual uses of salt in Romania

Ioan Cojocariu

In the Govora rural areas, many people bring home lumps of salt. On the bottom of an “unclean” tub, the people place hay and flowers up to the knee level, on top of which they pour warm water heated in the house. After this, they heat the darkest lumps of salt with earth/minerals. These lumps of salt are heated on a large tractor rim (from the rear wheel) with the top covered by a metal sheet on which they put sand and pebbles. Underneath the rim they start a fire. They heat the sand until it is scorched, until it is hot. Then they place the lumps of salt on the metal plate and they totally cover them with hot sand and keep them there for about half an hour. Then, using iron clamps with long handles in order to avoid the scorching heat of the lumps, they are taken while very hot and placed in the warm water. The lumps of salt mutter until they cool down, which accelerates the melting of the salt, releasing gases that produce ionization. Water temperature is around 42 degrees Celsius, and its measurement is done using the elbow, which is most sensitive to temperature variations. People who can bear this temperature enter the water for as many 10–15 minutes rounds as they can take. If the temperature drops, they place more heated lumps of salt. There are some homes which have two tubs, but only at a household level, especially for the elderly. The salt baths are taken especially on Saturdays, when, as is traditional in the rural areas of Romania, the general washing and cleaning is done. After people get out of the tub, they wash themselves with fresh water in order to clean their skin from salt.

Following a decree-law after the change of the political regime in Romania in 1989, commercial added value was limited to a maximum of 30% compared to the price of the producers, in order to stop speculation. This regulation caused a shortage of salt, because salt boulders were very cheap straight out of the mine, but their transport to customers situated at large distances was difficult and expensive. At the same time, usual crushed salt was available commercially. In the Vaslui county, on the Prut riverbank, in the village of Lunca Banului, this situation caused an unusual reaction. Thus, during the summer time, animal breeders bought dry poplar wood, which, because it was porous, had the property of absorbing water. They then boiled water in which they poured commercial crushed salt, continuously stirring the water in order to speed up the dissolution and to obtain the largest possible concentration of salt. In the thus obtained brine they also placed ashes and lime in order to disinfect the mouth of the animals and to complete their necessity of calcium and other minerals. The dry poplar wood with a length of max. 1 m. were placed in feeders which were filled with the salt water, and in order to stay on the bottom for 3 to 6 days, stones were placed on top of them. The wood soaked in brine after which it was removed from the brine and taken to the fields, in areas that were frequently passed by flocks of sheep and cows. The wood was placed on two stone or wood mounts so as not to draw moisture from the soil, which would cause the salt to melt. The

animals licked the top of the wood, and then the shepherd were careful to turn the wood over so that the lower part of it could also be licked.

Salt and shell-tempered pottery in European prehistory

Ralph M. Rowlett

Shell tempered pottery was widely produced and used by both European and North American prehistoric peoples, especially but not uniquely, among those with a Neolithic technology. What is not so widely known is that the successful production of shell tempered pottery requires the addition of salt to the inventory of shell and pottery clay. In North America, shell tempered pottery dominated the ceramic inventories of many archetypical eastern North American Indians in late prehistoric times, from ca. 800 bc to AD 1600, but modern North America archaeologists tend to use the pervasive shell-tempered pottery as a chronological and ethnic marker. In Europe the salt demanding shell tempered pottery was made for a much long longer time from ca. 5,000 bc the end of the barbarians Iron Age, but since the European shell tempered pottery tradition accompanied the manufacture of ceramics with other kinds of tempering, it can be seen from archaeological assemblages that the shell tempered pottery was used primarily for cooking. Since salt is notoriously easily water soluble, populations that cooked in shell tempered pottery may have ingested some of their salt from the cooking as well as for flavoring and for food preservation. Wheel-made shell tempered pottery places considerable stress on the finger tips.

Formation of the prehistoric urban centre Provadia-Solnitsata

Vassil Nikolov

The expanding scope of field studies on Provadia-Solnitsata allows this exceptional archaeological complex to be seen from a new perspective; an opportunity is created for its more detailed interpretation within the context of issues related to the emergence of the first urban centres in the Eastern Mediterranean.

Specialized salt production was the major economic activity whose results became a prerequisite for the development of Provadia-Solnitsata as a central place of special socio-economic significance in the Eastern Balkans. It started as early as the beginning of the Late Neolithic though only as a household craft practiced in the settlement. At the end of the Late Neolithic salt evaporation became a specialized production which was moved outside the settlement and most probably was run as a cooperative. During the Middle and Late Chalcolithic it evolved into an industrial-scale production

which would have been impossible without the formation of several specialized groups consisting of separate teams working in a well-coordinated way. These groups of specialized workers were engaged in the collection and delivery of firewood, manufacturing and supply of pottery vessels as well as in the process of salt production itself. All that would have been unthinkable without major technological steps taken in all three core production branches, especially in the thermal technologies related to ceramic production and brine evaporation. The emergence of specialized production was an indicator of the second major division of labour, which in turn was a prerequisite for the emergence of towns. In this sense the specialized salt production makes the agglomeration Provadia-Solnitsata a unique phenomenon on the old continent.

The specialized salt production and the successful long-distance trade in that product which was vital for both people and animals, transformed the Chalcolithic complex Provadia-Solnitsata into a prehistoric urban centre which existed during the middle and second half of the 5th mill. BC.


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Archaeological research in the salt springs area of Lunca and Oglinzi (Neamț County, Romania)

Gheorghe Dumitroaia

North from Târgu Neamț, on the north-western slope of the Pleșului Crest, there is an important salt deposit, highlighted by several salt springs. Around some of them, there are three of the most consistent archaeological deposits in the east of Romania, very interesting from a scientific perspective.

The research of the Lunca–*Poiana Slatinei* site represented an important moment in the history of research on salt. The excavations begun in 1983 have revealed a site with numerous archaeological levels belonging to pre-historical cultures and to civilizations that are more recent. It is situated near the salt spring, still used nowadays. During the excavations, carried out with interruptions between 1983 and 2005, three archaeological zones have been highlighted. Zone A, the most important one, consisted of an elongated mound (60 m long, 25 m wide, and maximum 3 m high) (Figure 2).

The artificial mound was made of pre- and proto-historical archaeological vestiges, but also of vestiges dating to the first millennium BCE, and the 10th–12th,

Figure 1. The saltprings in the area of the Pleșului Crest.

16th–17th, and 19th centuries. Following the excavations, the researchers who visited the site were surprised by the 2.65-m thickness of the Starčevo-Criș deposit, made of successive layers of burned soils, ashes, carbons, and pottery shards. The traces of pseudo-hearths did not feature the typical structures of Neolithic hearths. In the Starčevo-Criș deposits, no structure of habitation, tool, figurine, grindstone, or animal bone has been discovered. The amount of Starčevo-Criș pottery found is impressive, though the excavated surface is quite limited. All the pottery discovered was fragmented and the wide-mouthed pots, which may have been used for boiling the brine, were rather numerous. Small vessels and goblets (some of which were decorated with incisions or even painted) were also discovered. The absence of habitat and tool traces, the unusually important amount of ashes and wood carbons, the characteristics of zone A pottery, as well as the absence (on a 4–5-km radius) of fields fit for agriculture have determined the participants to excavations to believe that the *Poiana Slatinei* site was a seasonal site was used for the extraction of brine from salt springs. Concerning the Starčevo-Criș pottery inventory, the presence of fine pottery — that seems abnormal in the Lunca context — is yet to be elucidated.

Figure 2. Lunca–*Poiana Slatinei*. Stratigraphic layer of the Starčevo-Criș deposits (zone A).

Furthermore, research has revealed, in zone A, the presence of Precucuteni culture, Bronze Age, and Canlia culture deposits (5th–3rd centuries BCE), as well as sporadic vestiges pertaining to the cultures of Cucuteni, of free Dacians (2nd–3rd centuries CE), Sântana de Mureș (4th century CE), and of more recent periods. It is worth underscoring that, in the impressive Starčevo-Criș deposit within zone A and in the more recent deposits, no briquetage fragment has been discovered.

Zone B is situated on the *Poiana Slatinei* slope, approximately 50-60 m northeast from the salt source. In this place, too, the important Starčevo-Criș deposits make up the oldest level. The deposits comprising piles of pottery shards, of burned sediments, of wood carbons, and of hearth vestiges are situated between -2.70 and -1.90 m. The author of the excavations posits that the hearth vestiges in this zone are different from the pseudo-hearths in zone A, and that the highly corroded pottery shards belong to thick and flat bottoms of globular containers, truncated cones, and goblets. Though the amount of harvested pottery is significant, no briquetage or stone tool fragment has been pinpointed.

In the layer situated between -1.90 and -1.80 m, certain pottery shards can be ascribed to the LBK culture. The subsequent layer — situated between -1.75 and -1.45 m — includes Precucuteni III pottery shards, in its turn overlapped by a layer comprising Cucuteni A and A-B pottery shards, the last of which are scarce. We mention that the last layer contains Cucuteni B fragments and numerous Cucuteni C fragments. Only in the last layer, situated between -0.35 and -1.40 m, 420 briquetage fragments were found; they represented 16% of the entire Cucuteni material.

Finally, the last surface examined — called zone C — is situated southeast from the salt source; this is a 65-cm thick archaeological deposit, which comprised vestiges of the Dacian La Tène and of the Canlia culture.

We have insisted on the stratigraphy of the Lunca–*Poiana Slatinei* site because it clarifies the chronological position of briquetage, which belongs mostly to the Cucuteni B phase. After the end of the Cucuteni culture, the briquetage does not seem to have been used anymore.

The research conducted in the Neamț County was not limited to the site of Lunca, but it has integrated a rather large area, up to the river of Moldova and to the city of Târgu Neamț. Among the discoveries made there, we mention six salt sources, 24 prehistorical sites (most of them pertaining to Precucuteni and Cucuteni, though there were also Starčevo-Criș deposits, Bronze Age deposits, and deposits belonging to more recent periods).

The Oglinzi-*Cetățuia* site, situated only 1 km away from *Poiana Slatinei*, presents a particular interest. From the Cetățuia hill plateau, it was possible to monitor the micro-depression of Oglinzi, a part of the Moldova River corridor, and even a part of the Tg. Neamț depression. The plateau provides excellent conditions for monitoring the salt sources of *Poiana Slatinei*, *Slătior*, and *Sărături*. Certain trial excavations have highlighted the existence of habitations pertaining to the Cucuteni A phase, as well as fragments dating to Bronze Age and, probably, to the Starčevo-Criș culture. Protected by the abrupt slopes of the hill, the Cucuteni A site of Cetățuia represented an excellent point for monitoring the surrounding salt sources. It was also a refuge for the inhabitants of open habitats. The vestiges discovered seem to suggest an ordinary Cucuteni site, though some briquetage fragments were also found. The site seems to have preserved its importance during the Bronze Age, (including the excavation of a defence trench in the southern corner of the plateau).

In the same micro-zone, two other pre-historical sites situated near the salt sources were discovered. The Oglinzi–*Băi* locality is situated south from the micro-

depression of Oglinzi and at the foot Pleșului Crest. The salt source, captured in the 19th century for a balneary resort, was used until 1944, when it was closed down. The first site, Oglinzi–*Băi I*, is situated approximately 30 m south from the salt source. One of the excavated trenches showed an interesting stratigraphy. Around 1.10 m deep, a layer of brown soil contained wood carbons and small indeterminable pottery shards. This layer is overlapped by a Precucuteni II level, which ended at -0.60 m.

The second site — Oglinzi-*Băi II* — was identified approximately 100 m from the area comprising Precucuteni deposits. The trial excavations revealed the Starčevo-Criș culture in a 50-cm thick layer, where numerous corroded pottery shards, ashes, and carbons were discovered. The ceramic forms and the decoration are typical to the Starčevo-Criș culture, similar to the ones discovered at *Poiana Slatinei*. No briquetage fragments were discovered in either of the two sites.

The research conducted at Lunca–*Poiana Slatinei*, Oglinzi-*Cetățuia*, and *Băi* brought precious information concerning the seasonal pre-historical sites specialized in the obtaining of salt from salt sources, as well as the emergence of a particular ceramic form used for salt crystallization. The excavations at Lunca have shown that briquetage was an invention of the Cucuteni tribes during the last development phases of this culture. An equally important aspect is the surprising association of the Cucuteni C culture with the salt crystallization activity and with briquetage use. The massive presence of the Cucuteni C phase, generally ascribed to steppe shepherds populations, suggests the existence of exchanges between the salt-deprived populations and those within the saliferous region of Moldavia. Even before the radiocarbon dating and independently from the salt crystallization method, it was apparent that the site of Lunca was one of the oldest salt exploitations in Europe.

The interesting discoveries made in the Lunca–Oglinzi micro-zone have stirred the attention of foreign researchers. Starting with 1995, Olivier Weller came to visit the sites, and then he analysed the salt springs and studied the archaeological material within his doctoral dissertation on salt exploitation. Several years later, John Chapman proposed a collaboration for investigating the micro-zones of Lunca-Oglinzi and Poduri. In 2000, an English team led by J. Chapman conducted a geomagnetic survey for the zone B of Lunca. In 2002, the same researcher conducted two small test excavations in the zones investigated from a geomagnetic perspective. Meanwhile, Olivier Weller participated to the excavations at Lunca, before coming back in 2004 along with a team of specialists, for studying the exploitation techniques and their impacts on the environment, and for dating these exploitations accurately. The nine AMS C^{14} datings have allowed placing the Starčevo-Criș levels between 6050 and 5500 BCE, thus confirming Lunca as the oldest salt exploitation in Europe and maybe worldwide.

The excavations at Lunca have more or less ended, but the abundant archaeological material harvested will be further investigated; the paleoenvironmental analyses (wood carbons, ashes, soils, and pollen) will also be finalized.

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The Vall Salina: more than 6500 years of halite exploitation. Cardona, the Salt of History

Alfons Fíguls, Olivier Weller, Thomas Xaver Schuhmacher, Mireia Martínez, Ainhoa Pancorbo, Raül Segarra, Rosa M. Lanaspa, Marc Cots, Aitor Henestrosa

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 since 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 has an "orient" 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. In the southwest is located the diapir of the salt mountain. This diapir is unique in all Western Europe.

The outdoors exploitation (terraces exploitation system) was the system that was used until the early twentieth century, when started the underground exploitation (exploitation wells and galleries). 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.


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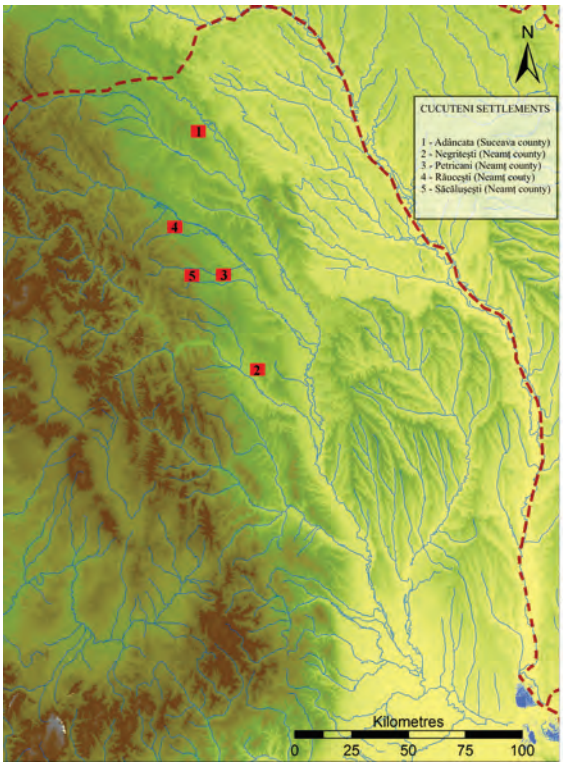
Briquetage in Cucuteni settlements from Moldavia (Romania)

Gheorghe Dumitroaia, Vasile Diaconu, Ciprian-Dorin Nicola

Briquetage are clay-made recipients used during the prehistory in order to obtain salt cakes through salty water's evaporation. These recipients, discovered in fragments, largely emerge from the settlements linked to salty waters exploitation, such as those from Lunca, Țolici, Gârcina, Cucuieți and Cacica.

Within several Cucuteni settlements from the Subcarpathian area of Moldavia there have been discovered fragments of *briquetage*, namely in the settlements from Adâncata (Suceava county), Negrițești (Neamț county), Petricani (Neamț county), Răucești (Neamț county) and Săcălușești (Neamț county). The above mentioned settlements belong to all the three stages of evolution of the Cucuteni culture. In the same time, one can but notice that in the great majority of cases, these *briquetage* show themselves in settlements closely related to salt water resources. The distance between these objectives ranges from 1 to 7 km; the sole exception regards the settlement from Adâncata, situated 40 km from the most important salt water resources. We should underline the fact that the Cucuteni settlements where these *briquetage* were identified are all situated within the hydrographic basin of several important rivers such as Siret, Moldova and Bistrița.



Reconstruction of the *briquetage* from Răucești

Briquetage from Răucești

The fragmenting of the *briquetage* was explained by the necessity of obtaining the salt cakes, which could have been later transported to long distances. The mere fact that in some Cucuteni settlements were discovered *briquetage*, could serve as an argument to the idea that those communities knew and controlled certain salt resources. It can also be implied that those communities served as centres for resources redistribution.

The "Vall Salina" of Cardona and the role of salt in the exchange network during the Middle Neolithic (4500–3500 BC) in Catalonia

Alfons Fíguls, Olivier Weller, Fidel Grandia

As a consequence of our study on the only salt-mountain mining in western Europe, we present the results obtained for the first European mine salt exploitation, at Cardona's "Muntanya de sal". Moreover we focus our study on the role of the salt in the exchange of different Middle Neolithic material and specific values. As such, we analyse the origins and the distribution of different raw materials and products in order to reconstruct the exchanges of other worthy values (variscite pearls, shells bracelets) and other exogenous materials (alpine axes, blond flint, etc.). Crossing the information, it is possible to evaluate the salt socio-economic role in the intercommunity exchanges and to propose a dynamic model of circulation with privileged axes of exchanges and key regions like Solsonià and Vallès.

Settlement density around salt springs from Solca and Cacica (Northeastern Romania) during the Neolithic and Chalcolithic

Andrei Asăndulesei

The paper presents a number of methodological aspects, based on GIS (Geographic Information System) applications, useful in complex studies of prehistoric economies, or, more specifically, of subsistence strategies employed by prehistoric agrarian communities. The study provides arguments for the existence of an economic potential in the sub-Carpathian areas (Solca-Cacica microzone) applying, by means of landscape analyses, the radial model of salt supply elaborated by M. Alexianu for the prehistoric settlements from this area. Relying on a series of case studies, the main natural resources available in the area were identified, with a focus on the salt springs, which undoubtedly played a key role and should be considered a decisive factor in selecting the occupation areas. Directly related to this, density and

statistical analysis were provided. For the sub-Carpathian area of Romania, the ethnoarchaeological investigations conducted recently as part of two research projects, alongside the archaeological researches performed throughout time, interpreted conjointly in a GIS environment, support the hypotheses regarding the archaeological potential of the area directly conditioned by the presence of salt resources.

Archaeological approaches to salted areas from Northeastern Romania

Ionuț Cristi Nicu, Andrei Asăndulesei, Gheorghe Romanescu,
Alin Mihu-Pintilie, Vasile Cotiugă

The present relief of this region is overlaying upon clays, sandy marls and oolithic limestones. In the past (5-7 million years ago, starting from Miocene), the area was covered by Sarmatic Sea, which gradually has withdrawn to the south-east. Based on regression of Sarmatic Sea, salt deposits, retained in sedimentary rocks, were formed. The geological and hydrogeological conditions of the area are the main triggering factors of the emergence of salt and sulphurous springs, which were used by the Neolithic populations. Due to climate changes, especially during the summer, when the evapotranspiration is high, the groundwater level is at shallow depths (< 3 m), the soil salt content comes to surface by capillarity forming salty areas (Rmn. *chelituri*). Within the Valea Oii river basin, after analyzing the map of parent material, it can be observed that there is a high concentration of prehistoric settlements around salty deposits (that occupies 1% of the total surface of the catchment of 98 km^2); this proves that they were used by the population. An interesting point of interest in the basin is at Balș (*Arcaci*), representing an old salty spring located on the left side of the valley.

The toponym *Arcaci* is of Turkish origin, referring to a paddock of circular shape for the sheep, which probably refers to the fact that the sheep could easily be gathered in this place to satisfy their needs by consuming halophyte plants (*Suaeda maritima*, *Salicornia herbaceea*) that grow here, or just lick the salted soil surface. Thus, the location of the sheepfolds in the proximity of these areas has a local economic importance, because the commercialization of salt is no longer needed. This is an eloquent example of how the salty areas are being used along the Prehistory since present.

Tyrawa Solna. Salt, settlements and a magnetometer survey along the lower course of the Tyrawka River (SE Poland)

Maciej Dębiec, Thomas Saile

The landscapes on both sides of the lower course of the Tyrawka River, a tributary of the San, cannot be regarded as favourable for settlement. Nevertheless, a dense concentration of archaeological sites has been recorded. A reason for this observation might be seen in the local deposits of salt and copper, exploitation of which would have compensated the environmental disadvantages. Magnetometer survey has been conducted on part of a Linienbandkeramik, Bronze Age and Early Medieval settlement site close to one of the local salt springs.

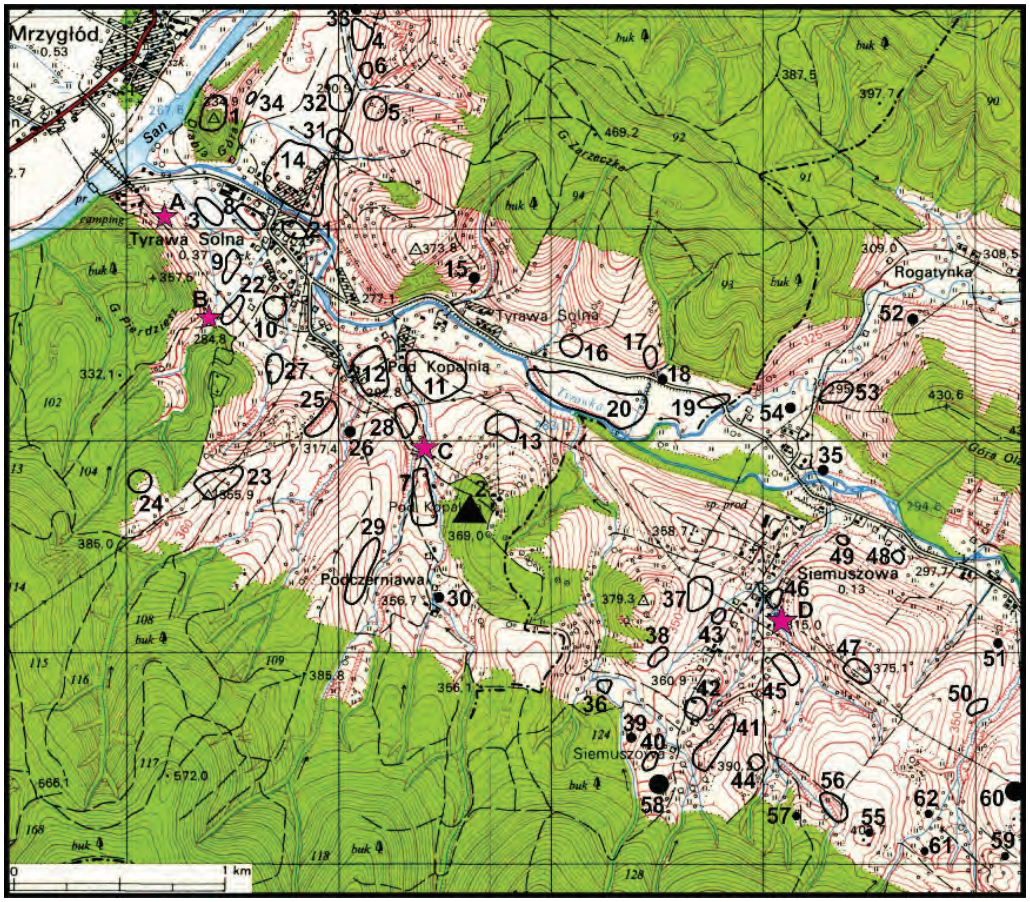


Figure 1. Settlement structures in the Tyrawka Valley. Star – salt well; triangle – bronze hoard; black points and outlines – settlements and camp sites.

A reassessment of the importance and nature of salt-production around Tuzla (Eastern Bosnia) during the Early Neolithic

Ivana Pandzic

By the time the Neolithic reaches the western Balkans (modern-day Croatia, Serbia, Montenegro and Bosnia and Herzegovina) in the 6th millennium cal. BC, it takes the form of two distinct complexes, the Impressa Complex in the Adriatic Sea and the Starčevo-Körös-Criş complex, found in Bosnia and Herzegovina, Bulgaria, Croatia, Hungary, Romania and Serbia. Some new research studies related to this subject claim that salt may be a useful link for the further investigation of the process of Neolithisation and the Neolithic in the Balkans. Except for some brief notes concerning salt trade there have been no attempts to explain the connection between the salt mines and the Early Neolithic settlement pattern. Traces of salt production at such an early stage are very rare, and recent work has demonstrated its existence and importance in other parts of the Starčevo-Körös-Criş complex which we can use as a model for our research.

In order to pursue the means by which the salt was used firstly in Tuzla region, where (so far) we have the earliest use of salt in the Balkans, this new research has to do the evaluation of the geographical situation as well as consideration of historical and ethnographical evidences. According to existing archaeological evidence, we know that the site of Gornja Tuzla in the eastern Bosnia, is abundant with rock-salt mine, as well as a very rare Neolithic site in the Balkans where a mixture of the two cultures (Starčevo and Vinča's neolithic layers) has been found. The abundance of pottery, ornamental techniques and motifs is striking, and the cone-shaped ceramic ware has been directly linked with salt production. The new research will also try to explore the chaîne opératoire of salt, which skills were needed for the development of salt production, to establish some kind of 'recipe' and identify which were the economic aspects of the Neolithisation in Tuzla region and what was the role of salt in the establishment of the village of Gornja Tuzla and Tuzla, whether it was crucial for its development, etc.

Therefore, it is assumed that the production of salt is one of the existential activities for the residents of the locality of Gornja Tuzla in the eastern Bosnia, which is located a few kilometres away from the mine rich in salt. The aim of this new research is to reassess the value and nature sites in eastern the Bosnia after at least 40 years, focusing on sites in the vicinity of Tuzla thanks to new excavations that were conducted in 2007 and 2008 (not published), and to fill the gap of our knowledge of the exploitation of salt in Balkans.

Brine processing at the Beaker site of Molino Sanchón II (Zamora, Spain): a technological approach

Elisa Guerra Doce, F.Javier Abarquero Moras, Germán Delibes de Castro

The Beaker site of Molino Sanchón II, located at the saline Lagoons of Villafáfila (Zamora, Spain), is interpreted as a centre for salt production through the method of brine boiling. Theoretically, the procedure might have involved the following stages: (1) Brine was poured into coarse ceramic vessels placed over fires; (2) the resulting salt paste was transferred to smaller ceramic moulds placed on clay pedestals which stand over a hearth of glowing embers; and (3) finally, those moulds were broken open in order to obtain hard and transportable salt cakes. However a detailed analysis of the ceramic assemblage has shown that small containers representative of stage 3 are quite exceptional at Molino Sanchón II. Alternative procedures are discussed in this paper. The function of Beaker pottery at this site, one of the most abundant collections known in Iberia, is also assessed here.

Unique Cucutenian artefacts related to salt recrystallization

Gheorghe Dumitroaia, Constantin Preoteasa, Ciprian-Dorin Nicola

The study presents a series of ladle-shaped artefacts that are so far unique in Cucutenian inventory, found in the Cucuteni A_2 (4450–4150 BC) layers of the Eneolithic tell from Poduri–*Dealul Ghindaru* (Romania), a site located near several rich salt springs of the Moldavian Subcarpathians.

The differences between these items and classical Cucutenian ladles, their rarity, and their discovery in a site where salt played a major role, compels us to associate them with salt recrystallization processes.

Analogies can be made with a series of discoveries from Provadia–*Solnitsata* (Bulgaria), a major centre of salt exploitation and capitalisation during the Neo-Eneolithic (5500–4200 BC).

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Neolithic territories and salt exploitation in Moldavia (Romania)

Robin Brigand, Olivier Weller

This paper presents the results of a spatial analysis project in Moldavia focused on the dynamics of salt exploitation in the longue durée. Spatial and statistical measures are used to investigate the relationship between salt resources distribution and settlement patterns from the Early Neolithic to Chalcolithic (6000–3500 BC). This work combines methodologies used in landscape archaeology with the potential of the Geographic Information System to mobilise archaeological artefacts in a large-scale setting and for many thematic purposes. The general goal is to evaluate how salt resources were a driving factor for these farming groups of eastern Romania.

Sărata Monteoru: a Chalcolithic site in a saliferous region

Roxana Munteanu

Cetățuia from Sărata Monteoru is one of the key sites for the understanding of the archaeological map of eastern Romania during the Chalcolithic period. Contributing to this, on the one hand, is its location in an area of convergence - the external line of the Curvature Subcarpathians, a region where several cultural phenomena such as Gumelnița, Cucuteni and Cernavodă I are to be found during the Chalcolithic. On the other hand, the chronological layout of the discoveries, towards the end Cucuteni culture, is repeatedly cited when discussing the cultural processes and transformations that occur at the end of Chalcolithic.

The investigations from Sărata Monteoru regarding the Chalcolithic layers are old and briefly published. The information is limited to a couple of sentences inserted into the excavation reports appeared in the 50s, which refers to "a significant number of huts with their inventory" and the ceramics that would later be labelled "Monteoru variant of the Cucuteni pottery". Most of the information and discoveries, however, remained unpublished.

We review the archaeological materials from the collection of the Institute of Archaeology in Bucharest, coming from the excavations conducted by the team led by Ion Nestor more than 70 years ago. The focus of our study is the ceramics, especially the shell-tempered pottery.

As to the cultural development of the area, we emphasize both the existence of the mineral springs near the site from Sărata Monteoru and the rich salt deposits of the Curvature Subcarpathians.

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The role of salt in the spread of the Beaker package during the 3rd millennium BC: some hypotheses

Elisa Guerra Doce

This paper focuses on the production of salt and its socio-economic implications in Europe during the third millennium BC. In comparison with previous periods, there is scant knowledge of salt processing, and most evidence comes from South-western Europe. In Iberia, where Beaker pottery may have originated, there is an association of salt processing with Beaker groups. We suggest here that Beaker groups might have assumed control over the circulation of salt in Western Europe. The role of salt in the spread of the Beaker package is assessed, both as an exchange commodity on its own right, and also as food preservative, facilitating the movement of peoples and long distance travels.

Ceramic management at the salt production site during the Early Bronze Age in the North Shandong, China

Qiaowei Wei

Questions about the salt production during the early Bronze Age in the North Shandong Region have been examining the function, typology, and chronology of a certain type of ceramic vessels, the Kuixingqi (Helmet-shaped vessel). To examine the salt production during the Late Shang and Western Zhou period, Chinese archaeologists considered the interaction between the central power and activities of specialized production as main issue of social control, without revealing the strategy on monopoly policy of salt and other prestige goods. Salt workshops at the North Shandong area, would provide the outline of the salt production as social process, which lead archaeologists to reconsider the concept and types of collaborations involved in the organization of salt production. This research focuses on ceramic vessel management strategies in the organization of salt production, that is, to analysis the social process of ceramic vessels within the salt workshops. It also provides records of economic, socio-political activities under the processing of state formation during the period of early Bonze Age in China.

A site for salt production in the Bronze Age in Baratti Bay, Tuscany (Italy)

Giorgio Baratti

The investigation is carried out in the beach of Baratti bay (Populonia, Tuscany_ITA) by State University of Milan with Soprintendenza Archeologia della Toscana.

The excavation, started in 2008 due to an accidental discovery as a result of powerful storm, revealed the remains of a stone structure close to the shoreline. The archaeological evidence was consisting of three or four parallel stonewalls, close together, arranged with clay. Although the complete profile of the structure is unknown, the planimetry suggested by the remaining elements shows a structure made by a rectangular pit, whose preserved sides measure 5.40×1.80 m (17.72×5.91 ft).

For comparison with similar patterns in archaeological site, especially in France, we identify these features as structural remnants of a a protohistoric furnace for salt making.

Although this feature contained a large amount of pottery, presumably part of containers of salt cakes reused to create floor plans of the structure, the majority of sherds were highly abraded and fragmentary and only a very tiny number were diagnostic. Ceramic assemblage includes thick-walled red ware vessel shaped as a truncated pyramid, also with a simple handle; decorative motifs include applied horizontal plain or impressed cordons. This material can be broadly dated to the late Bronze Age.

The research in the surrounding area revealed the existence of a wide archaeological deposit on the pre-olocenic soil, related to the salt structure, with presence of anthropic impact signs (i.e. leavings of the clay, fire-hardened clay, sherds). Therefore, it can be assumed that in the Bronze Age an important salt production site was present in the Baratti Bay.

Searching for salt in central coastal Italy (Tuscany): Mobility and exploitation of salt from the Bronze Age to the Early Middle Age

Edoardo Vanni

The question of the production of salt has passionate archaeologists for long time. The link between mobility strategies (as transhumance) and salt production must be rethinking. First of all salt consumption increased first and foremost to preserved meats and other animal product as cheese and it may be necessary to provide

addition salt to animal diet. Usually archaeologist think that in hot climates of the Mediterranean, the production of salt was made exclusively by evaporation of water without left significant traces in the archaeological record. Conversely the extraction of salt blocks obtained by cooking into boiling pots, is a method well-documented in Continental contexts. Once evaporated the water, the crystallized salt was extracted by breaking the pots. The salt could have been reduced in blocks to facilitate its transportation for long-distance trade. Nonetheless we know In Italy some sites, mainly occupied during the Late Bronze Age, where this method is attested. These sites are characterized by high percentage of red-orange vessels, manufactured with non-depurated local clays. It is not only a speculation the fact that the shepherds, during the winter-pasturing, were involved in the production of salt blocks, that they used for dairy production and as goods of exchange during the summer pastures in the Appennines. It is therefore necessary to reconsider data from past archaeological excavation to put the record in the new perspective so that the use of salt production with these techniques can at least be proposed for some sites till here interpreted differently.

The Bronze Age salt production technologies in Transylvania and Maramureș

Valeriu Cavruc

The Bronze Age salt production evidence includes various types of landscapes, sites, contexts, structures, installations, tools and implements.

The earliest Bronze Age evidence for salt production in Transylvania dates from the late phase of the Early Bronze Age (ca. 2400–2000 BC) and comes from the Băile Figa site in northeast Transylvania. Its archaeological remains were distributed in the inferior valley of the salt stream above shallow rock salt deposit. To this horizon of the site belongs a round pit dug in the rock salt with the brushed and textile imprinted pottery of so-called Iernut-Zoltan type. The sites with the pottery of this kind are located in Transylvania and Oltenia exclusively in the salt-rich zones. No other sites with similar pottery are known in northeast Transylvania. The most plausible interpretation of the pit dug in the rock salt is that it was dug for accumulation of highly salt-concentrated brine. The brine seems to have been evaporated in the ceramic pots. The obtained salt seems to have been intended to the salt-poor areas.

The only salt production evidence from the Middle Bronze Age (ca. 2000–1600 BC) in Transylvania comes from the Comănești site in the Homorod valley in eastern part of the province. It is located close to the brine spring. The pottery belongs to the Wietenberg culture, and all shards come from coarse pots. It seems that salt in this site was obtained by brine evaporation.

The number of salt production sites has significantly increased during the Late Bronze Age (ca. 1600/1500–800/750 BC). 9 archaeological sites of this period with salt

production evidence are known in Maramureș and Transylvania: Solotvino and Valley of the Kings in Ukrainian Maramureș, Băile Figa, Săsarm, Caila, Valea Florilor, Ocna Mureș in the northern half of Transylvania, Zoltan and Olteni in southeast Transylvania.

The sites in Maramureș and northern half of Transylvania expose a very complex and efficient technology of rock salt mining and quarrying using a complex set of wooden structures (enclosures and fences), installations (troughs and channeled pieces), tools (mining stone hammers, wooden sledge hammers, wedges, shovels, ladders etc.). It seems that the main method to take rock salt in these sites during LBA was to drill it with jets of fresh water and to crack it with wedges and hammers.

At the same time, in the salt poor southeast Transylvania in the Olteni and Zoltan sites, salt seems to have been produced by evaporation of brackish water in ceramic massive pans.

Figure 1. Băile Figa site, 2013. Wooden trough during the excavation.

Reddish *ollas* and production and use of salt: an open question

Tomaso Di Fraia

In the ninth decade of the 20th century, some Italian archaeologists (Pacciarelli 1991 and 1994, Menchelli and Pasquinucci 1997 and 1999, Belardelli 1999) brought to

the attention of the scientists some coastal sites characterized by large deposits of ceramic materials, most of them consisting in reddish-orange *ollas* (ceramic jars). The combination of containers coming from sites *à briquetage* of the Atlantic area and characterized by some similar aspects (colour, relative crudeness of the paste and of the manufacturing technique, local production) guided the interpretation of the Italian sites, made by the above mentioned scientists, as probable places for production of salt and / or of activities related to the use of salt, even amongst many doubts (Di Fraia and Secoli 2002; Di Fraia 2006, 2011).

After more than two decades though, few progresses were made in the study of this class of containers. In a recent article (Aranguren *et alii* 2014), physical and chemical analyses would indicate that the characteristic reddish colour could come from the way the vases were baked, although no traces of sodium chloride were found on these materials. It is rather uncertain that this interpretation could explain the coloration of all the findings, but if it was confirmed and if it could be broaden to other findings from other sites, one of the supposed indicators of salt production would fall, that is the particular colour of the ceramics. On the other hand, it should explain why this characteristic unites only particular coastal sites.

From this the need, in writer's opinion, to:

- Analyze, for every site, the different types of reddish colour containers and the eventual examples of different colours, checking if the reddish colour occurs also in tableware;
- Confront the results obtained from at least two or three sites with reddish ollas, partly at least contemporary;
- Check, by scientific analyses and experimental tests, if the reddish color could (also?) come from the use of containers or from particular postdepositional processes;
- Attentively study the different typologies of containers and check their feature based on ethnographical comparisons and targeted experiments.

We will be able to have enough data for adequately justified interpretations only after conducting these studies.

In the meantime, we have to limit ourselves to promoting some hypotheses that exploit at maximum the characteristics of every complex of findings and of every site.

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Settlements, micro-regions and natural resources during the Bronze Age in the Curvature Subcarpathians area

Daniel Costache, Laurențiu Grigoraș

In the Subcarpathians (the area between the Buzău and Prahova rivers), the Bronze Age is represented by Monteoru and Noua discoveries. Studying the dynamics of Bronze Age settlements was one of the main factors in determining the spatial evolution of the cultural-archaeological phenomenon, and—as a working hypothesis—the establishment of certain areas of economic interest to the human communities that have evolved in the prehistoric period.

Although easily to be considered artificial, the distribution of the Monteoru culture settlements on occupational-micro regions can serve as a starting point in analysing the organization, planning and use of economical determinant for the type

of economic activity. From each occupational micro-region we have identified natural resources and economic opportunities. Resources like salt, amber, grassland and fishing founds have long were exploited and in the same time secured. In an interesting way, even in Subcarpathians area we could have made archaeological researches in salty areas, the cartography of the settlements show us increased interest for those lands starting with Bronze Age. Because of that our paper represent an theoretical model for analysing some occupational micro-regions.

Salt in the Bronze Age. An overview of Subcarpathian Moldavia (Romania)

Vasile Diaconu

In Subcarpathian Moldavia (Eastern Romania), there are many saltwater springs and some of them have been exploited in the Bronze Age. The most important are: Lunca–*Poiana Slatinei* (Neamț county), Țolici–*Hălăbutoaia* (Neamț county), Gârcina–*Slatina Cozla II–III* (Neamț county) and Cucuieți–*Slatina Veche* (Bacău county). These salt springs offered not only an essential mineral in human and animal nourishment, but also a trade merchandise and a prestige good.

Based on the pottery analysis, we established that the mentioned salt springs were frequented in all stages of the Bronze Age. At Țolici and Gârcina were discovered archaeological materials specific to the Early Bronze Age. Middle Bronze Age is attested only in the sites from Cucuieți and Lunca. Only in a singular case (at Lunca), archaeological data were identified with direct connection to the exploitation of salt water in the Late Bronze Age.

The data that we possess about the location of the Bronze Age settlement from the region of Subcarpathian Moldavia reveal that a settlement's economic hinterland (max. 10 km) almost invariably harboured a local salt source.

As a conclusion, we can say that these salt water springs were sources of local importance, but especially macro-regional importance.

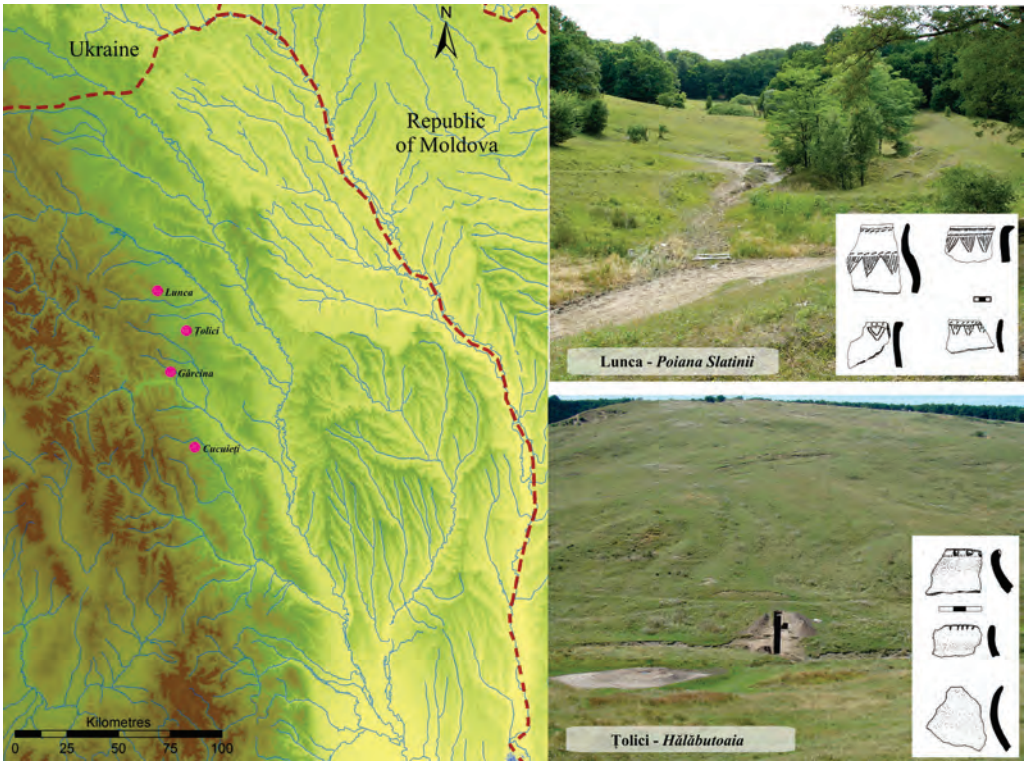


Figure 1. The salt springs from Lunca, Țolici, Gârcina, and Cucuieți in the Moldavian Subcarpathians.

A tiny story about salt, herding and landscape in Late Bronze Age (LBA), Eastern Romania (work in progress)

Neculai Bolohan, Luminița Bejenaru, Alexandru Gafincu

A story in just three words about some novel discoveries from Bistrița-Cracău depression may represent the beginning of a transdisciplinary research. This would had the objective of capitalizing certain surface archaeological research in order to set up a coherent story about the use of sources of salt by some of the communities in the Late Bronze Age from the area under study. Through surface research conducted in May–June 2015 we managed to identify dwelling structures (zolniki) specific to the LBA east of the Carpathians. Of the investigated area we extracted miscellaneous archaeological material composed of pottery, adobe, stone objects.

The need to develop this topic is supported by a significant number of faunal remains and the proximity of the source of Slatina Negrițești, jud. Neamț. The archaeozoological analysis of the LBA settlements/temporary camps (*zolniki*) of Cracău-Bistrița depression suggests the long-range pasturing of domestic cattle (*Bos taurus*) — this species dominate, on average, 73% of identified debris. Other species

identified in much smaller proportions are: horse (*Equus caballus*), domestic pig (*Sus domesticus*), sheep/goats (*Ovis aries*/*Capra hircus*); dog appears sporadically (*Canis familiaris*) and water turtle (*Emys orbicularis*). There are no remains of hunting with the exception of only one fragment of antler (*Cervus elaphus*), which was however collected for processing (identified piece bears traces of shaping). Of the entire bone material there is tobe noted the presence of processed bones, most of them from domestic bovine shoulder.

To these data we will add the observations made based on the study of media sources, cartographic sources, toponymy, hydronimy and some valorised already about the the referred salt source. The information will be integrated into a model regarding the organization and the use of the landscape by herders from LBA Cracău-Bistrița depression.

Acknowledgments: The financial support for this study was provided for Neculai Bolohan by the PCCA 1153/2011 No. 227/01.10.2012 *Genetic Evolution: New Evidences for the Study of Interconnected Structures. A Biomolecular Journey around the Carpathians from Ancient to Medieval Times (GENESIS)*.

Research on the use of Hallstatt's stone axes: study of mechanics

Alfons Fíguls, Hans Reschreiter, Kerstin Kowarik

About the salt mine of Hallstatt, there is documentation of various stone axes, stone axes-hammers and fragments of polished material. We have analysed 15 stone axes (11 from the Hallstatt Museum and 4 from Naturhistorisches Museum Wien) and compared the traces of use with those of the axes found in the Vall Salina of Cardona.

The results show that there are axes that were used to hit a really strong material as the Hallstatt salt, and there are axes that have been used to hit soft materials and there are prestige axes as well.

Salt in Southwestern Germany at the end of the Iron Age

Martin Hees

The underground layers of southwest Germany holds deposits of rock salt. This salt is the origin of many salt springs with a low salt content. Their use is presumed to have to the Neolithic and Bronze Age, but is attested only for the second Iron Age,

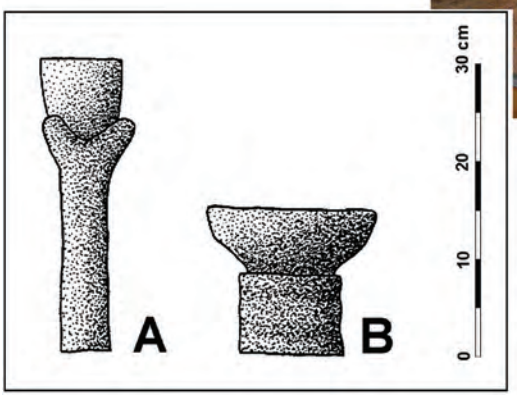
and from the Middle Ages until now. There are several likely sites for the location of protohistoric salines. The site in Schwäbisch Hall is the only one that was excavated, and only on a small area, in 1939-1940. With the results of the excavations, the comparison with other salines dated back to the Iron Age, and ethnographic observations, it was possible to reconstruct the salt production process.

In the second Iron Age, for 4 centuries, salt was produced using briquetage from the salt spring water in the Schwäbisch Hall saline. At least a portion of this salt was transported in briquetage buckets used for its production. Fragments of these containers have been found in settlement sites at a distance of up to 100 km around the saline.

As part of a research project on the late la Tène habitat surrounding the city of Heilbronn, research is underway on the distribution of briquetage in the habitat sites, possible trade routes and the use of salt. New excavations and examination of old collections have defined 5 types of briquetage buckets belonging to the Iron Age, and provide maps of their distribution. Salt was transported from the salines to consumers preferably by river, but new research also show possible land routes.

At the site of Nordheim, with two housing enclosures from the 2nd/1st century BC, the inhabitants used large amounts of salt, probably for the production of canned meat. This site also served as a storage and redistribution facility.

reconstruction d'un four à sel
(Latène C/D)
Hällisch-Fränkisches Museum,
Schwäbisch Hall



reconstruction graphique de briquetage,
saline de Schwäbisch Hall.
A: Latène A/B (5.-4. siècle)
B: Latène C/D (3.-1. siècle)

Salt winning and environmental changes along the central Tyrrhenian coastal belt (AD 400-1800)

Carlo Citter

Salt winning is one of the key factors of the Italian economy since the Iron Age, up to the 19th c. AD. In this paper we shall briefly summarize the results of some researches on the coastal belt of central western Italy, in particular, from Rome to Pisa and we shall focus on three periods, which affected the whole asset of salt's production and distribution as well as the political and social framework: the end of the Roman west (AD 400-600), the Communal age (AD 1200-1400), and the making of the «ancien regime» kingdoms in modern Europe (AD 1500-1700).

Data about salt winning come out mainly from literary sources, though there are some archaeological evidences and, recently, some predictive models too. They used to extract salt from sea water in the summer, thanks to the daily variation of the sea level: in fact the tide is no more than 50 cm, which allows sea water being collected into basins or tanks.

The deltas along the Tyrrhenian coast have partially a common environmental evolution. The sea level was almost stable, but still rising from Roman times on. In particular during the central centuries of the last millennium, the coastline expanded strongly through the growth of the dune belts, following a peak of erosion in the hinterland and of sediment load in the rivers, and therefore of flooding The main rivers slowly filled in the lagoons with sediment deposited during the floods. The combination of these factors led to an increasing retraction of the lagoon surface, their isolation from the open sea and a consequential decrease of the salt content of the water. This evolution pattern has required a regular adaption of the salt work locations over time.

We have indications that the salt winning did not stop at the end of the Roman west, because, both, Lombards and Carolingians had a strong interest in gaining such a crucial resource. We still miss excavations that can show us possible changes in the size and structure of the winning areas, but we have some indications that more recent plants were not so different from, say, those of the Roman period. Tide and climatic conditions always favoured this activity, which virtually lasted only after the unification of the peninsula under the kings of Piedmont, who pushed other regions like Sicily and Puglia.

Archaeology of Salt Works in Ancient Sardinia

Alfonso Stiglitz

The earliest evidence of salt works in ancient Sardinia is contained in the inscription found in San Nicolò Gerrei, inland from Cagliari, dating to the second century. B.C. The reference to Cleon the supervisor of the salt flats proves their existence, in Cagliari. The same salt flats are mentioned in another inscription (VI century AD.), which mention the guild involved in the work of salt flats.

Beyond these direct evidence we have no archaeological remains to be carried forward with certainty to the salt flats, although the the spatial distribution of settlements can provide useful information on their existence. In this paper is discussed the area of modern salt flats of Capo Mannu (central-western coast of Sardinia), whose earliest documentation dates back to the Middle Ages, but the study of coastline transformations and of dynamics of occupation allow us to postulate their use probably since the late Neolithic age.

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Subterranean water as a source of salt. Reflections on technological variations of their use in the south of Mexico

Blas Castellón

The central-southern area of Mexico is a mountainous zone with orogenic phenomena which has left many marine formations from the Cretaceous period over 60 million years ago, exposed along with recent volcanic formations. In these parts, there is a presence of subterranean water flows which pass through ancient marine deposits and originate natural brine which emerges along different points of the current mountainous landscape. The raw materials for the production of salt are these saltwater springs, and their presence has been the object of knowledge and control of these sources since at least 2500 years.

Here, I present a chemical and morphological characterization of these saltwater sources in the Mixteca region, indicating the technological variants of their knowledge and control, which have been very important for the start of the salt production process in inland regions. I also present how salt has been historically obtained through several methods up to present times, considering the formation variants of these springs, some religious beliefs, and other details of local knowledge concerning the presence of subterranean water.

Figure 1. Salt water well at Salinas Las Grandes, Zapotitlán, Puebla, México.

The sacred salt spring of Erechtheion, or how the Aegean Sea got to flow high on the top of Athens' Acropolis

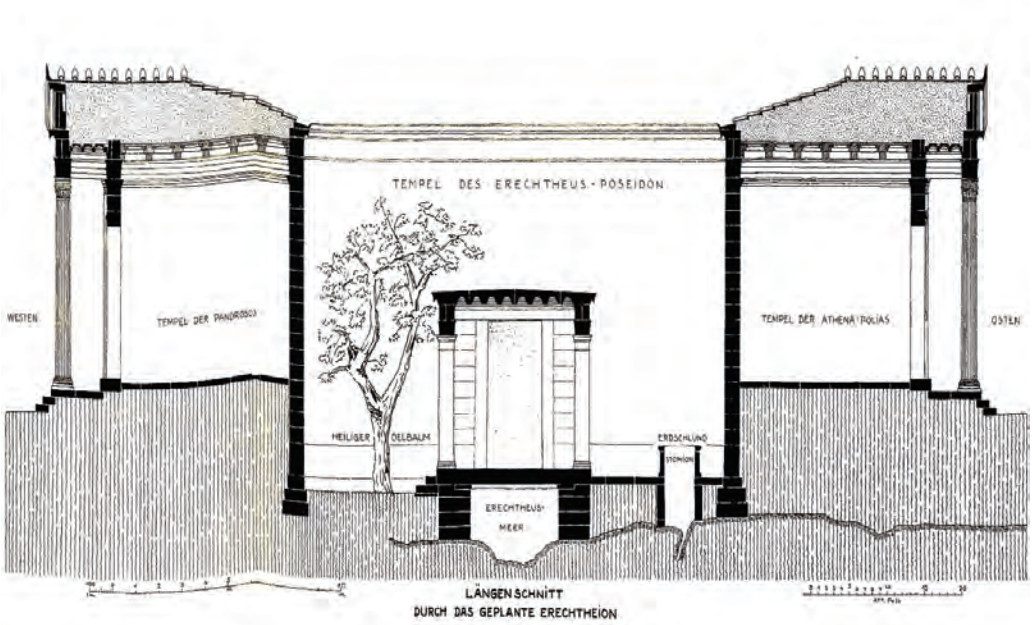
Magda Mircea

“The Sea of Erechtheus" was a sacred salty well, housed by the Temple of Erechtheion, on the Acropolis (Athens, Greece). According to the legend, it was Poseidon who produced this spring by striking the rock with his trident. It was his gift to the city of Athens, in the competition with the goddess Athena for the patronship of the city. Ancient authors suggest that this salt water well had a hydraulic communication with the Aegean Sea. Pausanias has described it as a "sea-like water”

(*thalassion hydor*) and has also mentioned an intriguing acoustic phenomenon: the noise made by the waves at the harbour of Phalerum could be heard near the spring.

Finding sea water in a well relatively distant from the sea might be surprising for the modern reader or visitor to Athens, who knows that Acropolis is few kilometres away from the shoreline and, in addition, the hill of Acropolis rises a few tens of meters above sea level.

Since previous studies have not tackled yet the mystery of the "Sea of Erechtheus", the present paper aims to integrate ancient Greek narratives, travelogues, ancient geography, (ethno)hydrology and hydromythology, in order to provide a plausible explanation for this phenomenon. The conclusions support the validity of ancient sources and point to a regular phenomenon common to the frequent landscape of Greece: the intrusion of seawater into the coastal karst limestone aquifers.

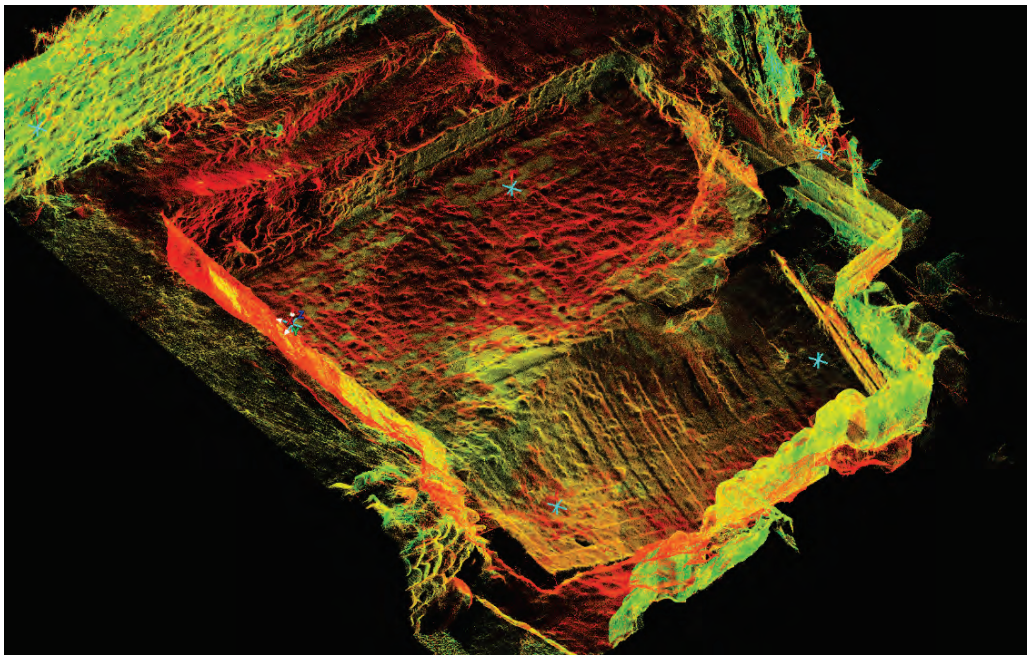


The archaeology of salt in Ireland

Wes Forsythe

Salt-making is an under researched area of study in Ireland. Only recently prehistoric evidence of salt making has been recognised, and Medieval sources have largely been documentary rather than archaeological. Yet the production of salt was central to the Irish economy as it emerged in the Late Medieval and Post-Medieval periods. Ireland remained an agricultural country and relied on the export of salted beef and butter, in particular the emerging transatlantic trade. A major project over

the past two years has reassessed the material evidence of salt making in the country with an emphasis on coastal sites. The use of sea water in the absence of geological sources of salt was expensive and inefficient, yet provided an important means of securing a commodity of importance. This paper will present findings from the Irish Salt project derived from survey and excavation activities.



Salt *vs.* Limes in the eastern part of Roman province of Dacia

Alexandru Popa

Rock salt in the eastern part of Roman Dacia was a valuable resource both due to the large dimension of the natural rock salt deposit as well as because there was no rock salt whatsoever on a large territory neighbouring Dacia (Pannonia, Balcanic Peninsula or the regions north of the Black Sea). From this point of view studying the issues related to salt economy in Dacia is easier in combination with the study of the Roman Limes in this area.

Regarding the archaeological researches one can notice that the subject of „Salt in the eastern part of Roman province of Dacia" is mostly approached and sustained by „logical indicators" rather than doubtless research sources. Modern research knows little or very fragmentary information such as salt deposits showing traces of exploitation in the Roman Period, tools, paleo-chemical traces of salt, clearly written testimonies regarding salt extraction, trade or traffic.

The most important pieces of information regarding salt in the eastern part of Roman Dacia are found in the field of Roman epigraphy: inscriptions related to people involved in entrepreneurship activities such as salt trade. Other indirect pieces of information are revealed to us by fields such as geography of soil (the localization of salt sources) and historical geography (roman denominations of places and salt sources). As result of these considerations our researches regarding „Salt *vs.* Limes in the eastern part of Roman Dacia and its neighborhood" aim to increase the credibility of historical-archaeological research by using a series of related methods usually applied in the field of natural sciences (geography, geophysics, geochemistry, mineralogy etc.) and modern informational technologies such as GIS. In my opinion, this is the only way we can reach tangible progress in getting to know the issues related to the extraction, distribution and use of salt in the Roman Period.

The development of salt industry during the State Formation Period

Shinsaku Tanaka

Analysing the development of the salt production during the state formation period, I will clarify the control of the production system by the kingship in the middle Kofun period, the fifth century. From the later Yayoi period to the early Kofun period, sites in the Osaka bay area yielded a small amount of salt-making pottery fragments which could have been brought from various salt production sites. However, in the middle Kofun period, a limited number of sites with enormous amount of salt-making pottery fragments appeared in the southern Osaka bay area such as Kojimahigashi

and Nisinoshō. Salt pottery was highly standardized in form, size, production technique and clay and many kilns were constructed in this period. Some scholars have pointed out that this capacity of the salt pottery was a unit of the salt production and transportation. We could understand that this stage of the salt production had changed its meaning as consumer goods to producer goods in order to produce preserved foods, the horse production and the leather production and so on. It is notable that in the same period specialized production occurred in the ceramic, defence, and horse industry, which were introduced from the Korean Peninsula in the middle Kofun period. These techniques could have been politically located in the south of Osaka Plain which was thought to have been the centre of the kingdom, in terms of fuel which was the key factor to control efficiently these industries.

Archaeometric analyses on briquetages from Minogahama site, Japan (ca. 6th–7th Century AD)

Kei Aoshima, Takamune Kawashima, Viorica Vasilache, Ion Sandu, Felix Tencariu

The Minogahama site was located on a sandbank of a former island in the western end of the Inland Sea, Japan. While the site was well-known as it contained artifacts from the Paleolithic to the ancient period, it was at the excavation in 1960 that the site was recognized as the salt production site of the Late Kofun period and the beginning of ancient period, ca. 6-7th century AD. The analyzed briquetage sherds which were obtained at the excavation in 1993, could belong to this peak period of salt production at the site. Not only briquetage but also the hearth which was paved with pottery sherds and clay were found. Houses and pits were distributed on a slightly elevated area. As on the top of the small hill tomb mounds were constructed, the salt production group was organized by those who were buried.

The 8 samples analysed consist of 4 thinner fragments of briquetage, 2 thicker pieces from the Kofun to ancient period and 2 small legs of briquetage.

Analyses were performed in the Laboratory of Scientific Investigation and Conservation of Cultural Heritage of the Interdisciplinary Platform Arheoinvest, "Alexandru Ioan Cuza" University of Iasi, for the project Ethnosalro., following the same methodology as in the case of a previous investigation (1).

For analysing the samples were used optical microscopy (OM) and scanning electron microscopy SEM-EDX. Surface microstructures of ceramic fragments were studied using a Zeiss optical microscope A1m Imager, which has a photocamera attached AXIOCAM, and a specialized software to 50X magnifications.

For understanding the elemental composition and arrangement of

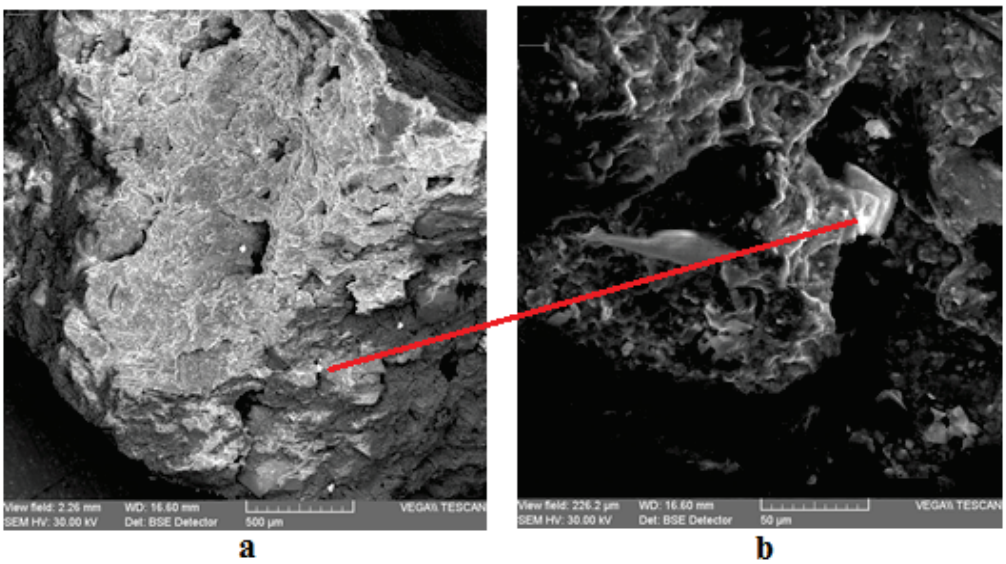


Figure 1. SEM images of sample no. 6: inclusion with Sulph and Barium: a – overall image, with 100X magnification of its interior; b – inclusion detail on a 1000X magnification.

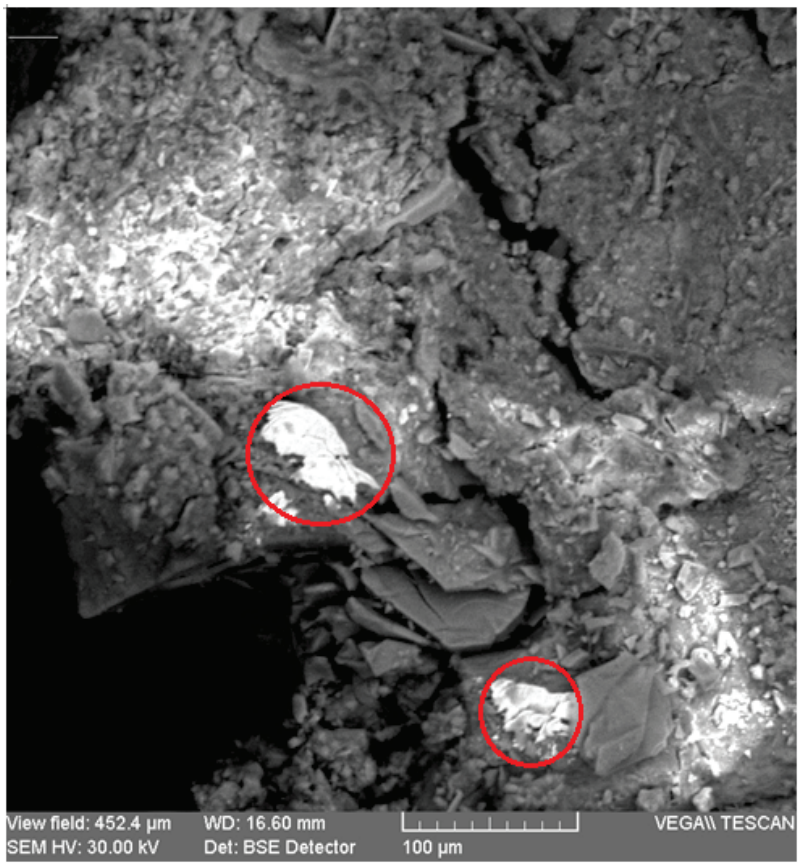


Figure 2. SEM image of sample no. 6 at 500X magnification.
Contamination with an object containing Fe, Cr, C.

microstructures in the analysed samples was used the scanning electron microscopy, SEM VEGA II LSH model, coupled with an EDX detector, type QUANTAX QX2. Magnification range is between 100 and 1000X, and the image was created by secondary electrons (SE) and backscatter electron (BSE).

In the sample's matrix were identified the following chemical elements: Si, Al, Fe, Ca, Mg, K, Na, Ti and O, and some samples also contain P, C and S in different proportions. The inclusion compounds (temper) have a variable composition dominated by alumina-silicates. In some inclusions a high carbon process was observed. In the inclusions from sample no. 6 were found significant quantities of Ba and S. On the surface of the same sample was found, besides Al, Si, Ca, Mg, Na, K and A, a high content of Fe (59 wt%), Cr (7.7 wt%) and C (3.11 wt%), possible from contamination with an object with which it came in contact.

Continuing the investigations by other types of analyses will lead to acknowledge other important parameters of briquetage from Minogahama site.

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Salt, shell and obsidian. The role of salt producers-craftsmen in the sociocultural dynamic of the Sayula Basin (Mexico) between 500 and 1000 A.D.

Catherine Liot, Elodie Mas, Javier Reveles

The Sayula basin is located in a geographical corridor between the Pacific coast and the western Mexico highlands. Twenty-five years of a regional archaeological research has enabled to draw the main phases of the cultural sequence, from the installation of the first permanent settlements during the second millennium B.C. till the Spanish conquest.

The Sayula Phase (450–1000 A.D.) corresponds to the apogee of a regional identity along with a socio-economic and political system based on the management of strategic resources. In this pattern, salt production plays a major role and its characteristics attest a regional specialization, revealed by a genuine "salt-oriented culture" with specific artefacts and structures distributed in workshops. Many evidences indicate that a production of shell and obsidian items—both foreign prime materials—occurs in these workshops during this period. A recent PhD dissertation about the shell issue shows that more than 50 species mainly proceeding from the Panamá province (Pacific littoral)—five species come from the Caribbean province—and a strong diversity of types of ornaments were manufactured in the region, according to technical processes both singular and homogeneous which enable to

reveal an own technological style. Besides, this study underlines the occurrence of analogies between the shell work and the obsidian one, which testify some interdependent specializations probably implemented by the same craftsmen.

We propose here to explore the tracks that enable to explain how salt production had contributed to the development of a regional multi-crafting specialization, in particular through the decoding of salt workers' social organization.

Salt production as a reflection of inter-ethnic contact and culture change during Late Prehistory (A.D. 800–1100) in South Alabama, United States

Ashley A. Dumas

Despite the wide distribution of salines throughout eastern North America, the Alabama salines are the only ones in the eastern Gulf Coastal plain. Thus, Alabama salines provided salt for thousands of prehistoric and early historic peoples. The prehistoric components of these sites reflect a major cultural transition between horticultural Late Woodland populations (A.D. 400-1100) and the agricultural chiefdoms of the Mississippian culture (A.D. 1100-1550) that followed. It is likely that salt production itself was the reason for this change.

Archaeological evidence suggests that Late Woodland people of the Tombigbee River Valley, known archaeologically as the McLeod culture, began to manufacture salt around A.D. 800. At the Lower Salt Works salines, a dense layer of McLeod-style pottery is the earliest evidence for use of the site. Analysis of features and pottery reveals that salt was made by boiling brine directly over a fire in small bowls. Unlike typical coiled bowls from McLeod villages, bowls at salines were made by pinching clay into the desired form. This technique suggests an expedient, casual manufacture of salt by McLeod people, who, in the absence of any exotic trade items at McLeod salines or villages, seem to have been consuming it themselves. McLeod use of the salines ended abruptly around A.D. 1100.

Directly overlaying McLeod artifacts at several saline sites is a layer with Mississippian culture artifacts attributable to a large chiefdom located over 400 km away. There is no evidence for *in situ* development of Mississippian culture from McLeod; Mississippians simply displaced McLeod people from the salines. Mississippian layers have an abundance of fragments of large, shallow ceramic basins, called "saltpans," that, according to ethnohistoric sources, were used in the solar concentration of brine before boiling it in jars, a marked change in technology designed to produce large quantities of salt.

Evolving methods of manufacturing saltpans reveal a production process that became increasingly refined and specialized. Mississippian salt specialists returned with salt to their home chiefdom, where elites likely controlled its distribution and trade. Within a few generations, the McLeod people were no longer in the region,

completely displaced or absorbed by the Mississippians, a significant cultural shift originating with a shift in the desire for salt.






Archaeological observations on the salt production in Mesoamerica and other parts of the world. Technological Implications

Jorge Alejandro Ceja Acosta, María Luisa Martell

The crystallization of brine to a solid salt is one of the most important elements in the production of salt. Salt production was carried out in Mesoamerica from different strategies. The induction of heat to crystallize the salt significantly reduces the time of the process. The use of kilns and hearths was perhaps the most popular strategy for boiling salt.

Technology in the pre-Hispanic Mesoamerica used boiling as the primary method to change the brine to salt. This technology used for the production of salt may be derived from the domestic sphere, although it should have been strengthened by the knowledge generated in another area, for example, ceramic technology (Odrizola and Martinez-Blanes 2012: 437). It is simply a knowledge related to the development of ceramic. This knowledge was an important source of experience for the saltmakers since it could serve them to make decisions in the production of salt. The use of kilns and hearths have the same technological function, the difference is as will be seen later in the intention that the saltmakers have to use one or the other. Salt production in Mesoamerica is divided mainly into two strategies: boiling of salt and solar evaporation, despite the fact that the solar evaporation could remain as a separate category, It is considered that the absence of fire sets a variable that radically changes the process of salt production. In this research, it was decided that the solar evaporation would be seen as part of the strategies of salt production since, in both cases, it is the knowledge of the management of the temperature to the brine that can be transformed into salt. The first part of this section will describe the kilns and hearths, while the second section will deal with the strategy of solar evaporation, It will subsequently be referred to as the importance of the arrangement of the vessels in the salt production and implications in the use of different types of fuels, and finally, in the combination of elements of the oven, stove top, and solar evaporation to generate different strategies to produce salt.

Ethnoarchaeology of salt production in saltplaces from Oaxaca, Mexico

Jorge Alejandro Ceja Acosta, Braulio Pérez

At the beginning of the Ethnoarchaeological project of Salt Production (EOS in Spanish) in the summer of 2005 our goal was to understand salt-water boiling in Veracruz and for that reason our ethnoarchaeological model it was strong tides with

very specific technology and material culture. At his time, however, we are interesting in understand two different aspects in salt production: leached soils including solar evaporation and the transition of the Mesoamerican period to the colonial period.

In previous research, we have shown that salt production strategies can be observed in the archaeological context, but now, we want to know if it is possible to identify two different salt production strategies with different cultural tradition, specifically the Oaxaca-Mixteca and the Spanish traditions.

We are interested to know if through ethnoarchaeological model it is possible to distinguish the saltmaking strategies between preindustrial and industrial societies.

Figure 1. Semi-abandoned saltplace (photo by Braulio Perez).

Salt Islands: historical archaeology and human ecology of the saltpans of the Venezuelan Caribbean, 16th–19th century

Konrad A. Antczak

This paper discusses a diachronic approach to the interaction between humans and saltpans in the Venezuelan Caribbean from the 16th to the 19th century. This research is based on historical archaeological, documentary and oral historical evidence marshalled to understand the dynamics of solar salt production, and the impacts of the natural environment on the final product's output and quality. "Tending" a saltpan was not always simple as knowledge of the weather patterns, yearly, monthly and daily tides, and the right physical conditions and biotic factors involved in the concentration of brine and the subsequent crystallization of sodium chloride was indispensable to augmenting the quantity and quality of a salt harvest.

During the decades of the 1620s and 1630s, the Dutch from the Low Countries were in dire need of salt for their lucrative herring fisheries. With the mainland Venezuelan salinas [salt lagoons] of Araya (once briefly exploited by the Dutch between 1599 and 1605) closed off in 1622 by a Spanish fort, the Dutch industriously and brazenly engaged in salt production on the desert island of La Tortuga (Fig. 1). On the island's southeastern end of Punta Salinas, they 'tamed' and modified the natural environment and created a built landscape for salt production including pumps, dikes, sluices and pans (Figures 2 and 3). They were expelled from the island definitively in

1638, following a fierce armed confrontation with the Spanish and their Amerindian allies.

Beginning in the last decades of the 17th century, what was at first a trickle of determined Salem merchants heading to the Venezuelan island of La Tortuga to rake salt became a steady stream. By the early 18th century, Boston and other Eastern Seaboard ports such as Portsmouth, Newport and New York, along with Bermuda, had joined in on the salt venture that became the lifeblood of New England's refuse cod industry. It was this cod that fed the enslaved Africans on Caribbean plantations. Protected by various Anglo-Hispanic treaties, and by naval guardships, between 1700 and 1781 more than 1000 ships set sail to rake free salt on La Tortuga. Archaeological and historical evidence shows that even though the island's salt was of great importance to them, the New Englanders minimally modified the natural environment on La Tortuga's saltpans and only raked the salt when it crystallized naturally.

One hundred and eighty kilometers to the northwest of La Tortuga, the saltpans on the long and narrow island of Cayo Sal, in the Los Roques Archipelago, drew the eyes of Dutch Antilleans in the 18th century (Figures 1, 4 and 5). Throughout the 18th century, the island was visited by Curaçoans who would leave their enslaved mariners here to rake salt. Archaeological and documentary sources also suggested that occasional visits were made to the saltpans by Anglo-Americans on their way from La Tortuga, French smugglers and privateers and the inhabitants of the Province of Venezuela. Cayo Sal's lagoons are crisscrossed by a dense network of dikes, separating various concentrating ponds and crystallizing pans, that attest to the level of industrial salt production that occurred here.

In the 19th century the saltpans of Cayo Sal vied for a position amongst the most important saltpans of the Caribbean together with those on Curaçao, Bonaire and the Turks and Caicos Islands, being exploited by merchants from Bonaire and the recently established United States until the 1880s. The built saltpan landscape of the 19th century included windmill pumps used to pump brine, dozens of dikes, sluices, a salt-packing patio and a jetty, demonstrating a keen understanding of how the natural environment could be manipulated to increase salt output.

This research indicates that the Dutch in the 16th and 17th, the Anglo-Americans in the 17th and 18th, and the Bonaireans and Americans in the 18th and 19th centuries, each applied different types and levels of expertise to the process of salt "cultivation" on the saltpans of the Venezuelan islands, resulting in a variable final product geared towards diverse market necessities.

Figure 1. The Caribbean and the northern coast of South America.

Figure 2. The Island of La Tortuga and the site of Punta Salinas where the saltpans are located.

Figure 3. Saltpans at the top and Los Mogotes Lagoon to the right, La Tortuga Island, Venezuela (photo: José Miguel Pérez Gómez).

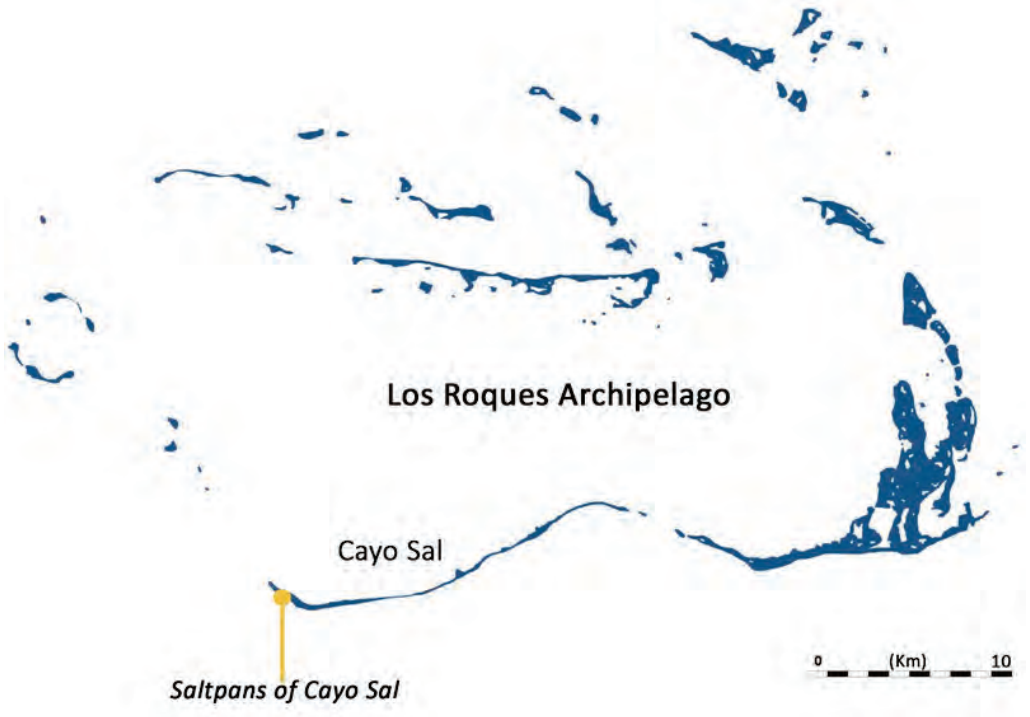

Figure 4. The saltpans of Cayo Sal in Los Roques Archipelago, Venezuela.

The People of Salt: Experimental archaeology in Romania

Dan Lucian Buzea, Andrea Chiricescu

Since ancient times salt was considered a very precious natural resource. Today we take advantage of its varied properties, regardless where we find it: on the surface or deep under the earth, in brines (salt water brooks). We use salt to prepare our meals, to preserve food, in therapies, in research etc. But if today we know how to exploit salt and how to benefit of its properties we cannot avoid wondering about the way people exploited and used it thousands of years ago, in prehistoric ages. The National Museum of Eastern Carpathians (MNCR) tried to find an answer to this question by resorting to experimental archaeology, organising, with the support of its partners: the "Cucuteni for the 3rd Millennium" Foundation from Bucharest (FCMIII), the "Carpații Răsăriteni" Cultural and Scientific Association (ACSCR) and Exeter University, Great Britain, "The Experimental Archaeology Camp from Beclean–Băile Figa, Bistrița-Năsăud County — 2010" as part of the "People of Salt" Project, financed by the Administration of the National Cultural Fund (AFCN). During several archaeological researches the Museum revealed at Băile Figa one of the most important Romanian archaeological findings — one of Europe's oldest rock salt exploitation sites, dated in the Middle Bronze Age.

Why experimental archaeology? Because, on the one hand, it facilitates a better knowledge and understanding of the past through experiments that reproduce aspects of ancient life and test the interpretations of the researchers, and, on the other hand, it represents a highly efficient way to attract the younger public towards archaeology and towards getting to know *salt* in a much different way than reading about it in school books. The artefacts of the salt exploitation are not as spectacular as other ancient findings, and this fact explains the lack of scientific studies, presentations and exhibitions in museums related to this very important economic activity. But regarding the success of this archaeological camp and the results of the experiments conducted in 2010 by the Museum at the Băile Figa site the Romanian museology slowly rallies to the European current of presenting ancient civilisations through the reconstruction of settlements with all their aspects, based on archaeological findings.

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Salinization as a trigger for historical change? The case of Mesopotamia

Sebastian Fink

Environmental explanations of historical change are a much-discussed topic in the last years and especially Jared Diamond's 2005 book *Collapse. How Societies Choose to Fail or Succeed* popularized the idea that most societies collapsed mainly due to environmental problems. Eric H. Cline, in his book entitled *1177 B.C. The Year Civilizations Collapsed* argued for a perfect storm, the combination of several factors that overburden societies at one point and lead to a severe crisis or downfall of a society.

With an article published in 1958 Thorkild Jacobsen popularized the idea in Ancient Near Eastern Studies that salinization was a major factor in the shift of power from southern to northern Mesopotamia around the year 2000. Due to the fact that we have texts describing the phenomenon of salinization from earliest times on we know that salinization was a problem for Mesopotamian agriculture. Unfortunately the texts do not inform us how the inhabitants of Mesopotamia dealt with this problem and so the historian has no direct evidence to decide if the Mesopotamian farmers were able to cope with the problem or not. Jacobsen argued that they were not able to reduce the amount of salt in their fields and thereby the crop yield was

reduced year by year. So, he argues, salinization lead to a decline of the economy of the south and, in a second step, to a shift of the power-balance between northern and southern Mesopotamia.

This paper explores Jacobsen's arguments and the controversies about his ideas in in the light of contemporary and ancient evidence and tries to answer the question to which extent the phenomenon of salinization can be used as an explanation for historical change.

Salt and Antiquity in the Iberian Peninsula: Research Perspectives

Nuria Morère

The work that we presenting an analysis of historical and archaeological research on the ancient Iberian salt, while laying out the prospects for studies that are opened to this territory, one of the most privileged of the Mediterranean and Europe.

In fact, the Iberian Peninsula is exceptional in terms of salt through its natural, geological and geographical conditions, which have resulted in complex political and socio-economic issues, better known since the Middle Ages as a result of the rich preserved documentation, but which are beginning to be discovered and interpreted also for antiquity by pioneering archaeology and especially by the first literary analysis.

Literary sources, though very partial, are of a very significant interpretation, and are essential as well as the results of the archaeological field work conducted on a small scale, which lead to the understanding of the general problem but also to the prospects for studies. By following and interpreting the methodology of Michel Mollat, we emphasize the following points for our analysis: documentary sources; the techniques; the qualities of salt; salt and politics (the Conquest of Hispania); salt and spatial planning (socio-economic context), the economy of salt (agriculture, fisheries, etc.), salt and men: food.

Salt outlets: Which statistical profiles in the Roman Empire?

Bernard Moinier

This contribution is aimed at determining to which extent statistical profiles could be elaborated with regard to salt outlets in the Roman Empire (even if Rome's rise to dominate over the Mediterranean took place during the Republican period). It is

merely considered as a geographical area[1]. The scholarly consensus of the total population of the Roman Empire centres around 60 million people. What would be the corresponding salt consumption? The yearly figure we are indebted to Cato the Elder[2] relates to domestic uses (too much for dietary intake, and less than appropriate to meet global requirements). As a foodstuff salt is used either in cooking or in food processing (fish salting, meat curing). The human priority for a continuous supply of food, clothing and housing largely depends on livestock. Besides dairy products, skins and leather include methods like dehydration via salt which improve their preservation and utilization. A number of goods destined for the Roman army, especially tents, require huge quantities of leather and hides for its equipment.

It makes sense to investigate which data are available in literature and archaeology to be used to elaborate statistical profiles. Such profiles are artefacts indeed. It is nevertheless easy to understand that they would obviate current lack of figures. The growing application of quantitative analysis in salt production and uses makes it essential to define a clear-cut methodology, its limitations and appropriate interpretation to compensate the absence of reliable statistics pertaining to its ancient economy. The pertinence of these post hoc constructions depends on the combination of available parameters (including demography).

We are doomed to develop a sensible ability to bypass the failure to make the correct evaluation of what the salt market was, with respect to its dietary uses, salsamenta processing, livestock activities, etc. Next to the meat itself, hides and skins are a significant source of income. As soon as the animal is killed, the hide is subject to decomposition by bacterial action. This decomposition is stopped by curing with dry salt or concentrated brine. With either method, the actual salt needs approximate 30 % even slightly less of green hide mass. The example of the tents necessary for the Army allows their calculation within this sector. 126 kg of salt are used for a standard tent (1.8 kg per hide × 70). The theoretical requirements of the Army represent at least 22.000 tents. The total of salt for that purpose relates to 2 800 t. By taking into account the requirements of the auxiliary troupes, although less important, the volume can be raised to 4 600 t. Similar calculation applied to other leather goods would contribute to a more accurate appreciation of what the global market might be.

Other outlets deserve similar elucidation and criticism. The difficulty remains to collect a good deal of information. Every trial paves the way to a better evaluation of salt economy, more especially with the view to check whether the offer meets the requirements of the demand.

[1] The Roman Empire extended from Scotland in the north to Numidia in the south, from the Straits of Gibraltar to Iraq in the east.

[2] 1 modius per capita (7,3 kg).

The halieutic circuit in Scythia Minor

Iulia Dumitrache

The author proposes an analysis of the salted fish industry and trade from the western shore of the Black Sea, focused on the quantitative and qualitative changes occurred in Roman times. Literary sources that do not cease to praise, without exception, Pontic *salsamenta*, are stubbornly silent on fish sauces. Although the Black Sea region was well known for its salted fish products, vats for fish sauces production were not found in this area, a challenging situation to explain.

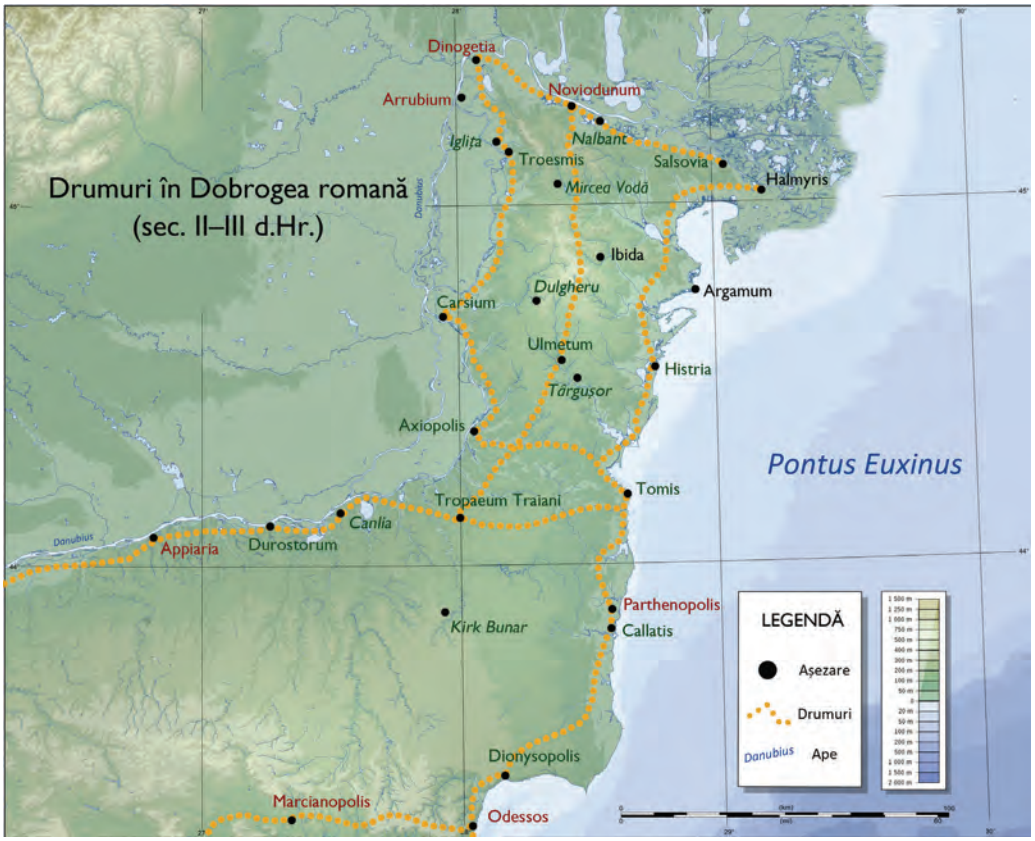

Figure 1. Roads in Scythia Minor during the 2nd–3rd century AD.

Use of salt in the Christian Church of Late Antiquity: Literary and archaeological evidence

Ioan Iațcu

Used during religious rituals (baptism, funeral) and medical procedures accompanying the healing process through *incubatio*, salt represented an indispensable element in the meals of Egyptian anchorites and it was mentioned under various forms, such as *sal frictum* (Cassian, *De coenobitorum institutionibus*, XXII), but also as raw material for preparing and curing various marine species, such as sardines (*moenomenia*). Literary sources mention the impressive amounts of dried fish sent by the Alexandria Patriarchate to the Church of the Holy Sepulchre, in Jerusalem (besieged by the Persians). Hence, for the Egypt area, archaeological discoveries and the information provided by *papyri* or *ostraca* confirm the existence of a tradition in fish processing in monasteries (St. Jeremias at Saqqara and the monastery of Bawit). In those monasteries, they traditionally had salted fish (*salsamenta*, *tarichos*) or a fermented fish sauce called *garum*, which was recommended by friar Pahomie in the diet of invalid monks. The fact that sometimes the Church had access to salt resources, which they could value to their own benefit, is apparent from the Edict issued by Emperor Justinian II in 688; he granted to the Church of St Demetrios in Thessaloniki the right to exploit one of the salt mines (*halyke*) near the city. A letter written by Pope Gregory the Great mentions that in Rome (among the estates owned by a monastery) there was also a salt deposit or a deposit of fruits and vegetables pickled in brine (*salgamum*). In this sense, it is only natural to wonder whether in the province of Scythia (Dobrudja), the placement of monasteries attested at Halmyris (Lat. Salmorus) and at Stratonis Turris (modern-day Tuzla; "tuz" means 'salt' in Turkish) was dictated by the existence of important agricultural, fish, and salt resources.

Salt "roads" in Moldavia by the 18th century: production, transportation, and consumption

Mihai-Cristian Amăriuței, Ludmila Bacumenco-Pîrnău

Though the title uses the term "roads," the purpose of this paper is not to reconstitute the itineraries of salt in Moldavia during the Middle Ages, but only to outline a possible history of salt east from the Carpathians, as well as three essential phases of its valorisation: production, transportation, and consumption. We do not claim our study to be exhaustive; furthermore, we mention the limits imposed by the

various sources of the time (documentaries, narrative, statistic, treasury records or records of 18th-century noble courts).

In Moldavia, there was an abundance of "very clean, crystal-clear salt," in the words of the scholar prince Dimitrie Cantemir. This mineral, indispensable for human diet and livestock breeding, has always been monopolized by the State (in terms of exploitation and outlets), including special taxes and exemptions, granted mostly to monasteries. Whoever failed to prove that the salt used for consumption came from domestic mines had to pay a special tax. Exploited directly by princely administration (by mid-16th century) and subsequently leased, salt mines were managed by dignitaries charged with monitoring production and collecting the incomes ("*cămăraşi de ocnă*" [salt mine administrators]). This income was sent either to the State (to the State Treasury), or to the prince (to the princely Treasury); these incomes were strictly accounted for, and special records were used for bookkeeping. In mid-18th century, some of these incomes were used for paying the wages of several high dignitaries in the country, such as the High Chancellor, the High Spatharios, and the Great Ban. In their turn, princes made significant donations to the monasteries in the Orthodox East, either in kind, or in cash (from salt incomes). Administrators were able to make small fortunes from their jobs; such an example is Căzan: in 1552, he ordered the copying of a very expensive religious manuscript. On the other hand, some of those who leased salt mines were unable to pay the due amount to the State in time; sometimes, they even had to pawn their jewellery to various merchants.

The *Şaigăi* ("mine workers") who "cut the salt" in the mines, assimilated to craftsmen ("all the salt taken from mines [...] is cut by specially designated people"; their job was "indispensable and harder than other jobs"), inherited it "from their ancestors". Besides their wages, they benefitted from tax exemptions and other financial aids.

From the mine, salt was transported as *drobi* ('blocks') and later as *moloz* ('crushed salt') in large sacks, in small or large wagons. Salt ended up on the country's roads during fairs (in 1670, a Iaşi-based *pârcălab* [administrator] was stated as the son of Neniuţul the salt-dealer, with still unidentified purposes); for its trading, merchants had to pay taxes to the princely court (in 1741, mine administrators were ordered to send 300 salt blocks, 30 *ocă* each, by rented wagons). They also sold salt to private households, for individual consumption.

Concerning household use, there are direct testimonies on salt purchasing and valorising in people's houses. There are also records on its use for cooking or for curing foods for the winter (salt fish, pastrami, sauerkraut, sheep cheese), for which salt was mandatory. Certain records of noble courts (which have lasted to our days) provide first-hand information on salt: purchase prices, sources comprising the annual amounts used in a countryside estate (in 1789, a noble court had used 2000 *ocă* of salt, the equivalent of around 2500 kilograms), bought from mines, for the estate's kitchens and for the livestock.

Salt works in Western Siberia in the first half of 18th century influence on the foreign affairs

Natalia Matveeva

The influence of salt works on the foreign affairs in Western Siberia has been repeatedly discussed in the scientific researches, but most historians observed only the period of the 17th century. Meanwhile, during the first half of the 18th century salt extraction remained an important factor in relations between the Russian subjects and nomadic tribes from the southern part of the region. The salt lakes' location became the basis for the cultural cross-contacts. Not coincidentally, the most famous of the salt deposits—Yamysh lake—in many state papers mentioned as a meeting point for embassies to conduct negotiations.

In the first decades of the 18th century salt works development depended on the nomadic tribes behaviour. Head of the salt works' group, which was going from Tobolsk fortress up the Irtysh river, was advised to avoid conflicts and military collisions by any means possible. If Dzungars were aggressive and didn't want to allow Russians to reach Yamysh lake, then the group had to strike into steppe and seek other salt deposits. But the nomadic tribes not always met Russian groups aggressively. They often allowed the salt miners to reach the salt deposits, and sometimes even offered them help - gave horses and camels for salt transportation from the lake to the coast.

In 1715, the Russian authorities have tried to confirm their right to perform salt works without any restrictions and on the regular basis. One of the first steps was the foundation of the Yamishevskay fortress during the I. D. Bykhgolts expedition. After the military conflict with Dzungars the fortress was destroyed, but it was rebuilt the following year. Consequently salt works in Western Siberia became independent from the nomadic tribes influence.

But in the 1720–1750-ies a new difficulty appeared. The prices for state-owned salt often were too high, so the farmers and urban residents went to steppe to the unknown lakes without authorities' permission where they mined salt for themselves and for sale free of charge. As a result of these expeditions such miners often died or were taken captive, moreover angry nomadic tribes made incursions on the territory of the settlements near the border and on the Kolyvano-Voskresenskie steel works that were under construction these years.

Salt and economic activities on the Pruth River, from Antiquity until the Late Medieval Period

Ioan Iațcu

This study proposes to present, from a diachronic perspective, the various economic activities attested along the Pruth valley, with an extension to the Iași microzone, provided by the existence of customs and commercial points. The discovery at Pruteni (the Republic of Moldova) of four furnaces for big amphorae destined to fish transportation indicates the existence of multiple economic activities in the middle Pruth area: fishing, fish processing, and trade. The pottery-making centre is directly connected, most probably, to fish processing activities, for which salt brought from an average distance was used. At the same time, watercourse favoured the transportation of these amphorae both downstream and upstream, using the towing technique. This aspect attests the dynamic of local trade in the Daco-Carpic environment: fish products were traded in local markets or used within merchandise exchanges with foreign merchants. In the settlements distributed along the Pruth valley, the presence of Roman amphorae deposits that transported Heraclea Pontica and Sinope wines indicates the existence of dock points for ships with merchandises, like the one at Țuțora, probably. The activities related to fishing in the Pruth waters and in its ponds or on its main tributaries are confirmed by a series of fishing utensils (hooks and fishing net weights discovered at Holboca, Hlincea in the 4th century, as well as in the 9th–10th centuries).

In the Late Medieval period, because it was turned into an imperial stream by the Ottomans, Pruth became the main axis connecting the Danube mouths to the Upper Dniester centres (Hotin). The navigable channel and the water body of Țuțora (*Zezora*) ensured the presence of ships carrying salt that sailed on the Pruth waters (*nehr-i Purut*) up to the Issaccea port on the Danube, alongside other types of vessels within the imperial fleet (*çekdirdi*), for which the upstream Ștefănești town was the *punctus terminus* in that period. Furthermore, three iron anchors were discovered in this place.

The Țuțora channel, along with the city of Iași, represented the outlet for carloads (*maje*) with salted or fresh fish, either from the Danube, the Dniester, or the Black Sea (sturgeon), or the Moldavian rivers, ponds, or stews (carp, crayfish), such as the "fish ponds at Vlamnic." For the Iași area, medieval documents attest two categories of fishermen who offered their merchandise for sale: "*păscariul prospătașu i sărătașu*" [fishermen for fresh and for salted fish]. This suggests that the second category knew how to salt fish, while the first category of fishermen merely sold fresh fish; the second category of fishermen used huge amounts of salt for their business. Accidental discoveries and the documents edited by the princely chancellery of Iași attest the use, within fishing activities and for transportation, of floats "on the Pruth" and of

boats (*șeici*), such as the log boat discovered in this riverbed. Made from a single log, it is dated to the 18th century, maybe even sooner.

The presence, along the Pruth valley, of certain toponyms (such as the village of Solonăț [which means brine], Fântâna Sărătă-Cârniceni, Budăiul Sărat of Mahalaua Frecăului in Iași, Sărata River valley within the Fălciu region, Gura Sărății, Sărata village, Sărata town) indicates the existence of salt water springs, most probably used for household purposes. For completing the picture of diet habits in this area (besides the archaeological evidence that indicates salted fish consumption in antiquity), medieval written sources also add Mediterranean delicacies (dried octopuses and mashed roe), and cured agricultural products, such as sauerkraut (*Bi-ma wa milh*) and pickled fruits, or animal products (salted meat and pastrami). All of them attest the use of salt as "rocks" or "boulders," a raw material brought from the "Mines" by carriage.

Organization and functioning of salt extracting industry in Bessarabia (1812–1850)

Andrei Emilciuc

In the Russian Empire, salt extraction constituted a state monopoly which was strictly regulated by the Salt Law of 1781 (including following complements to it), and was performed either by institutions subordinated to state or private manufacturers. After the annexation of Bessarabia to the Russian Empire in 1812, it was decided that extraction of salt from the saline lakes of the province to be given in concession to various local or incoming (from neighbouring guberniyas) entrepreneurs.

The Russian government set up here only a Salt Office, which managed the granting of concessions and levying of the contractual payments. Efficient organization of the process of salt extracting by privates determined a high competitiveness of the salt extracted from lakes of the province in terms of price, considering the fact that the salt trade was free of restrictions. Thus, the salt from Bessarabia was able to create a substantial competition to the salt extracted in the Crimea, where deposits were exploited with large investments by the Russian government. After several unsuccessful attempts to impose bans on salt export from Bessarabia to territories lying over the Dniester, the Committee of Ministers from St. Petersburg decided to take over local salt extraction industry. Thus, on April 6, 1837, Emperor Nicholas I approved the *Regulation on organization of salt industry in Bessarabia,* by which saline lakes were submitted to newly instituted Salt Administration of Bessarabia and private manufacturers were given a period of two years to evacuate the already extracted salt deposited near the lakes. This was followed by a strict regulation of the quantities of extracted salt, but also by a lack of investments, which culminated with flooding of the lakes in 1850, due to the failure to take required elementary prevention measures.

The export of salt from the Principality of Moldavia to the Russian Empire at the end of the 18th – early 19th century

Irina Cereș

An important role in the trade between the Principality of Moldavia and the Russian Empire was held by the export of salt. Salt represented an important resource for the Principality of Moldavia, as well as a strategic export product. Among the researches dedicated to the Romanian exports of salt a great significance hold the studies of A. Ilieș (1974), D. Vitcu (1979), B. Murgescu (2012), etc. However, there is no work until nowadays that would regard this problem in all its aspects and from the perspective of its consequences on the economy of these two states.

Because of the interdiction of trade with the Ottoman and the Austrian possessions, laid on the Romanian principalities, the Russian Empire became the main market for the Moldovan salt and wine. Salt was exported over the Dniester through the custom offices of Movilău, Isacoveț, Dubăsari, and Criuleni. At the end of 1807, Russia's interest for the salt brought from Moldavia increased. For instance, during one single year, between the 1st of June 1806 and the 1st of July 1807, Russia imported 5 mil. *ocale* (1 *oca* = about three pounds) of salt. In case salt wasn't imported directly from Moldavia, Russia purchased it from the Ukrainian market, where salt of Romanian origin was likewise imported.

The amount of Moldavian salt exported to the Russian Empire varied, throughout time, depending on the general conditions of the production process and according to the specific circumstances that occurred within the process of sale. An important place held the random fluctuations, becoming evident during the Russian-Turkish War of 1806–1812, when the exports of Romanian salt in the Ottoman Empire were seriously affected by the measures of the tsarist administration.

Salt exports of Bessarabia to Ukrainian and Russian Guberniyas (1812–1850)

Valentin Tomuleț

Salt was an important product in the export from Bessarabia to Russian domestic guberniyas. Its export was largely determined by the trade policy promoted by the imperial government in this area. After the adoption in 1816 of a liberal customs tariff, there were adopted new rules for the commerce with Bessarabia, which got generalized in the Council of Ministers decision of 28 November 1816. According to this decision all the goods, including salt produced in Bessarabia were allowed to be exported to domestic guberniyas through all customs and customs offices functioning

at the border between Russia and Bessarabia, on the basis of certificates issued by the regional administration, that were to confirm autochthonous origin of those goods. This measure has benefited the extraction of salt in Bessarabia and its export to the Ukrainian and Russian guberniyas.

After adoption in 1822 of a prohibitive customs tariff, on 17 February 1825 in Bessarabia was adopted the Regulation on the trade with Bessarabia, which allowed the export of salt to Russian guberniyas only through Dubăsari and Movilău customs, with requirement to own a special certificate on local origin of the cargo and to pay the duty. But at the insistence of Regional Administration, shortly after, the salt export was allowed also through other customs and customs offices — Odessa, Nikolayev, Ovidiopol, Mayak, Parcani. The export of salt increased especially after 1831, due to the suppression of customs cordon on Dniester River. In the years 1833-1849 only via Ovidiopol and Akkerman were exported to various Russian guberniyas 9.7 million poods of salt; in 1840–1850—after the establishment of the Company for Navigation on Dniester River—the volumes of export increased to 25.2 million poods, which created a strong competition for the salt extraction industry in Crimea. Exports of salt to the Ukrainian and Russian guberniyas ceased in 1850, when the lakes from the southern Bessarabia were flooded.

From blessing to punishment. The salt issue in the Romanian space in the 19th century as seen by foreign travellers

Mircea-Cristian Ghenghea

Present and exploited in all Romanian historical provinces, the salt represented a natural resource almost unavoidably remarked by the majority of the foreign travellers who crossed the Romanian space. Many of these offered relations regarding the salt sources and the way in which the salt was exploited and used. From the testimonies of the foreign travellers in the 19th century one can remark especially those belonging to German speakers and French travellers. The first ones emphasized the practical and economic side of the salt sources' valorisation, while for some of the others the ill-treatment of those who had to work in the salt mines represented an issue that necessarily had to be dealt with. In our paper we present and we try to frame within the specific historical context the most relevant of these testimonies in order to understand the reasons that led those foreign travellers to their points of view.

The export of salt from Moldavia to Poland (the second half of 18th century – beginning of 19th century)

Valentin Arapu

During the medieval era from Moldavia were exported to Poland in particular food and agro-livestock. Salt was among the export items, especially to the voivodships of Southeastern Poland. The export of salt from the principality into Poland was favoured by annual extraction of huge amount of this product and due to the situation that Poland used the imported salt abundantly. In mid-18th-century Moldavia, salt was mined in Târgu-Ocna, where 100,000 boulders was extracted each year, each weighing 100 *ocale*, and in Poland were exported tenth of its total volume, i.e. 10,000 units of 100 *oca* each, which represented 1200 tons. Unlike Muntenia that oriented its salt export in the Balkans, Moldavia oriented itself more towards Russian and Polish market. Thus, "in the period from 22nd of June 1801 to 19th of September 1802, i.e. for 15 months, 5,180,001 oca were sent from mines to "jetties" in Movilău (from Podolia). Of the total amount, the markets located in the South of the Danube received 16.8%, and the remaining salt was exported to Russia and Poland". Moldova exported 200,000 scales annually (one scale = 58-60 kg) of salt in Poland, Hungary, Russia and Turkey. The importance of "Moldavian salt in Polish bordering provinces" was often mentioned in diplomatic negotiations, such as those in December 1776 between the Minister of the Republic and the lord of Moldavia, Grigore Ghica, at Constantinople. Following the first territorial division of Poland, Polish salt mines entered under the Austrian authority. It is this fact that encouraged further export of salt from Moldavia to the independent territories of Poland. Meanwhile, some Polish officials tried to negotiate with the Moldavian princes discounts of the price of the salt. In 1787, Tadeusz Czacki tried to persuade Alexander Ypsilanti to lower the price of the salt exported to Poland. In 1791, Poland imported salt from Moldavia in the amount of 153,000 florins or 561,000 zlotys, so Moldavia was ranked sixth in the line of salt exporting countries into Poland.

Marine salt exploitation in the coastal area of Chile

Răzvan Victor Pantelimon

Our presentation will be a description of the traditional marine salt production in the coastal area of the central part of Republic of Chile. The sea salt produced here is the result of a very interesting procedure, which is a long process—from seven to eight months—requiring specialized knowledge, and dedication of the workers of the

salt. Another interesting point is that this way of producing salt, has been kept almost intact along the time, as well as the technology used. In our paper we will describe the way in which is produced the salt in the central coastal area of Chile using the same methods, proceedings and tools as a few hundred years ago.

Halotherapy in Graeco-Roman Antiquity

Roxana-Gabriela Curcă

The author emphasizes the role of salt in the works of Greek and Latin authors, with a special focus on the therapeutical proprieties of salt in treating certain diseases. The Greeks and Romans had a very good empirical knowledge on these practices, proving a real ethnoscience for a general and special spectrum of diseases.

The underground salt mine environment and therapeutic properties

Iuri Simionca

In 1949, Dr. Karl H. Spannagel, confirmed the benefic effect of patients with respiratory diseases treatment in Cave "Klutert" (Germany), then in the years 1950-1960 in the underground therapy is recognized and recommended.

Prof. Dr. Mieczyslaw Skulimowski in 1964 after 4-5 years of study mentioned therapeutic effect of patients with bronchial asthma (BA) in Wieliczka Salt Mine (Poland).

They are known 60 caves and salt mines or other origin used for underground treatment called "speleotherapy" (ST) or currently in the evaluation stage of potential curative properties, Inclusive in Poland, Austria, Italy, Czech Republic, Slovakia, Ukraine, Romania, Russia, Armenia, Iran and other countries.

In 1985 it was built "salt room" at surface for treatment in artificial salt mine microclimate (Union Institute of Pneumology, Leningrad / St. Petersburg, Russia), method of treatment is called "galotherapy / halotherapy". "Halotherapy" (HT) originated from the Solotvino - Slatina (Transcarpathian Region, Ukraine) allergy hospitals with sections in underground salt mines, artificial analogy of "salt room" named "ionotron" was realized in 1978 in Uzhgorod Branch of Odessa Balneology and Physiotherapy Institute.

In Romania, in the years 1970-1980 microclimate studies were performed in Tg. Ocna and Praid salt mines and some clinical investigation in patients with BA.

In the years 2002-2012 were made the projects in National R & D Program dedicated to ST in salt mines "Slănic Prahova", "Cacica", "Ocna Dej" and investigations

cave "Castle Valley"- Râșnov; in INRMFB - Bucharest it was realized the space for HT, experimental studies in laboratory animals with induced pathology, in BA patients and with other chronic respiratory diseases on effect and methodology cure.

In Salt Mine "Turda", after tourism arrangement completed in 2010 (PHARE Project), have been conducted studies — contracts for evaluating the quality of the underground environment and its speleotherapeutic efficacy

Houses constructed of salt in Herodotus and Strabo: the first halo-chambers?

Marius Alexianu

The father of history mentions the existence, in northern Africa, of a salt mine in an area where all inhabitants “have their houses built of the lumps of salt, since these parts of Libya we have now reached are without rain; for if it rained, the walls being made of salt would not be able to last” (Hdt. IV, 185).

Strabo (16.3.4) describes a similar situation in Arabia. Details are included within a fragment referring to the city of Gerrha “belonging to Chaldaean exiles from Babylon, who inhabit the district in which salt is found, and who have houses constructed of salt: as scales of salt separated by the burning heat of the sun are continually falling off, the houses are sprinkled with water, and the walls are thus kept firm together” (Str.16.3.4).

We highlight that, in both texts, the use of salt for house building is not motivated by the absence of usual building materials. Considering all of the parameters included in these descriptions, the author raises the question if these houses made of salt may have represented predecessors of the modern halo-chambers, and thus being actually used for halo-therapy.

New serum lipid biomarkers can be useful in bronchial asthma and speleotherapy treatment monitoring

Roua Popescu, Cristina Nica, Mihaela Bertescu, Ovidiu Mera,
Nicolae Țigănilă, Mădălina Necula, Iuri Simionca, Gheorghe Stoian

Bronchial asthma is a pulmonary disorder characterized by reversible obstruction of air flow, hypersensitivity of airway, chronic inflammation, generation of inflammatory mediators and epithelial cells exfoliation. Worldwide, asthma incidence increase with 50% for each decade and the most used classical biomarkers in patient monitoring are IgE, antibodies involved in allergic diseases. The aim of this study is to relieve new serum biochemical markers helpful to monitor the asthmatic patients and

to compare the experimental parameters values obtained from patients who took only medicines and patients who used an alternative therapy (speleotherapy) besides medicines.

In this study we used healthy patients (control group), untreated asthmatic patients and asthmatic patients treated by speleotherapy in Turda salt mine to analyse a number of parameters with a potential role of serum biochemical markers in bronchial asthma like total sialic acid, oxidized LDL and sialic acid from oxidized LDL.

Our data shows that pathological processes involved in asthma imply a sort of modifications in serum lipid profile, confirmed by the increase of total sialic acid levels (30%) and decreased levels of oxidized LDL (29.6%) and sialic acid conjugated with oxidized LDL (45.5%); after speleotherapy all values have tended to be normalized.

Based on this results we consider that our studied parameters can be successfully used in detection of bronchial asthma and monitoring the speleotherapeutical treatments in asthmatic patients.

Oxidative stress biomarkers useful in bronchial asthma and speleotherapy treatment monitoring

Cristina Nica, Cristina Cercel, Mihaela Bertescu, Ovidiu Mera,
Nicolae Țigănilă, Rodica Rogojan, Iuri Simionca, Gheorghe Stoian

Oxidative stress and reactive oxygen species (ROS) play an important role in the etiology and progression of a number of human diseases, being a significant component in the pathophysiology of airway disorders such as asthma and chronic obstructive pulmonary disease (COPD). ROS can interact in biological systems with a variety of molecules by electron exchange. This may lead to lipid peroxidation, enzymes dysfunction, induction of the pro-inflammatory cell signalling, and hence, serious alterations of cell function in inflammatory lung diseases.

In this study we analysed and compared experimental parameters values obtained in a group of asthmatic patients that followed, in addition to medical treatment, an alternative therapy (speleotherapy), and a group of patients who only used drugs, to identify a number of parameters with a potential role of serum biochemical markers in bronchial asthma like MDA, carbonyl and thiol groups and xanthine oxidase.

Our data shows that pathological processes involved in asthma imply an increased enzymatic activity of xanthine oxidase (28%), which correlates with increased levels of MDA (87.2%), carbonyl groups (80%) and decreased levels of thiol groups (37%); following our analysis, we found that after speleotherapy all values have tended to be normalized.

Based on this results we consider that all the parameters we studied can be successfully used in detection of bronchial asthma and monitoring the speleotherapeutical treatments in patients suffering from this illness.

Studies regarding the balneoclimatic potential of Cacica Salt Mine, Suceava County

Ioan-Sorin Stratulat

Priorities in the field are to correlate medical scientific research with the challenges of specific scientific and technical developments (genomic medicine, nanotechnologies and bio-nanotechnologies with clinical medical applicability), to comprise the standardization of functional medical recovery protocols — from the level of nanostructures to the level of the whole body, to correlate the natural factors of the climate with the influence of climate changes by creating a medical tourism facility.

Important factors when we are considering the right location for balneoclimatic therapy are:

1. *The local governance capacity* → supportive and goal oriented local authorities;
2. *The state of the local ecosystems and their ability to sustain social and economic activities* → existence of a healthy ecosystem; we analysed the Cacica salt mine, the resort and medical area in the salt mine, hydrotermotherapy using saline water. The salt mine was analysed from the anthropological point of view.

3. *The dynamic of human resource* → the necessity for the offered service, but also the presence of local people that can benefit from the economic input of the facility;
4. *The economic aims and opportunities* → a competition free (or low) area;
5. *The contribution of science and technology to the progress of the area* → the existence of an improved balnoclimatic therapy facility to attract connected investments;
6. *Pollution (air, water and soil pollution)* → area free of pollution;
7. *The vulnerability of the area caused by the number of poor people* → low rate of poor people in order for the investments to be local and, therefore, to improve the local living standards.

We have analysed all these factors from different points of view in order to determine the medical potential for rehabilitation in this natural area.

Halotherapy and sports

Maria Canache, Ion Sandu, Dan Canache,
Andrei-Victor Sandu, Viorica Vasilache, Ioan Gabriel Sandu

This paper presents a number of issues related to the instalment of saline aerosol generating devices in gyms, in order to create “fresh air” environments, suitable for the optimal carrying out of physical education lessons. By practicing proper and systemic individual and team movement games, but also through applicative pathways in an environment with salt aerolosols/solions, in the current environment of intense pollution, there is a substantial contribution to the development of students; resistance to disease, to a better functioning of the body and to obtain better sports and school performances.

Figure 1. Sports carried out in the halochamber — the boys group.

Salina Center Iasi — five years since we breathe healthy

Ștefana Andrei

Above-ground artificial saline has appeared as a solution for some of the current necessities of our communities. In Romania there are lots of places like this (private and individual or incorporated in medical unites) especially in areas where there are no natural salts reserves. At the moment, in Iasi there are three artificial units with really varied purposes: therapy, relaxation, fun, free time, recreation space, business meetings.

Our unit, Salina Center Iasi marks the pioneering faze in the domain in Iasi and Moldova. At Salina there can be found two types of salt, from natural salines, the salt blocks are from Praid and Tg. Ocna. There can be observed two interesting types of blocks: processed from Praid in order to deliver a more pure salt block and unprocessed from Tg. Ocna. Inside this king of salines it is necessary to imitate the natural conditions of temperature and humidity in order for salt to give us all of its benefits. Besides the physical manifestation, that can be observable with the naked eye like: dusty white fluorescence or crystalized that are new layers grown from the principal salt block, salt also gives us the curative benefits: concentrate obtained by evaporation from the saline and as saline climate generator.

Our space functionality it depends on the activity the client/ applicant to our services wants to conduct inside the unit: corporate events, support groups meetings, business presentations. This kind of activities are previously scheduled in order to not affect the daily program. Also the unit space can be used simultaneously as playground for kids, coffee shop, cinema, conference room.

Economically speaking we can observe two periods when the incomes are increasing.

1. The autumn end — winter — and spring start. (Period that is characterized by the presence of allergens or because of the colds that are frequently in the winter season).

2. In summer, when the hot days are a problem (temperature over 35°C), the saline represents a refuge with appreciated temperatures around 16–18°C. Standard temperature in the natural salines.

There is still a category of clients worth to be specified, those who cross our threshold, or how we love to call them, the friend from Salina: the children, they come to us no matter the season, they are coming for immunization and to prepare their organism for integration into society/collectivity (schools, kindergartens). But also the people with diseases for which is indicated the saline aerosol cure as a way of maintaining the health condition without replacing the drug treatment. We are talking about those who suffer from respiratory diseases (asthma, bronchitis,

respiratory infections with allergic nature, seasonal colds), chronic fatigue, depression or low resistance to stress.

In a non-saline area, the distance represents a problem, this is why the artificial salines represent an alternative, by offering this type of treatment with saline aerosol for those who need it and also for those who want to maintain a balanced physical and mental health.

Figure 1. Walls made from rock salt slabs (left) and children in a workshop (right).

Salt of the earth: making the case for environment

Naomi G. Riddiford

Interest in early salt production has increased greatly in recent years, reflected by the growing number of publications and conferences on this topic internationally. It is encouraging that the importance of salt as a natural resource and its role in society since prehistoric times are gaining wider recognition. However, consideration of the environmental context and human–environment relationship of salt making is conspicuously absent, with few exceptions. This is problematic, given the intrinsic link between salt and environment, which would have influenced (along with social and economic variables) the establishment, success and longevity of production sites. The aim of this paper is to encourage the salt community to incorporate environment into future discussions and research, by demonstrating (through review of published literature, including the author's own work in the Seille Valley, France) how this can enhance understanding of site organisation, waste disposal practices, natural and human-induced environmental change, and the ongoing viability of early salt making centres.

The distribution of resources and quality of salt in Europe

Gheorghe Romanescu

Salt has a marine origin. The main element of salt is represented by sodium chloride (NaCl). The difference in quality is given by impurities. Salt is found in the form of underground mineral halite and in mixed evaporitic form in salt lakes. Seawater has an average salinity of 3.5%, of which 2.6% is represented by NaCl (26 million metric tons per cubic meters). In terms of chemistry, salt contains 60.663% Cl (elemental chlorine) and 36.337% Na (sodium). The most important element of salt is sodium chloride.

Worldwide salt resources are virtually unlimited. From this point of view Europe has a leading place given by the salt basins in Poland, Germany, France, Austria, Romania, Ukraine, England, Spain, Slovakia, Bosnia and Herzegovina etc., which, at the same time, hold the supremacy in the production of salt. Salt deposits in Europe have different ages: Paleozoic salt deposit (Permian) (Röttiegend below Zechstein which covers the territory of Poland, Germany, Denmark, the Netherlands and the North Sea, Ukraine, Russia); Mesozic salt deposit (Spain, France, Britain, Austria, Switzerland, Slovakia); Tertiary salt deposit (Romania, Ukraine, Slovakia, Poland, Bosnia and Herzegovina, Italy, Spain, France).

Most of the salt is used in the chemical industry (60% — chlorine, caustic soda and soda ash), followed by household use (30% — to regulate physiological functions of the human body, food preparation) and other uses (10% - Road de-icing, water treatment, protection of coolings brines etc.). The annual production of salt around the world exceeds 200 million tons. 33% of salt is obtained from evaporated sea water (solar salt), 33% comes underground or surface deposits exploited in rock form and 33% is obtained from brine deposits.

Neogene and Quaternary salt in the Central Andes (Peru, Bolivia, Chile and Argentina)

Ricardo N. Alonso

South America´s Central Andes provide one of the planet´s highest evaporitic concentrations. Two metallogenic provinces that possess world class deposits (WCD) belong to this geographical area, overlapping one another: the nitrate-abundant Chilean Province and the (sodium) borate-abundant Central Andean Province. We must also take into account the fact that there are enormous amounts of halite or rock salt in neogenous rock strips that can measure up to one hundred kilometres in

length ("Giant Evaporite Belts", Alonso, *et al*. 1991, Geology, 19: 401-404), while considering the large amounts of rock salt that can be found in modern day salt pans. The Uyuni salt pan in Bolivia, the Atacama salt pan in Chile and the Arizaro salt pan in Argentina are the three largest salt flats of the Andean Mountain Range. The halite core of the Atacama salt pan consists of 3000 square kilometres of sodium chloride. It is by far the highest concentration of salt on Earth. The Uyuni salt pan can easily be noticed from space and occupies the entire width of the Bolivian highlands, stretching over a surface of 10,000 square kilometres. 100 more salt pans provide important quantities of common salt that are distributed along the South part of Perú (Salinas Lagoon) to Northern Argentina (Antofalla, Hombre Muerto, etc.).

There are two types of salt pans, depending on whether they contain a developed halite core or not. Consequently, salt flats can be mature (crystal deposits) or immature (earthy). The explorations have revealed pure halite veins up to several hundred metres thick. An important part of the salt flats is represented by the brines, rich in valuable chemical elements, such as lithium, potassium, magnesium, boron, caesium, rubidium and strontium.

The current paper proposes a definition of the Central Andes region as the Sudamerican Evaporite Province, whose formation lies in the mixture of geological, geographical, morphotectonic and climate related factors. The processes that generate the evaporitic activity are linked to volcanism, thermalism, the endorheic nature of closed basins and the arid climate. All of these factors are present in a non-collisional orogen that was created by the normal (30°) subduction of the Nazca oceanic plate, which fell under the Continental South-American plate.

Salt use dates back to the ancient people of the Andes, who employed it for trading purposes with the damp valleys in the East, carrying it on camels´ backs. Later on, the Spanish exploited great amounts of salt and used it in the silver industry in Potosí and in other rich mining districts.

Ethnographical perspective on salt in Japan

Takamune Kawashima

Salt studies in Japan have been developed by ethnology, usually recognized as folklore, as well as history which could reveal the salt production after the 8th century. As noted elsewhere Japan's salt has been made by seawater since the Jomon period. Folklore covers various tools of salt production, life of salt makers, trade, utility form of salt, etc. Salt is used for fermented food and seasoning production, such as soy sauce, fish sauce, soy paste, etc. Not only salt but also bittern, left over after the crystallization of seawater, is used for making soybean curd. While these food tradition was greatly influenced by the continent, no direct trace of salt production between Japanese archipelago and the continent is clarified. Salt also has been used in industrial field, and played important role in religion, Shintoism and folk beliefs. The importance of salt in the inland areas can be seen in major place names, which were mostly connected with salt trade, except one, Shiogama where the shrine which produces salt for ritual is located. Numerous land names from inland areas containing the term 'salt' could produce salty water including hot springs. However only a few examples of salt production from salt springs are known. As salt production is strongly connected with the local history, especially along the Inland Sea, many museums keep and exhibit historical and folkloric collections relating salt production. In this paper, I will focus on salt production and usage of salt seen in ethnography and try to link them with archaeological remains.

Traditional salt exploitation in South-eastern Transylvania

Andrea Chiricescu

The ethnographic research campaigns initiated by the National Museum of the Eastern Carpathians and Exeter University, conducted in 2003–2005, 2006, 2007–2008 and 2012 were intended to establish the role, place and significance of salt in traditional village communities in south-east Transylvania. The aim was to outline the specific 'ethnographic scenery' created by the presence or absence of nearby salt sources. The research and documentation of the traditional exploitation methods of all types of salt sources, in terms of processing and use of salt in the household in everyday life, is still an on-going process. Its preliminary results were published in 2013, as a collection of raw, unprocessed information. Their interpretation, synthesis, contextualisation and all the connections with other researches carried out in similar geographic areas are being carried out as we speak. Earlier work had established the

existence of four large saliferous areas in south-eastern Transylvania, in which ethnographic research was conducted (Reghin-Gurghiu Valley, Homoroade Valley, Bistriţa-Năsăud, and Praid–Sovata–Corund areas). The common characteristic of these geographical areas is the large number of salt sources, covering a wide range of source types: salt marshes, brine springs, wells, pools, lakes and salt rock mountains. This variety raised a number of questions from an ethnographic point of view. In our researches we focused especially on those linked to traditional exploitation methods and the role that salt sources play in the everyday life of nearby communities. Although there is a large variety of sources and methods to exploit them, we found some common aspects which are further to be compared with other geographical regions of Romania and, even further on, with other countries of the world.

The presentation comprises a typology and short description of the salt sources with a special focus on brine wells, the main ways of their identification and exploitation, concluding with the use of brine and rock salt in the traditional household. As a primary general conclusion we considered that there are no significant differences in the traditional methods of exploitation and appearance of salt sources in Transylvania, or for that matter in Romania. The differences however lie in the details, and a more specific research will prove us right or wrong.

Figure 1. The brine well from Cepari, Bistrița-Năsăud County. Drawing by Éva Ibolya Délczeg.

What factors contribute best to preserve the heritage of inland salinas in Iberia?

Katia Hueso Kortekaas

The Iberian Peninsula is extraordinarily rich in inland salt heritage. Besides the renowned coastal salinas and salt mines or the lesser known saline lakes and rivers, more than 500 references to inland solar evaporation salt making sites have been found in this region, operating in different periods in History. Half of them have been abandoned before the 20th century, many of which have disappeared altogether. Of the other half, less than 10% still are or have been active in the last couple of decades. Some of the latter have had a great historical relevance, featuring important cultural and natural values, which have granted them public attention and legal protection.

This contribution presents the conclusions of a recent study on the nine inland salinas that have thus far been declared as a Good of Cultural Interest in Spain. The main outcome of this research is that this status does not necessarily guarantee the preservation of their heritage, which in some cases is actually in process of decay. The most effective way to preserve this heritage seems to be the production of artisanal salt, followed by the creation of tourism products and services linked to the salt itself and its associated values. Artisanal salt making can thus be a heritage-friendly activity

Figure 1. Salinas of Imón, Guadalajara, Spain, a good of cultural interest, but currently inactive.

that guarantees the preservation of both tangible and intangible cultural values, as these are in turn needed to sustain the activity itself. Other factors that seem to contribute to the positive outcome in the preservation of these values is the presence of public authorities in the managerial structures of the site; the creation or support of horizontal ownership organisations (cooperatives, associations…) and the use of strategic plans or similar documents to guide and assess the management decisions.

Yām HaMélah — The Sea of Salt

Arina Ceaușu

Viewed from multiple directions the facts about **salt**, from use in time, from Prehistory to present, indispensable substance in the nutrition of humans and animals, the multitude terms derived from the word *salt* in onomástica and toponymy, in general, the echo in folklore and literature, all together give the dimensions of a spread that is preceded only by water, air, earth and fire.

From the various hydronymy related to salt only one belongs to a Sea: Yām HaMélaḥ, in Hebrew — "The Sea of Salt", located in the Jordan Valley. This is not the only name, at least two others largely used: "The Dead Sea" the present name in many languages, and "Asfaltida" in the Greek and Roman period.

References about Yām HaMélah and the events that took place on the banks of the Sea are mentioned for thousands of years. In the Bible, the Dead Sea is called the *Salt Sea*, the Sea of the Aravah (meaning the Sea of Desert), and the Eastern Sea. The presence of King David, or of the Herod the Great are only few examples through the history. Illustration of "Yām HaMélah" appeared on the Mosaic Map from the early Byzantine church of Saint George at Madaba, Jordan, in the illustrations of "The Itineraries of William Wey" (15th century) and in Tabula Peutingeriana (16th century).

Several Characteristics: It is located in the Earth lowest elevation on dry land, at –427 m. Its surface 1050 km^2 in 1930 was gradually reduced to 600 km^2 in our days. Jordan is the major inflow source, the rains are rare, entire zone is arid. The salinity of the water is 34%, about 10 times more than the Mediterranean Sea, and the water density of 1,240 kg/m^3, makes unclear the difference between swim and float. Beside sodium chloride (NaCl), the water of the *Sea of Salt* contains calcium chloride, potassium chloride, magnesium chloride. The concentration of sulphate ions is very low, and the concentration of bromide ions is the highest of all waters on Earth.

From the Dead Sea brine chemical companies produce potash, elemental bromine, magnesium metal, caustic soda and sodium chloride.

The water has unique therapeutic properties, well known from antiquity. Cosmetic products containing the beneficial minerals from Dead Sea are developed and manufactured in Israel and commercialized around the world.

The vicinity of Masada fortress – the symbol for Jewish Freedom and of Qumran caves – the finding place of the "Dead Sea Scrolls", bring additional special attributes to the region.

In order to stop the continue drying process (about 1m per year), a project is in evaluation to convey seawater from the Red Sea near Aqaba to the Dead Sea, through a channel of 300 Km long. Present in the economic life of three government bodies, mainly for Israel and Jordan, the *See of Salt*, certainly not *dead*, contributes significantly in the life and the revival of an important region.

Huixtocíhuatl. The Goddess of Salt

Martha Monzón Flores

In this paper, I aim to present the main traits of the Goddess of Salt, in an attempt to reveal the importance this mineral had for the lives of the indigenous people, during the final years of the Mesoamerican splendour (before the arrival of the Spanish). The present paper focuses on an ethnohistorical perspective.

Religion was closely interwoven with the power relations of the ruling circles and was created by incorporating deities pertaining to previous periods, gods whose powers over nature´s forces were already acknowledged and others whose characteristics were clearly oriented towards the military aspects and human sacrifice. Thus joined, military and religion were subject to political approval, contributing to create a stronger State.

The objective of this paper is to pinpoint the importance salt had in the life and rituals of the Mexica people—to the point where they created a goddess named Huixtocíhuatl—whom the salt mine workers worshipped in order to ensure she provided them with this basic necessity. The goddess was also worshipped by traders or the Pochteca population, who prayed to have successful journeys, hoping that salt reached the regional markets. A specific date was set for the celebration of this goddess. Festivities included rituals and human sacrifices in which all the dwellers of México, Tenochtitlán took part. The timeframe is set during the Postclassical period (900 A.D to 1521 A.D), in the Valley of México.

Sulphur, mercury, salt: the juncture of transcendence and concretion in hermetic metaphysics

Aaron Cheak

Since Paracelsus (1493–1541), salt has played a role in alchemy as the physical "body" which remains after combustion, the corporeal substance that survives death to reinaugurate new life. It was both 'corruption and preservation against corruption' (Dorn); both the 'last agent of corruption' and the 'first agent in generation' (Steeb). Salt, it seems, straddles dualities, and to understand this, the present study explores the rich body of alchemical precepts and practices in order to highlight the function of salt as a "juncture of transcendence and concretion". In the language of western alchemy, salt embodies the ligature between the primordial polarities, sulphur and mercury, mineral theophanies that, together with salt, represent the three formative metaphysical principles inherent to phenomenal reality. To provide adequate background to this, a historically grounded phenomenology of salt is first undertaken, drawing on perspectives from philology, mythography, chemistry, philosophy, and, of course, alchemy. These multiple modes of access highlight what Visser calls "the contradictions [salt] embodies", and how it becomes a "generator of poetic and of mythic meaning". Ultimately, the role of salt in hermetic metaphysics should be seen as a principle worthy not just of material explication, but of meaningful philosophical, symbolic, and soteriological investigation.

The salt of Ivory Coast (Africa)

Adopo Kouassi Laurent, Romanescu Gheorghe

Salt, commonly called sodium chloride, has not been industrially exploited in the Ivory Coast. The main reasons are: the saliferous episode known from geological studies on the western Atlantic margins is dated from the Lower Aptian and was more pronounced in the basins of Angola, Bas-Congo and Gabon; the sub-equatorial position at that time did not favour the accumulation of brines on the cord Ivorian coast; the inhabitants of the areas of the coastline are predominantly farmers. They grow cocoa, coffee, rubber and pineapple trees. These products are very cost-effective for the population at the expense of salt. However, this country has a coastline of nearly 600 km long, including 350 km of low coast, and salt marshes may be harboured in its eastern part. Indeed, in Grand Lahou on the Ghana border, high tides often cross the barrier beach. It is therefore possible with appropriate training, to lead populations to engage in salt exploitation as a form of profitable business,

because the cash crops are often dependent on market prices and given the fact that at present, the Ivory Coast has to import salt either from Niger or from Europe.

«Salt of the Earth». Salt extraction and trade in Lomas del Real (Costa De Altamira, Tamaulipas, México). A 3000 year old tradition that is becoming extinct

Gustavo A. Ramírez Castilla

In 2002, the excavations for a new road revealed a 2900 year old indigenous village within the port area of Altamira, Tamaulipas. The above mentioned area spread along ten thousand hectares, half of which were floodplains that belonged to the Lomas del Real congregation. This territory was part of the marshland where, for almost 3000 years, the ancient—as well as the modern—inhabitants of Nueva España have extracted the so-called «salt of the earth», a mineral that was the region's most important natural resource up until the middle of the last century. Over the last 30 years, the marshlands have been filled in to form the infrastructure of a gigantic industrial zone communicating with the sea. This entailed a fatal blow for small local companies and cooperatives, the last stronghold of what was once a flourishing salt-making tradition in Altamira.

Lomas del Real was founded in the mid-eighteenth century, a time when Spanish colonists occupied the territory of modern-day Tamaulipas, located in the northeast of the country. Colonization came late to these territories due to the fierceness of the indigenous tribes of hunters and gatherers that had already driven away the huastecos, the land´s former dwellers. 15th-century documents reveal that the huastecos embarked on the perilous journey back to their previous settlements, in order to bring with them a small amount of salt. Archaeological excavations performed since 2006 in the port area by the author of this presentation have led to the discovery of possible evidence of such incursions. Among these are a series of exotic sumptuary objects that are thought to represent indirect evidence of salt extraction and trade between 900 B.C. and 200 A.D., revealing commercial ties to faraway regions such as Guatemala.

Salt in Canada — distribution and reserves

Ioan Nistor, Gheorghe Romanescu

Canada's territory holds some of the largest deposits of salt (rock salt) on Earth. Their discovery and exploitation coincided with the prospecting of oil and natural gas

reserves. Impetuous development of chemical industry resulted in increased production of salt in almost all states that have important resources. Salt deposits in Canada are divided into three distinct areas: the Atlantic Provinces, Ontario and Western Canada. The salt is extracted from these deposits using two processes: underground mines and brine. Thin layers of salt in the Atlantic Provinces, belonging to different geological eras are located in Nova Scotia, New Brunswick and in some sectors of the Gulf of Saint Lawrence and Newfoundland. The salt deposit in Ontario is located in the area surrounding the Huron and Erie lakes. It is in this deposit that the largest salt exploitation on Earth was created: Goderich, which annually produces over 9,000,000 tons of salt. Western Canada holds thick deposits of salt located in the Alberta, Saskatchewan and Manitoba states. This area is home to one of the largest deposits on Earth, that sums up a reserve of over one million billion tons of salt. This deposit has an average thickness of 122 m and covers a surface area of 390,000 km^2. Evaporation salt (solar salt) in Canada reaches a production of 470,000 tonnes per year, and is extracted from the southeast coast. Canada is ranked number 5 in the global production of salt.

Environmental care in modern salt production

Ramón Ojeda-Mestre, Tamara Montalvo-Arce,
Jesús Montaño-Avilés, Maribel Patiño

México has an important experience to share in environmental protection in the Peninsula of Baja California. We have very important wild life surrounding our most relevant mining industry 7 million tons of salt production per year. Hundreds of whales, all kind of pacific ocean fishes, millions of different bird species, turtles, coyotes, hares, snakes, puma, goats, cimarrons and many other animals and beautiful wild life vegetables near to lagoons and the sea coasts are a well-protected and monitored environmental inheritance we take care simultaneously with the salt production.

The salt extraction on the region started little after the discovery of the fossil deposits and potassium nitrate naturally formed for the immense areas flooded in the low parts of the swamps from “Laguna Ojo de Liebre”. Those deposits of salt or floors were formed by the natural evaporation of sea water that flooded the impermeable and flat lands during high tides.

Using the method of water evaporation by solar energy of sea water. was this way that Exportadora de Sal came to have an approximated extension of 89 Km^2 and a yearly production of 79,790 tons of salt and an operative infrastructure able to produce, transport and ship 7 million tons of volume per year. Actually Exportadora de Sal conts with 28,184 hectares (281 Km2) of evaporation ponds or concentration areas, 3000 hectares (30 Km2) of crystallization ponds in the low lands adjacent to the ponds “Ojo de Liebre” and “Guerrero Negro”.

Exportadora de Sal current facilities are located between Baja California and Baja California Sur States. On the one hand, in the region of Guerrero Negro, B.C.S., to four Km to the south of the 28 parallel, in the pacific slope of the Peninsula de Baja California and for the other one in Cedros Island, B.C.

The production process is still carried out by means of solar evaporation of sea water.

Baja California Sur — the Queen of Salt in Mexico

Jesús Montaño

This video shows the challenge and commitment with the environmental sustainability of the biggest salt producer in the world located in Baja California Sur, México.

This sea salt producer and facility is situated in one of Mexico's most ecologically-sensitive national reserves. The Guerrero Negro region is located within the Great Biosphere Reserve of El Vizcaíno, managed by the National Commission of Natural Protected Areas and with a total of 2,546,790 hectares it is the largest protected area of the country and one of the largest in Latin America. The reserve is part of the UNESCO International Network of Man and Biosphere Programme and the Ojo de Liebre Lagoon, is the principal whale reproduction and mating ground on the Pacific coast.

It is one of the world's largest salt exporters with a 10-million-ton annual production, has strengthened its environmental commitment in its 33,000 hectares of salt "harvesting".

Salt exploitation in Africa

Kouame Kouassi Innocent, Romanescu Gheorghe

Salt was and still is an important commodity for the people of Africa. Although salt did not present interest for Western markets directly, it was of great importance to the trans-Saharan trade in Africa. The salt used in the Sahel and the Sahara served, between the 18th and 19th centuries, as exchange currency with which traders from the Sahara paid and acquired slaves from their Ethiopian and Soudan (Niger and Nigeria) owners. By the twentieth century, the trans-Saharan trade focused on the export of salt to West Africa and that of gold to North Africa. The amount of exploited salt was poorly estimated in this period. The main salt deposits were Tishit and Ijil (Mauritania), Trarza and Aulil (Senegal), Taghaza and Taoudeni (Mali), Tegidda, Bilma

and Fachi (Soudan). To this day, salt deposits are mined in Africa mainly for basic food needs. Reserves and also the extraction techniques are diverse.

The majority of salt reserves are inland lakes dried up during the dry season and exploited in a traditional way by the population. This is the case of Pink Lake (Senegal), Lake Assal (Djibouti), the Afera and Assale Lakes (Ethiopia), Lake Katwe (Uganda), Lake Quaroun (Egypt), Lake Taoudeni (Mali) and Lake Karoum (Kenya) (Figure 1). Around 50,000–60,000 tonnes of salt are used each year from the Pink Lake in Senegal. Other extractions of salt from salt marshes are done using an artisanal mining technique as in Guinea Conakry. A significant part of salt deposits are mined industrially in various kinds of deposits. This is the case of Tunisian deposits exploited on the seafront, deposits in Ghana whose production varies between 250,000 and 300,000 tonnes and that of deposits in Senegal, Mauritania, South Africa, Niger, Namibia, Morocco, Botswana and Cape Verde.

Figure 1. Countries of Africa with at least one exploitable rock-salt outcrop.

The 'patrimonialization' of the Maras Salt Mines (Cusco, Peru): Traditional salt production systems and their use in tourism

Oriol Beltran Costa

During the last few years, the Maras salt mines have become a must see location on all tourist itineraries beginning in Cusco, in the Peruvian Andes. Nowadays, the terraces consisting in salt water evaporation surfaces are considered to be a common tourist attraction, among traditional options such as Machu Picchu and the surrounding visiting spots one might encounter—aside from the monuments and archaeological sites of the Andean capital—on the Sacred Valley of the Incas route (i.e. Chinchero, Ollantaytambo or Picac).

This presentation proposes an analysis of the patrimonialization process undergone by the Maras salt exploitation sites over the last decade. This activity which—until recently—focused on obtaining salt for general use and for regional interchange (in the form of barter) has undergone a series of changes. The transformations apply not only to the manufacturing procedures, but also to the monetary value of the finished product and to the way work is organized, rendering it a valuable touristic attraction. The current example provides, thus, an interesting reference in order to evaluate the challenges brought on by the contemporary use of traditional salt production systems.

Ukrainian traditional salt traders ("Chumaks") in the north of the Sea of Azov (Case study of Berdyansk District)

Igor Lyman, Viktoria Konstantinova

The North of the Sea of Azov remained for a long time a region of activity of Ukrainian traditional salt traders — the Chumaks. The expansion of Chumaks directly into the area where today the city of Berdyansk lies, was directly connected with the Zaporizhzhyan Cossacks, who collected salt in the local estuaries, although these territories till 1774 belonged to the Ottoman Empire. When the lands became part of the Russian Empire, Russian and Ukrainian entrepreneurs began to rent the local estuaries exactly for salt extraction. The situation was changed significantly in the nineteenth century, which was directly related to the emergence and development of the port city of Berdyansk. The opening of the pier and port development created conditions for the transformation of this area into a powerful centre of trade where Chumaks' wagons were directed. There are many reasons to talk about originality and grate significance of the phenomenon of Chumaks, which is far beyond the purely economic sphere. To study this phenomenon we have conducted extensive archival and library research for several years. Interesting folk materials, including Chumak songs were found. Besides, we have conducted a series of oral historical expeditions in the North of the Sea of Azov. Their results showed that folk memory about Chumaks is quite deep.

Salt in Georgia

Manana Odisheli

The Georgian or *Kartvelian* language does not belong to the Indo European language group and it is no surprise, that is does not resembles the most widespread name of the substance of the sodium chloride salt but it is *marili* – მარილი. The problem of the salt production has not been studied extensively, but fact remains that Georgia was not rich in salt and there were virtually no salt mines. Historically salt was imported from Armenia, Persia, or even from India together with the Indian spices that reached Georgia through the Silk Road. Agriculture started in Georgia as early as the 7 Millennium BC, the Shulaveri, Arukhlo cultures already demonstrate an advanced agricultural society with the settlements consisting of up to 60 dwellings. The increasing population needed salt for their own diet as well as for the animal husbandry. Georgia is extremely rich in rivers and mineral waters, that perhaps were used as a source of salt; sea water from the Black Sea could had been used for producing salt. But there is a lack of scientific research in this matter.

Georgian expressions and folk tales explicitly demonstrate that obtaining salt was not an easy business. When somebody dies, Georgians would say humorously that he had 'gone for salt' There is a Georgian say: 'Do a good thing and sprinkle it with salt', meaning that as salt makes food taste good and brings all ingredient together, so must a good conduct be accomplished. A wholesome person would be described as 'salty'.

The Georgian fairy tale 'One and a half handful' is a cautionary story of a peasant who set up for a journey to the town to get a handful of salt, where he had been accoutered with different situations; his response and conduct was always considered to be inappropriate; the poor guy was beaten up on every occasion and went back home empty handed. The moral of the story was that only money could not buy you salt, one had to be more diplomatic; one should not only know other peoples' habits and traditions but should be a smart decision maker as well.

The most deprived of salt was, Svaneti, the highest inhabited mountainous region of Europe. There are numerous mineral waters in Svaneti, but they also cannot supplement sufficient amount of iodine in the Svans' diet and they have been suffering with thyroid problems for generations. Lack of salt was substituted with a delicious combination of dry garlic, lots of herbs and spices mixed with salt. Svaneti salt became a favorite condiment in Georgia. The famous Georgian film director Mikhail Kalatozov made a brilliant film 'Jim Shvante' (salt of Svaneti), one of the first artistic documentaries in the world.

Nowadays Georgia exports salt from the neighboring countries such as Russia, Armenia and Iran, also from Ukraine and Poland. There was a scandal recently in

Georgia concerning the imported Iranian salt that contained lead and mercury, harmful for health.

Salt in Romanians' traditions. Notes for the intangible heritage in Dâmbovița County

Ana Ilie

The author reviews the traditional practices in the use of salt for the curative or apotropaic purposes identified in the Southern Carpathian, specifically on the territory of Dâmbovița County. Despite of the earlier destructuring of the traditional village life, occurred in the middle of the 21st century, which made this area systematically excluded from the ethnographical studies, we were pleasantly surprised to find out that there are still in use different curative magical formulas and many others customs, superstitions and divination practices regarding the salt.

This study has two parts; the first one is an inventory of different treatments or hygiene practices using the salt as active substance. The treatments are used for inflammations, local bleeding, facilitating intestinal tract, stimulating potency, colds and flu or hepatitis.

The second part was dedicated to the gathering and understanding of the traditional practices, in which the practical and magical qualities of the salt are integrated in magical practices and in rituals used to provide protection and safety for the human and animal community. The role of the salt is explained in different chants, is evocated during the festivals in which it takes place the sacralisations of the salt and in different forms of use of the sacred salt.

All this customs gathered in this area of the superior courses of the Dâmbovița and Ialomița rivers are compared with those documented in the other, more traditionally ethnographic area, as Moldavia.

Wooden recipients used for salt. An ethnographic approach

Roxana Diaconu, Vasile Diaconu

Within the range of objects belonging to the world of the traditional village one might also find the wooden recipients used to transport, keep and process the salt. In the Subcarpathian zone of Moldavia there are known different types of recipients for salty water (brine) or for the crystallized salt, such as: *bota, fedeleșul, cofa, piua*

pentru sare, sărărița, solnița (Figure 1). Those were all made out of wood or bark tree. Generally, they were of medium or small size, 1as they were made by assembling pieces of wood or by carving in wood. As seen in the area of our survey, the most frequent ones are the recipients used for keeping the brine. From the functional point of view, several wooden vessels were used only for salt, while others could have been used for both salty water and/or other liquids. The wooden recipients used for keeping and transporting the salty water bear no metal components. In the same time, the wooden vessels were used to preserve the salty water only for short periods of time, while for longer ones one might chose the clay made vessels.

Some wooden vessel, namely the *bota*, were made in order to facilitate the salty water's transport by means of animal transportation (especially with horses).

Through their functioning and easy way of producing, many of these recipients could confirm the existence of similar vessels for even older periods of time.

Figure 1. Different types of recipients for salt.

The vertical transportation of salt in the old Turda salt mine, Romania

Ovidiu Mera, Dan Mera, Tudor-Gabriel Bodea

The geological features of the deposit in Turda, where salt can be found very close to the surface or even as outcrops or as salt springs, meant that the area became known and the object of a rudimental and primitive extraction, probably even in the Dacian period. The oldest documentary attestation of the Turda Salt Mine is from the 1st of May 1271, and the interest for exploitation of salt in Turda was maintained until 1932, when the mine was closed.

All the time when the mine was functioning, the salt was extracted in large chambers (conical or trapezoidal halls), using the sole hewing method. This led to using the equipment on vertical transport of appreciable distances (120-140 m).

The equipment for vertical transportation of salt is still preserved in the Turda Salt Mine. The CRIVAC, which was used in 19th and 20th centuries, is the only extraction machine of this sort found in Romania that can still be admired on the original place.

This paper tries to present this equipment, from the point of view of evolution, construction and emplacement, in tight relation with the evolution of salt extraction in Transylvania and, particularly, in Turda.

Mining and tourism in the Turda salt mine

Ovidiu Mera, Dan Tiberiu Mera, Tudor-Gabriel Bodea, Iuri Simionca

The deposit of salt from Turda belongs to the west diapir alignment of the Transylvania Depression, belonging to the Middle Badenian – Wielician. Exploitation of salt in Turda was carried out between 1271 and 1932, in large excavation chambers, of conical or trapezoidal shapes. The presence and exploitation of salt had a big impact on the environment, with important influences in over geomorphology and biodiversity. The salt exploitation activity was made between 1690 and 1932 in the current-day emplacement of the Turda Salt Mine. Since 1992, the mine has been operating as a touristic attraction. In the underground it was preserved and can be admired conical and trapezoidal chambers of excavations and also technical works used for the miners movement or salt transportation.

The curative effects of the salt mine microclimate for treating respiratory problems have been evaluated in 2 steps, with experimental studies over lab animals with induced asthma and over human patient, being preceded by studies which have followed the assessment of physico-chemical and microbiological parameters of underground environment. The results have been statistically interpreted and its represents the base for the conclusion in the possibility of using Turda Salt Mine in therapeutic scope. The Turda Salt Mine is a modern balneo-touristic attraction, with specific features, which completes the European network for this kind of attraction.

The Ocnele Mari Salt Mine: a polyvalent wealth

Petre Iordache

"Salt is born of the purest parents: the sun and the sea." — Pythagoras

The Ocnele Mari salt mine is managed by the Râmnicu Vâlcea branch of the National Society of the Salt, SALROM Bucharest. Known as one of the oldest salt producers, Romania has a significant potential in regards to this natural resource, ranking fourth in Central and Eastern Europe. The rock salt deposit formed in the Badenian stage is situated within the limits of Ocnele Mari city and has a length of 7.5 km, a width of 3 km and a thickness of 350–400m. The exploitation of the Cocenești salt mine (the present-day mine) began in 1993 and the tourist base was set up in 2009, when the exploitation at this horizon + 226W was completed.

The rock salt extracted from the Ocnele Mari deposit is used in a percentage of 95% for industrial purposes, namely in chemistry–electrolysis, water softening, skins, textiles and snow removal and approx. 5% in animal husbandry and food industry.

The rock salt deposit takes the form of alternating white and grey-blackish layers of salt, which were formed 10 million years ago in a halogenated basin, consisting of a series of bays and lagoons, under an arid climate. Ocnele Mari rock salt deposit settled rhythmically, influenced by seasonal weather conditions that determined the succession of white salt layers settled in a hot arid climate, alternating with darker salt settled during a climate with heavy rainfall and input terragenous material. Inside the rock salt deposit one can observe the small tectonic foldings that took place after the deposit was formed, on multiple directions.

The mining of Ocnele Mari salt deposits is made using a Canadian technological method through small mining chambers square pillars. According to this method the set out frame is a rectangular network of squares (30×30m from which 15 m is the length of the chamber and 15m the length of the pillar between two consecutive chambers, the chambers being of 8m height). The floor between two horizons is 8 m thick.

Salt mine therapy is an alternative method of preventing and treating various breathing problems, having a beneficial impact on the entire body: improves immune function, supports detoxification, improves the functioning of the digestive system, helps skin regeneration and reduces fatigue and stress. Aerosolized micro particles larger than 10 microns in diameter are caught in the upper airways and transported up and out of the respiratory tract by the mucociliary system. In the range of 5–10 microns, they penetrate into the trachea and central bronchial area, but no farther. Only below 5 microns do the micro particles penetrate deep into the lungs, though the larger micro particles have useful effects in the upper respiratory tract. In the range of 0.1–2.5 microns—the same size as the most damaging micro particles from

auto and industrial pollution, and invisible to the human eye—the micro particles of salt penetrate into every corner of the bronchi, bronchioles, and alveoli and deposit upon the surface. The inhalation of the salt particles helps to reduce inflammation in the airways, opens constricted airways, and increases the clearance of mucous. Salt, by its nature, is a 100% allergen-free substance, acting like a disinfectant.

Movement facilitates the penetration of salt aerosols in the bronchial area, this being the main reason why Ocnele Mari salt mine offers a wide range of recreational activities both for adults and children.

Salt in the opsartytic ancient literature

Mihaela Paraschiv

The author of this paper aims to indicate and analyze the information about salt in *Ta opsartytika biblia,* the Greek name for cookery books. The remaining pieces of opsartytic Greek literature are very scarce, but its influence is manifested in the Roman cookery books, where many references about the usage of salt can be found. It is well known that the physician Hippocrates, putting a particular emphasis on nutrition, considered each sort of food a substance by which human health is maintained or restored (cf. Hippocrates, *De alimento*, 19, in *Oeuvres completes d'Hippocrate*, vol. IX, ed. E. Littre, Paris, 1861; S. Byl, *L'alimentation dans le Corpus Hippocratique*, in *Alimentation et médecine*. Actes du colloque Brussel-Bruxelles, 12. 10. 1990, ed. R. Jansen-Sieben, F. Daelmans, Brussel/Bruxelles 1993, pp. 29–39). In addition, it is of the utmost importance that this Hippocratic doctrine has become commonly accepted in the medical milieu and therefore has resulted in a considerable and permanent interest in food on the part of his Greek and later Roman followers. Centuries later, an eminent medical doctor born in Pergamum, named Galen, educated in the teachings of Hippocratic School, included in his treatises an exceptionally high number of details referring to selecting, correctly processing and effectively making use of different foodstuffs. As a consequence, a lot of information was left for modern researchers, not only on medical practices typical of his time, but also on the tradition of culinary art prior to his lifetime (cf. *Galeni de alimentorum facultatibus libri*, 461, 7–11, in *Claudii Galeni opera omnia*, vol. VI, ed. D.C.G. Kühn, Lipsiae, 1823). Food along with its medical properties (including dietetic ones) is also part of a discussion by Anthimus in *De observatione ciborum,* a *sui generis* mélange of medical and gastronomic knowledge, which in a brief brings the knowledge of generations down to practical suggestions concerning healthy nutrition. It should be noted that references to the therapeutic role of food is also visible in the sole ancient cookery book that has survived until present times, known under the Latin title *De re coquinaria*. Its authorship is attributed by tradition to a certain Marcus Gavius Apicius, a Roman gourmet who lived at the beginning of the 1st century A.D. *De re coquinaria* contains some information on the usage of salt for consumption purposes in Roman cooking and also a prophylactic recommendation. *Sales conditi* (herbal salts) are an example of a food additive to which medicinal properties were ascribed; according to Apicius, herbal salts facilitated digestion, counteracted indigestion and had a purgative effect; they were also supposed to prevent numerous illnesses (*omnes morbos*), epidemic diseases and fevers. Thus, salt would not only improve taste, but also facilitate the digestive process and the purging of the organism. Similar spice mixes may be found in the works of Aetius of Amida, who left us three recipes for salt with vegetable additives, which he collectively called 'purifying salts' (*hales katharktikoi* - cf. Aetius of Amida, *Iatricorum libri*, III, 110, 1–9).

In conclusion, *De re coquinaria* can be seen as a piece of work from antiquity, that supports the existence of an indissoluble bond between medical doctrines and culinary practices of those times.

Testimonies in Latin regarding salt exploitation in Moldavia in the 17th and 18th centuries

Claudia Tărnăuceanu

Two important testimonies concerning salt deposits and their exploitation in the Moldavia of the 17th and 18th centuries can be analysed, for they meet in the works of some authors of the Latin language. One belongs to the Catholic missionary Marco Bandini who, in 1648, in a rapport for Pope Innocent X over his visit in Moldavia, he mentions about the existence of some salt mine around the locality of Trotuș and of a village built on a salt deposit, Sărata, in the neighbourhood of Cotnari. Being interested in the economic realities of the Moldavia from the 17th century, the Italian monk offers information regarding the quantity and quality of the extracted salt, the internal consume and salt export, workforce and payment method, also attaching a description of the mine from Trotuș. The second proof belongs to the Prince of Moldavia, Dimitrie Cantemir, who created a complex description of Moldavia (*Descriptio Moldaviae*) in 1716, at the request of the Academy from Berlin. The scholar prince dedicated an entire chapter to the description of the mountains and mines from his country (*De montibus et mineris Moldaviae*), emphasizing the richness of salt deposits and their exploitation method. Thus, we have solid proofs of the used techniques, of the economic limits regarding extraction during his time, in connection to previous eras, of salt export and the wealth gained through salt exploitation, about those charged with the administration of the salt mines.

Salt symbolism in the work of Elena Niculiță-Voronca

Mihaela Asăndulesei

The purpose of this paper is to study salt symbolism in the book *Datinele și credințele poporului român adunate și așezate în ordine mitologică* [*Traditions and Beliefs of the Romanian People, Gathered and Chronologically Ordered*], written by Elena Niculiță-Voronca at the end of the 19th and the beginning of the 20th century. Though she did not have any higher education, the author was an active and talented researcher. Through considerable efforts, she gathered within a private project and she created a huge body of work on the intangible heritage of Bukovina, influenced by

the co-existence of other nationalities in this region. Furthermore, she focused on respecting the authenticity of the information she received.

The central objective of the present study is to present in detail the salt symbolism, whose importance in the daily life was underscored by the fact that an entire chapter of the book was dedicated to it. It is worth noting that salt, considered a gift of God, accomplishes multiple and diverse functions (e.g., purification, reward, or protection, but also destructive force). It is a mineral to which people within the investigated area ascribed important imaginary properties.

Indo-European linguistics: IE onomastics related to salt and salt-related places

Peter A. Dimitrov

As we plan to explore the ancient roots of a major cultural activity of the remote past in trying to cover the main points of evidence, our goal is to present data from the ancient Indo-European languages.

First, these will be onomastics relics as the latter are a powerful instrument to study. Onomastics data are well known to be very conservative and containing pristine structure. Linguists dealing with onomastics should keep in mind that it might corroborate the study of the ancient stems (roots) offering precious variants such as allophones and allomorphs. Combined with data from later periods the outcome will increase our knowledge tremendously, especially if situated within the specifics of a cultural environment, e.g. salt mines etc.

Objectives

The overall objective of our research is to track connections between salt-rich areas, the Balkans as a whole, and the pristine territory of the pre-Indo-European times, namely Ancient Anatolia.

- The theoretical basis of Proto-Indo-European is not just the established relationship between the several oldest text-attested Indo-European dialects, but the territory of the dissemination of the specific IE culture, the latter spread over more than twelve thousand kilometres from the Himalaya to the west coast of Britannia, always north of the dwellings of the Semites.
- One has to realize that languages, as many as they are now, had not appeared at the same time. It took the IE roots to be developed by people that obviously were not numerous. How did they manage to survive? Were they eating salt?
- We know of so many words that connect salt and water. Is that a mere coincidence?
- That makes us move westward, over the plateaus of Anatolia and observe the life of people living by the see. So many of them slowly installed themselves on or near the coast line of Western Anatolia, and hence many famous towns flourished.

- Salt being obviously a great life-supporting instrument is in a way a mechanism to consolidate the union of families, tribes, ethnos, etc. In the vast and very rich areas of Anatolia, Greeks, next to overwhelming Hittites, Luvians, Thracians, Phrygians, Lycians, Indo-Iranians, and at some point later Persians remained Indo-Europeans, and were aware of salt being as precious as gold.

Immediate Objectives

- To possibly reveal salt-rich and salt-producing areas and sites in SE Europe through investigation of the ancient toponyms;
- To reveal common regularities and interconnections between ancient languages of the area, as well as their relics (or transformations) in modern languages.

Possible impediments to be expected might be those that are usually found on the way of attractive conclusions etymologies present to scholars. Therefore, one should stay away of the paths of long time rejected schemes, and avoid them. In this project, it is a priority for the scholar to set up a theoretical basis with which to comply. Here there many reliable examples:

If one deals in IE theoretical linguistics there are always ways to take a phonetics' evidence for a phonological one and thus get lost in trying to compare clusters that are irrelevant as to their structure and hence meaning. Sald-apa and Zald-apa both offer a good starting point. While Sal-d is said to be etymologically from 'salt' as in the name of the Dacian tribe *Saldensioi* (as known from Ptolemy), and in Saldae, a place in the region of lower *Sava* river in Serbia, now called *Slatina*, Zald is considered coming from IE root for 'cold'. However, opinions are divided as some scholars think it is the word for 'gold'. Is salt then only white in colour? Well, salt comes in different colours and sometimes it may be red, green or yellow.

And one more consideration: 'apa' is still the word for 'water' in Romanian. So we are looking at a strong evidence that salt goes hand-in-hand with water. Again in Romania, there is the Turda saltmine, Salina Turda, Cluj, Romania. Near ancient Durostorum at the Danube river there is *Saltoupyrgos*, a citadel. Or let's take *Salsovia*, at the Danube delta. All are good strong examples.

In fact, this is a misinterpretation of the allomorph's meaning: the allomorph is Z/Sald/t and is known from many places and in many stems. While *sal- is 'salt' in Dacian, Thracian, Old Bulgarian one should take a closer look at the phonemes /d/ and /t/ being allophones, and then allomorphs! The latter are bearing the meaning. And one more observation: /d/ and /t/ are components of past tense participles in IE. That is, in our case, sal +d/t gives the idea and meaning of "something that contains salt" or "is salty". So, the Thracian etymon for modern English 'salt' is 'sal', as in Old Bulgarian.

Salt terminology in Germanic languages

Adrian Poruciuc, Norbert Poruciuc

In the basic dictionary of Indo-European roots, Pokorny 1959, numerous designations of salt and salty things are to be found under **sal-* (a root that more recent specialists have presented, with a laryngeal addition, as **seHa-(e)l-*). The material of Pokorny's **sal-* entry actually suggests that the root under discussion is *European* rather than Indo-European, since recorded terms based on it occur in European historical languages (plus Tocharian and Armenian, which both have obvious ties with Europe), but they do not also occur in languages belonging to the vast Indo-Iranian branch. The two authors of the presentation will insist on Germanic salt terminology because it is especially in Germanic where an already established connection between **sal-* ('salt') and designations for a certain color ('dirty gray') is obvious, and also because Germanic languages contain terms, such as English *brine* and *pickle*, whose origins are presented as obscure by most dictionaries.

The grammar of salt: morphosyntactic and morphosemantic features of salt idioms in English and Romanian

Ileana Oana Macari

This paper involves discovering what characterizes several salt idioms in Romanian and English from a grammatical perspective, and mostly draws upon the material contained in several specialized online and paper-based dictionaries. Upon the examination of such idioms, it becomes clear that, while they reflect the expectable differences in the two cultures that produced them, they still share other essential grammatical features. Through identifying such instances, this research highlights the grammatical patterns on which they are built, as well as their cultural implications.

Salt-related toponyms in the Romanian area between the Carpathians and the Prut

Mihaela Asăndulesei

The author proposes to study the salt-related toponyms in the Romanian area between the Carpathians and the Prut River, with particular focus on the “spontaneous” micro-toponymy. Following a quasi-exhaustive inventorying of salt-related toponyms mentioned in various categories of sources (documents, geographic and toponymic dictionaries, specialized works, and maps dating to different periods), the latter were analysed from the perspective of the original theory of toponymic fields, elaborated by the Romanian scholar Dragoș Moldovanu ("A. Philippide" Institute of Romanian Philology in Iași). The main conclusion is that salt sources and salt deposits generate complex toponymic fields (by polarization, by differentiation, and by both).

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