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**Salt and Human Health: Science,  
Archaeology, Ancient Texts and  
Traditional Practices of Eastern Romania**

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This article presents the use of salt water springs in the Moldavian sub-Carpathians (eastern Romania) for treating certain diseases. The authors take into consideration archaeological discoveries and ethnographical surveys, correlated with known facts from the literature in the field. A special focus is on the presence of archaeological sites next to salt water springs, where specific objects were noted that are used in the extraction, storage, manipulation and use of salt waters. Nevertheless, what distinguishes the Romanian region under discussion from similar regions of Europe is the intense, unexpected continuity in the use of a traditional, non-industrial water supply from salt water springs. Among the uses of salt water and halite in the area, we will mention numerous traditional halotherapeutic practices. The concordances shown between ancient and current traditional halotherapeutic practices in eastern Romania infer the existence of a strong halotherapeutic element in prehistory. This aspect is generally neglected by archaeologists who deal with the evolution of human communities in an area rich in salt. The ancient and current halotherapeutic practices in eastern Romania are proof of an authentic ethnosience acquired by human communities with salt outcrops and salt water springs. The analysis of these practices demonstrates their scientific validity from the current biochemical and biophysical standpoint. The scientific explanation of the various effects of salt upon the human body is, in fact, given by the influence of NaCl aerosols and nanodispersions. Parts of these practices are being adopted by a series of recent halotherapeutic procedures, with reliable scientific and technological bases.

**Keywords:** Ethnoarchaeology; Ethnosience; Halotherapy; Salt water springs; Halite; Aerosols.

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## Introduction

The halite deposits in Moldavia are the largest in Europe and are distributed on a north-south axis of the sub-Carpathian Unit. In many areas they are close to the surface, as anticlinal or synclinal structures, forming salt massifs. There are 53 salt deposits along a 300 km distance. They stretch over 2-5 km and are up to 5 km thick. The salt deposits at Târgu Ocna-Slănic Moldova in the south and at Cacica in the north are industrially exploited (Stoica & Gherasie 1981). In parallel, though, many of the village or even city inhabitants exploit salt water springs for domestic uses. Salt excavation in the area (today's counties of Suceava, Bacău, Neamț and Vrancea) has been mentioned in documents starting with the 14<sup>th</sup>-15<sup>th</sup> centuries (Stoica 2003, p. 35; Vitcu 1987). Nevertheless, salt had been exploited for a long time, since prehistory, in the form of natural brine coming from salt water springs.

Not only Moldavia, but Romania as a whole is well-known for its huge salt deposits and numerous sources of salt water, therefore the map of the country shows an abundance of place-names based on terms for *salt*. Since the great majority of the population of Romania speak Romanian (that is, a Romance language), many of the toponyms under discussion (*Sărata*, *Sărătura*, *Sărățel*, *Sărățeni*, etc.) are based on the Romanian term *sare*, from Latin *sāl* (< Proto-Indo-European *\*sal-*'salt'). But there also are place-names that show *sol-* (as in *Solca*), *slat-* (as in *Slatina*), *slan-* (as in *Slănic*), or *solon-* (as in *Soloneț*), which represent Slavic loans that refer to salt (Poruciuc 2008, 144).

In the Moldavian sub-Carpathian area (with a high population density), in valleys of creeks and rivers, there are about 200 salt water springs. Their role in implementing and developing the human habitat, starting with prehistory, has been studied in the geographical and historical Romanian literature since the 1950s (Șandru 1952, 1961). After 2000 we witnessed a remarkable intensification of studies in the field. What differentiates it from other similar areas in Europe is the intense, unexpected

continuity of the traditional, non-industrial water supply coming from salt water springs, in cities as well as in villages. There are traditional behaviors specific to the Moldavian sub-Carpathian areas, where we have the oldest evidence of salt exploitation in Europe and maybe in the entire world. The existence of these traditions is a great opportunity for complex ethnoarchaeological researches, as emphasized by a Romanian team as early as 1992 (Alexianu et al. 1992). It is obvious that the ethnographic and archaeological researches in this geographic area, with evidence of continuity over time, can only strengthen the credibility of the ethnographic record in understanding the complex archaeological situations related to the exploitation of salt water springs. Starting with 2003, these studies and investigations became part of interdisciplinary French-Romanian programs (Alexianu & Weller 2007; Alexianu et al. 2007a,b, 2008). The ethnoarchaeological researches intensified beginning with the autumn of 2007 within the project called *Salt water springs in Moldavia: ethnoarchaeology of a natural polyvalent source*, financed by the National University Research Council of Romania. One of the main directing lines of the research was represented by complex ethnographic investigations, based upon systematic surveys of numerous salt water springs. The ethnographic investigations are complemented by ethno-historical ones on ancient Greek and Latin authors' texts that refer to salt. The latter studies were aimed at detecting constants in space and time about human behaviour concerning salt. The ethnographic surveys in Moldavia revealed – besides other aspects – a great number of traditional halotherapeutic practices. After analyzing certain ancient texts, we came to discover surprising analogies between the halotherapeutic practices of ancient Greeks and Romans and the current practices in Moldavia. We may thus presume the existence in prehistory of halotherapy related to the exploitation of salt water springs, which had numerous other uses besides nutrition. Among those uses, we may mention food preservation, skin barking, preservation of wood for artistic uses and of various vegetal

or animal materials, whether or not involved in domestic activities, rituals, spiritual practices, warfare, etc. Archaeologists have not paid proper attention to this halotherapeutic dimension, despite the fact that certain ancient objects (such as the ones needed in briquetage) have been found on archaeological sites near salt water springs.

One purpose of this article is to emphasize the concordances and similarities of contemporary halotherapeutic practices in Moldavia with the writings of ancient Greek and Latin authors. Another purpose is to stress the therapeutic importance of salt and salt water springs in the life of prehistoric communities of various continents. Also, we will examine the validity of these practices and their preservation to this day from the perspective of current biochemical and biophysical science. This certifies that traditions of today's villages are a continuation of ancient ethnoscience. Even though we could not find it in the writings of ancient authors or in current ethnographical surveys, the scientific explanation of the various effects of salt upon the human body lies, in fact, in the effects of NaCl aerosols. Currently, such practices are systematically taken over by a series of recent halotherapeutic procedures with reliable scientific and technological bases. Among them we can mention the therapeutic halochambers within mine and maritime natural systems, and also the man-made ones that use nanodispersions of NaCl dry or wet aerosols, as such or in combination with CaCl<sub>2</sub>, MgCl<sub>2</sub>, and iodine anions. These are used to treat asthma, flu, asthmatic bronchitis and chronic bronchitis. Aerosols have cleansing and anti-inflammatory effects on the respiratory system, enhance the removal of pathogenic agents, accelerate mucociliary transport, reduce bronchial inflammation, and find uses in dermatology and cosmetology.

#### **Data regarding salt-water springs of eastern Romania**

The entire area of the eastern sub-Carpathians, mostly locations close to the Moldavian Plateau, has brine springs along almost every creek and riverbed, and those locations

were named after them. Many are situated near very old rural or urban settlements. Those springs strongly influenced the pre- and proto-historical habitats in sub-Carpathian Moldavia. It was a geographer at the “Alexandru Ioan Cuza” University of Iași who first pointed out, during the 1950s, the importance of salt water springs in two regions of eastern Romania (the Cacica and Târgu Ocna-Slănic Moldova depressions) for the Chalcolithic communities of Precucuteni and Cucuteni (Șandru 1952, 1961). This line of research was reopened 25 years later, when an archaeologist wrote the first study in the Romanian literature in the field of archaeological discoveries near a salt water spring, which was exploited from the Chalcolithic (Starčevo-Criș culture) to the Middle Ages (Ursulescu 1977).

The discovery of a Chalcolithic *tell* at Poduri (Bacău county) in an area rich in salt water springs prompted a group of archaeologists to initiate researches on the possible relations between these springs and the habitation complexes of that *tell* (Monah et al. 1980, 1987, 2003). The importance of the saliferous sub-Carpathian Moldavian area for the multiple development of the famous Cucuteni-Tripolye Chalcolithic complex was brought into prominence by the American researcher Linda Ellis (1984) in a memorable statement: “It is also no accident that the longest area of occupation for the Cucuteni-Tripolye culture (that is, the Eastern Carpathians and sub-Carpathians) happens to be a region noted for one of the largest salt formations in Eastern Europe. Exploitation of, control over, and trading of this essential resource no doubt contributed to the stability of Cucuteni-Tripolye village life in the face of culture contact with Eastern steppe pastoralists, as well as enhancing the quality of food storage, food consumption, and animal and human health.” This hypothesis was confirmed by subsequent discoveries in an impressive excavation site, at the Poiana Slatinei–Lunca salt water spring (Neamț county), where the prehistoric stratum, starting with the Starčevo-Criș culture, is up to 2.65 m thick (Dumitroaia 1987, 1994). The rate of such discoveries was intensified by subsequent finds (Andronic

1989), which led to the first interdisciplinary archaeological studies about the exploitation of salt water springs (Monah 1991; Ursulescu 1995; Weller 2000). Taking into account that the archaeological data looked promising, mainly in regard to their antiquity, the problems of the exploitation of Moldavian salt water springs came to be approached within international research programs. Among these, we may mention the following: (1) two UK-Romanian projects: *Research on Trade and Exchange in the Cucuteni-Tripolye Network* from 2001 until 2005, and *Prehistoric Salt Exploitation in Romania and Anatolia* from 2002 until 2005; (2) two French-Romanian projects: *Aux origines de la production du sel en Europe: préhistoire et écologie des Carpates Orientales* from 2003 until 2004 and, starting with 2004 *Les eaux salées de la Moldavie roumaine: archéologie, histoire et écologie d'une ressource structurante du territoire*. By resorting to modern dating methods some archaeologists have been able to show that the oldest so far known salt water spring exploitation in Europe and maybe in the world, dated 6050-5500 B.C. during the Starčevo-Criș culture, is the one at Lunca-Poiana Slatinei, Neamt county, Romania (Weller & Dumitroaia 2005, Weller et al. 2008). The production of salt by evaporation of salt water from springs continued even later, during the Cucuteni culture, at the end of phase A, but very intense during Cucuteni B (Dumitroaia 1994; Nicola et al. 2007). A series of more recent discoveries produced new evidence about the Chalcolithic population's use of salt water springs in Moldavia (Andronic & Ursu 2003; Chapman et al. 2000, 2003, 2003-04; Chapman & Monah 2007; Dumitroaia et al. 2008; Monah et al. 2003;; Munteanu 2006; Munteanu et al. 2007; Nicola et al. 2007; Weller et al. 2007a,b).

What differentiates this sub-Carpathian Moldavian area from other similar areas in Europe is the unexpected continuity in the intense multiple uses of traditional, nonindustrial water from salt water springs, in the cities as well as in the villages of the area. As we mentioned before, there are many traditional specific applications, including food preservation (cheese, meat, fish, vegetables, fruit, etc.), skin barking, and the preservation of parchment,

membranes of various animal organs, wood, and other perishable organic materials. The fact that such applications are specific for the area in which we identified the oldest traces of salt exploitation in Europe constitutes a great opportunity for new and complex ethnoarchaeological researches. Ethnoarchaeology becomes “a real science of reference for interpreting the past if it was focused upon well-founded cross-cultural correlates, linking material culture with static and dynamic phenomena” (Roux 2007, p. 153, see also Damm 2005; Gazin-Schwartz & Holtorf 1999; Morantz 1998). As early as 1992, there was a focus on the importance of systematic ethnographical research in the area under discussion, where there also are elements of continuity in the chrono-topical system (Alexianu et al. 1992). Such elements can only strengthen the credibility of the ethnographic analogy in understanding the complex archaeological situations related to the exploitation of salt water springs. The latest data in the field are the subject of the aforementioned Romanian project, set for three years (2007-2010).

Since local ethnographers never investigated the implications of the salt-water springs under discussion, two of the authors of this article (M.A. and R.-G.C.) undertook a series of complex ethnographic surveys, from an archaeological standpoint, with the aim of pointing out the practical importance of the springs, the main focus being on prevention and treatment of certain diseases. It is worth mentioning that, although ethnographers never systematically investigated salt-water springs known since prehistory, several exhaustive surveys of such springs have been undertaken by archaeologists. They aimed to emphasize the multiple uses of salt water, and they insisted upon the aspects related to the prophylaxis and treatment of various diseases. Among the items within the above-mentioned surveys we can mention: (1) identification of salt water springs, (2) the chrono-topical dimension of the extraction, storage, manipulation and uses of the brine, (3) the transportation and storage means in households, (4) the range of uses for salt water or for salt, as salty rock or halite, as powder obtained through granulation or re-

crystallization, (5) the attraction exerted by salt water sources on wild and domestic animals, (6) the practice of hunting near the springs, (7) re-crystallization practices, (8) the frequency of salt supplies for domestic use, (9) the use in commerce and exchanges, (10) salt-related behaviors and ethnoscience, (11) symbolism and rituals centering on salt.

In parallel, ethnographic studies are complemented by ethno-historical researches on the texts referring to salt in works of Greek and Latin authors, as well as on trans-spatial and trans-temporal constants of human behavior regarding the uses of salt.

Recent ethnographic surveys in Moldavia have emphasized, besides other interesting aspects regarding salt uses, many traditional halotherapeutic practices. Thus, we could see that current rural Romania is one of the few areas in Europe where these practices are preserved and are still operational and considerably frequent, despite the ever-growing competition of modern medicine. Due to their ethnographic significance, they may be considered as authentic heritage of the local population.

The first objective of this study is that of identifying the concordances between the current halotherapeutic practices in eastern Romania and those mentioned by ancient Greek and Latin authors. The current traditional halotherapeutic practices so far identified (intra-cranial, aural, inter-costal, menstrual and rheumatic neuralgias, flues, dental hygiene, hemostasis, burns, asthma, bronchitis, etc.) were mentioned during 2003-2008 surveys by a French-Romanian team (Alexianu et al. 2007a,b, 2008). They were also identified by individual researchers (Curcă 2007; Monah 2008). Various halotherapeutic practices are also discussed in a paper on the medical folklore in Moldavia (Ciubotaru 2005). As regards the ancient halotherapeutic practices, they were analytically studied on the basis of specialized bibliography of the field (Gil 2004; Jouanna 1994).

**Table 1** (Continued on following pages)

Comparison of halotherapeutic practices described by ancient authors and observed in recent ethnographic surveys in Moldavia.

	<i>Gingival diseases</i>	<i>Dental diseases</i>
<b>Clinical spectrum</b>		
<b>Diseases in ancient authors</b>	<i>Swelling of the gums</i>	<i>Dental pain</i>
<b>Treatment method in ancient authors</b>	Rubbing tumescent gums with salt	Not mentioned
<b>References</b>	Plinius, <i>Naturalis Historia</i> , XXXI, XLV(9), 100	Stanching with vinegar or liniment with resin Plinius, <i>Naturalis Historia</i> , XXXI, XLV(9), 105 Aristotle, <i>Problemata</i> , I, 38
<b>Diseases mentioned in ethnographic surveys</b>	<i>Swelling of the gums</i>	<i>Dental diseases in general</i>
<b>Treatment method in ethnographic surveys</b>	Rubbing with halite or rinsing the mouth with salt water and vinegar	Rubbing teeth with halite
<b>References</b>	Curcă 2007	Curcă 2007



Table 1 (Continued)

Clinical spectrum	Angina	Tonsillitis
<b>Diseases in ancient authors</b>	<i>Angina</i>	<i>Tonsillitis</i>
<b>Treatment method in ancient authors</b>	Combination of salt, crude oil and vinegar	Combination of salt and honey
<b>References</b>	Plinius, <i>Naturalis Historia</i> , XXXI, XLV(9), 101	Plinius, <i>Naturalis Historia</i> , XXXI, XLV(9), 101
<b>Diseases mentioned in ethnographic surveys</b>	<i>Angina</i>	<i>Tonsillitis</i>
<b>Treatment method in ethnographic surveys</b>	Hot compresses with maize mush and salt	Gargle with salt water; crushed onion or cabbage leaf and minced horseradish with warmed salt; combination of warmed maize mush and halite; sprinkling salt on a finger and rubbing the tonsils with it.
<b>References</b>	Ciubotaru 2005, 112	Ciubotaru 2005, 168-169
	Sandu, personal communication	

Table 1 (Continued)

Clinical spectrum	<i>Furuncles, inflammatio of the skin and dermatosis</i>		
Diseases in ancient authors	<i>Blisters, rashes</i>	<i>Itchiness, scabies, ringworms</i>	<i>Inflammations</i>
Treatment method in ancient authors	Not mentioned	Rubbing with salt and vinegar	Combination of pitted plums, ox suet, marjoram, leaven or bread
References	Plinius, <i>Naturalis Historia</i> , XXXI, XLV(9), 98	Plinius, <i>Naturalis Historia</i> , XXXI, XXXIII, 65	Plinius, <i>Naturalis Historia</i> , XXXI, XLV(9), 101
Diseases mentioned in ethnographic surveys	References	<i>Furuncle</i>	<i>Itchiness</i>
Treatment method in ethnographic surveys	Compresses with salt water and vinegar, ribwort or cabbage leaves with salt, „loam from the rear cart wheel”, with salt or warmed salt compresses on the wound	Rubbing with salt, sometimes also with crude oil.	Salt or dispersions of salt in red earth oil of Câmpeni as abstergent
References	Ciubotaru 2005, 122, 233, and ethnographic surveys.	Ciubotaru 2005, 207	Curcă 2007, 264; Sandu, personal communication

Table 1 (Continued)

	<i>Kidney and stomach pains</i>	<i>Lumbar and leg pains</i>	<i>Joint pains</i>	<i>Dog or cat bites</i>
<b>Clinical spectrum</b>				
<b>Diseases in ancient authors</b>	<i>Stomach pains</i>	<i>Lumbar and leg pains after effort</i>	<i>Joint pains</i>	<i>Dog or cat bites</i>
<b>Treatment method in ancient authors</b>	Ingestion of salt and bread	Spluttering with warmed sea water and vinegar.	Drinking salt water	Bandages with salt water
<b>References</b>	Horatius, <i>Satirae</i> , II, 16-18	Hippocrates <i>Epidemiati</i> , V, LVIII,2	Plinius, <i>Naturalis Historia</i> , XXXI, XXXIII, 64	Plinius, <i>Naturalis Historia</i> , XXXI, XLIV, 57
<b>Diseases mentioned in ethnographic surveys</b>	<i>Kidney pains</i>	<i>Lumbar and leg pains provoked by inflammations</i>	<i>Joint pains</i>	<i>Dog or cat bites</i>
<b>Treatment method in ethnographic surveys</b>	Local applications of pouches with warmed salt or rubbing with salt water	Baths with salt water or local application of a piece of hare skin with warmed salt	In some Moldavian villages with salt water springs people indicate treating joint pains with topical applications of warmed salt water, mostly for aged people.	Bandages with salt water
<b>References</b>	Ethnographic surveys and Ciubotaru 2005, 203.	Ethnographic surveys and Ciubotaru 2005, 161, ...	Curcă 2007, 265	Curcă 2007, 265

Table 1 (Continued)

<b>Clinical spectrum</b>	<i>Frostbites</i>	<i>Mouth and ear diseases</i>
<b>Diseases in ancient authors</b>	<i>Frostbites</i>	<i>Mouth and ear diseases</i>
<b>Treatment method in ancient authors</b>	Salt is recommended for frostbites, but "before ulceration".	Not mentioned
<b>References</b>	Plinius, <i>Naturalis Historia</i> , XXXI, XXXIII, 65	Plinius, <i>Naturalis Historia</i> , XXXI, XLIV, 97
<b>Diseases mentioned in ethnographic surveys</b>	<i>Frostbites</i>	<i>Mouth and ear diseases</i>
<b>Treatment method in ethnographic surveys</b>	Warmed salt and cabbage juice, both before ulceration	Pouches with warmed halite on painful areas
<b>References</b>	Sandu, personal communication	Ethnographic surveys and Ciubotaru 2005, 187; Curcă 2007, 266

Table 1 (Continued)

	<b>Bleeding</b>
<b>Clinical spectrum</b>	
<b>Diseases in ancient authors</b>	<i>Burst blood vessels in the head.</i>
<b>Treatment method in ancient authors</b>	Strewing with table salt
<b>References</b>	Hippocrates, <i>Affectiones</i> , II, 2, XVIII (VII), 1-2
<b>Diseases mentioned in ethnographic surveys</b>	<i>Bleeding from open wounds</i> <i>Nosebleed</i> <i>Bleeding</i>
<b>Treatment method in ethnographic surveys</b>	Strewing salt and sugar      Salt water infusions in the nostrils      Red wine and copper filings and salted red wine      Compresses with vinegar and salt and salted red wine      Ciubotaru 2005, 171-172
<b>References</b>	Sandu, personal communication      Ethnographic surveys      Sandu, personal communication

### **Ancient therapies corresponding to current practices**

The comparative study of ancient texts and the aforementioned ethnographic surveys showed a great diversity in the use of both solid salt and natural brine. It could be established that many of the traditional uses and treatments for various diseases have been preserved through the centuries. We mention this, since there also are practices mentioned in ancient texts with no correspondents in the recent ethnographic record, or vice versa. Table 1 summarizes the important findings. We shall continue by mentioning only the cases of exact or approximate concordance between prescriptions in ancient texts and current therapeutic practices in eastern Romania.

A complex situation is the use of salt for newborns, with a prophylactic and magic purpose or against diseases. In Moldavia there are traditional practices such as strewing the newborn with salt in order to prevent future diseases, putting salt on its tongue as protection against whammies, and applying compresses with warmed salt against cramps (Curcă 2007). In antiquity, Soranus Ephesianus (II, 6a, 64-77) mentions strewing the newborn with a certain amount of salt powder or in combination with honey, oil, or in a barley decoction. In the same sense, we may mention a more vague indication regarding strewing newborns with salt in the Old Testament (Monah 2008).

### **Cases of no ancient-current correspondence**

As previously mentioned, the halotherapeutic prescriptions to be found in Greek and Latin texts are far more numerous than those still present in the rural Moldavian tradition. Among the ancient halotherapeutic uses with no correspondence among current practices, we can mention the following (Curcă 2007):

- aligning broken bones and in case of contusions;
- tumors or swollen parotids, in which case they use barley flour boiled in salt water;
- poisonous stings, such as those of the scorpion;
- snake bites (salt with oregano, honey and hyssop);
- strewing salt powder on the tongue;

- salt placed under the tongue, meant to allow convalescents to take hot baths;
- combined with vinegar, salt is good for healing of crocodile bites;
- salt with wheat flour and honey is applied to dislocated limbs, tumors, etc.

We also know of several halotherapeutic practices in eastern Romania which have no correspondent in ancient authors, such as:

- pouches with warmed salt water put on the forehead against sinusitis;
- inhaling salt water through the nose against sinusitis;
- rubbing teeth with halite to whiten them; etc.

Our ethnographic investigation identified around 20 diseases for which rock salt or brine is used, as such or in combination with other substances. In numerous cases we may talk about a perfect correspondence between the prescriptions of the ancient authors and the information provided by the Moldavian respondents in our surveys, who inherited such practices from previous generations. There also are cases in which for the same disease we have learned about prescriptions for salt (in ancient texts and surveys, or in recent papers), but in different ways. Thus, Plinius Secundus (*Naturalis Historia*, XXXI, XLV(9), 101) recommended salt against croup, in combination with oil and vinegar, whereas in Moldavia warmed compresses with maize mush and salt, or warmed cataplasms of plants (horseradish, cabbage, onion, garlic) with salt are used. But the number of such parallels is not fully relevant. On the one hand we have only partial knowledge of the ancient halotherapeutic practices. On the other hand, the ethnographic surveys, still in progress, cannot have included all such practices that are current in Moldavia.

### **The scientific basis of modern halotherapy**

The other important objective of this study is to present the validity of the corresponding ancient and current practices, analyzed from the scientific perspective of

biochemistry and biophysics. The continuation of ancient halotherapeutic practices in rural Moldavia proves that the area under discussion still has a true ethnoscience in the field. Simple people in Moldavian villages know the beneficial effects of salt in treatments against certain diseases, without being interested in providing scientific explanations for those effects. The use of halite and brine in various therapies, as such or as powders and solutions (natural or artificial salt water) in ancient times and in the current traditional areas or in modern preparations (pomades, tooth pastes, soap, sticks, etc.) has a scientific explanation in properties of nanostructures. These nanostructures may be dissolved or dispersed in the use systems, whose negative charge is usually represented by what we may call “solvions.” The latter become effective in osmotic processes that influence the mechanisms of dysfunction recovery. These actions begin at the epithelial surfaces but can also involve more specific metabolic processes. In an organism salt performs a series of actions, in accordance with the concentration level in the biotic system, with its mineral composition, with its retention and elimination capacity and with the coagulating capacity of gelling systems. High concentrations of salt also have antibacterial, antimicrobial, and even antimycotic activities. This is how we explain, besides the therapeutic action, its various uses in food preservation (Chervinskaya 2007; Hedman et al. 2006; Sandu et al. 2002, 2003 and 2006). Below we shall give more details concerning these actions:

- action on the nervous system through the ionic effects upon axons and neuronal cell bodies, reducing the pain (dental diseases, neuralgias, etc.);
- action upon mucosal surfaces, in particular their microbiotic systems, with effects extending to internal areas (such as salivary glands, middle and inner ear, sinus cavity, gingival zone, oral cavity, etc.), and physical lesions (including stings, bites, cuts, etc.).
- antimicrobial actions in case of tonsillitis, sinusitis and otitis, as well as infections after bites, stings, etc. Mechanisms include the astringent effect (i.e., protein denaturation), inhibition of microbial metabolism, as

well as increased efficiency of the leukocyte system;

- antagonism of rheumatic processes, by its effects on the erythrocyte sedimentation rate (ESR) and by modulation of processes in the circulatory system; effects on certain antigens, as well as stimulation of specific antibodies, by increasing their affinity for bacterial and viral proteins toxic bacterial components;
- effects on the coagulation process, which account for the hemostatic action.

All these applications are considered to be based on the saline effect of NaCl, as a strong electrolyte that can affect, at certain levels of concentration, the epithelial system and microbial flora, as well as the humoral system and superficial nerves (Sandu et al. 2009). NaCl nanostructures may take three forms: as dry glomerulate microparticles (dry aerosols); as hydrated microparticles (hydrated solvions or aerosols with a monomolecular layer of water); as nanostructures dispersed in aqueous systems, going as far as simple hydrated ions ( $\text{Na}^+_{(\text{aq})}$  and  $\text{Cl}^-_{(\text{aq})}$ ).

The glomerulate structure, which depends on the degree of hydration, can take shapes that resemble snowflakes. The shape and size of such nanoparticles is determined by a series of environmental factors, mainly by the ones depending on acid-basic reactivity of the environment. Nanodispersions of solvions in biological extra-cellular fluids can reach a concentration of ca. 0,9% NaCl, whereas in intra-cellular fluids the concentration is lower due to specialized membrane channels that allow direct and/or reverse osmosis of  $\text{Na}^+_{(\text{aq})}$  cations, which, comparatively, have ionic volumes larger than those of  $\text{Cl}^-_{(\text{aq})}$  anions.

Nanoparticles dispersible in the air behave as “negative aeroions”, since they are glomerulate nanocrystalites, either dry or hydrated, with negative surface charges. Such negative solvions have beneficent effects on organisms. Moreover, in the air they interact with organic nanodispersions, either dry or with one-layer hydration, which behave as “positive aeroions”, such as the ones resulting from pyrolysis, cracking, or burning of cigarettes, in which cases the toxic effect of smoke is eliminated by

electrostatic destabilization of the dispersion (Sandu et al. 2009).

Ethnographic surveys mention the fact that most of the cataplasms used in treatments, such as pouches with salt and even thin strata of salt, should be warmed to an optimal temperature for the human body (around 50-60 degrees Celsius). Usually, the users do not think about the thermal effect. It is true that the thermal shock produces certain improvements, but only during the application. Thus, the curative effect is mostly due to the aeroions emanated by the salt and inhaled into the lungs and thus acting upon the epithelia through osmosis. It also activates the immune systems, including the leukocytes; it stimulates the formation of antibodies and it improves potentially pathogenic biochemical processes. In this sense, the nanostructural NaCl aeroions play the multiple role of an antigen at the level of certain organs, producing most of the previously mentioned effects (Chervinskaya 2007; Hedman et al. 2006; Poryadin et al. 2002; Sandu et al. 2002, 2003, 2006).

Another therapeutic application that needs to be explained is the use of fine dispersions of salt having as basis vinegar, wine and oil. We know that the solubility and the formation of certain crystal solvates and of certain hydrolyzable molecular species formed *in situ* in a dispersed system depend on the pH. They also depend on the presence of ions other than sodium and chloride, on temperature and on other factors that favor the formation of certain nanostructural solvated aggregates of NaCl. In the latter the superficial single layer of water has a dipolar profile with external negative charge, which favors a behavior similar to the one of dry negative aeroions that stimulate recovery from certain diseases by biochemical mechanisms specific to inorganic antigens. Vegetable oil, as well as wine and vinegar create a mildly acidic pH and favor the specific nanostructuring of the crystallites with superficial negative charge, capable of osmotic processes through the membranous systems of internal organs. Also, membranous systems based on polypeptide structures with reactive support have an influence on the re-formation of NaCl structures of a solvion type, due to the fact that such

systems contain amphiphilic groupings. As a result of electrostatic interactions, polypeptides enhance, by their isoelectric point, ordering of flexible and mobile structures. Thus functional biotic microstructures of certain tissues are optimized (Sandu et al. 2009). Several concrete applications are known, in cases such as: lumbago, stomach, liver and pancreas aches. These applications are added, in combination with vinegar and wine, to the sodium chloride and to small amounts of bronze or copper filings, and are consumed after decanting. Nevertheless, we do not have enough explanations for such treatments (Poryadin et al. 2002). What we may observe here is that copper filings can be anodically dissolved ( $\text{Cu}^0 \rightarrow \text{Cu}^{2+} + 2\text{e}^-$ ) in the presence of the NaCl electrolyte, in a solvion form ( $\text{Cu}^{2+}_{(\text{aq})}$ ) that interacts with wine tannins in an acid medium, the result being molecular species that are hard to hydrolyze or dissolve. Copper filings provide completion of the macroelement deficit in certain enzymatic processes. Also, in the presence of NaCl as highly effective electrolyte, copper filings prove to play an important part in the elimination of toxicity from red tannin-rich mountain wines (Sandu et al. 2009).

### **Halotherapy by means of aerosols**

The massive use of halite as rocks, crystals, powder or salt solution (brine) and of natural locations with NaCl aerosols (maritime environments or salt mines) with various therapeutic purposes led to the creation of certain devices or installations. It also led to the elaboration of procedures for the generation of nanostructured aerosols, dry or humid, with high therapeutic action and with possibilities of *in situ* treatment in habitats (Chervinskaya et al. 1995, 2007; Hedman et al. 2006; Pascu 2003, 2008; Poryadin et al. 2002; Sandu 2003, 2004a, b). Such proceedings represent a reconstruction of the principle of the treatment system through saline halochambers, known in Romania and in many other countries in the world (Chervinskaya 2007; Sandu et al. 2006).

Many ancient documents describe the effect of salt taste in chambers where salt is deposited for use in traditional halotherapy, transmitted from generation to

generation (Sandu et al. 2006). Romanian 17<sup>th</sup>-18<sup>th</sup>-century documents mention that the exploitation of salt in the Târgu Ocna saline was done in huge bell-shaped chambers (Stoica 2003, p. 43). Although not mentioned in the documents, we assume the presence of beneficial NaCl aerosols in those chambers. Nowadays, in the Târgu Ocna mine, the microclimate at level IX, situated at about 280 m in depth, is used for the treatment of chronic respiratory diseases, mainly asthma and chronic bronchitis.

The old Romanian practices allowed researchers to patent devices for the generation of dry or humid aerosols, used in the *in situ* treatment of lung diseases or in creating ecologic habitats (Pascu 2003, 2203a, 2006, 2007, 2008). These practices were tested in laboratories (Sandu et al. 2003, 2004a, b) and in phthisiological studies, in which their therapeutic effect on the lungs was confirmed, under *in vivo* biochemical and biophysical conditions (Chervinskaya 2007; Hedman et al. 2006).

Part of the studies (Sandu 2003, 2004a, b) emphasized the behavior of the NaCl nanostructural dry aerosols in halochambers, where we observed the existence of three zones. The first is *the active zone* (near the source) – characterized by a high concentration, where there are all four dimensional groups of particles (Aitken – under 0.05 µm; submicron – 0.05-0.1 µm; micron – 0.1 - 1 µm, and giant, over 1 µm). The second is *the diffuse zone* (in the volume phase of the halo-chamber, at a rather big distance from the source), extended and characterized by a *dynamic state* of the distribution of the dimensional field and of the lifetime, having all the parameters in a continuous evolution/variation. The third is *the residual or passive zone* (when leaving the halo-chamber), characterized by a low concentration, usually uniform, a *stationary state* of the distribution of the dimensional field and of the lifetime. In the three zones there are different processes, with singular or cumulative, competitive or non-competitive effects in the stabilization-destabilization processes, such as those of: *nucleation, condensation, coagulation, lyophilization, peptization, sedimentation*, etc. They are co-assisted by hydration–dehydration processes of the nanoparticles, in the kinetics of which a special role is played by the *sterical and the*

*electrostatic effects*, the latter being dominant. The behavior of the NaCl nanoparticles in the active anhydrous state is different from the hydrated state in the zones of the halo-chamber.

The specialized literature after 2000 is full of studies and research reports on obtaining and characterizing the behavior of NaCl nanoparticles in *in vitro* and *in vivo* systems, as active principles for therapeutic halo-chambers. They allow the achievement of over 80 percent breathable NaCl dry aerosol nanoparticles and they behave as “bronchial brushes” for the respiratory tracts and as moderators of the dynamics of lung membranes (Alfoldy et al. 2002; Chervinskaya 2007; Hedman et al. 2006; Poryadin et al. 2002).

Through the involvement of other salts ( $\text{CaCl}_2$ ,  $\text{MgCl}_2$ ) and the iodide anions as negative aeroions in the halo-chambers, the applicability extends to other treatments. Among them we can mention the following: thyroidal and hypothalamic diseases, calcium deficits, etc. By associating these treatments with galvanic, diadynamic baths, electrodiaflux, etc., their efficiency is considerably increased (Sandu et al. 2002, 2006).

The action of the dry NaCl nanoparticles at the level of the pulmonary membranes and of the mucociliary system takes place by direct and inverse osmosis and by an ionic change process, with a revitalizing and cleansing effect. Halotherapy, through this type of aerosols, has high efficiency for patients with chronic lung diseases. Controlled-placebo studies have shown that the inclusion of halotherapy in the rehabilitation course of patients with pulmonary pathology improves outcomes for 82-96% of patients, when used in addition to optimal pharmacotherapy. The stronger positive effect is manifest with numerous patients suffering from: mild asthma – 83%, moderate asthma – 83%, severe asthma – 67%, chronic obstructive pulmonary diseases – 91%, simple bronchitis – 95%, acute bronchitis – 93%, pneumonia – 82%, pneumoconiosis – 96%, pollinosis – 81%, chronic rhinitis and sinusitis – 85%, chronic pharyngitis and laryngeal tracheitis – 71% and even skin diseases – 61% (Alfoldy et al. 2002; Chervinskaya et al. 1995, 2007; Hedman et al.

2006; Poryadin et al. 2002.)

The modern applications of dry NaCl aerosols include:

- obtaining ecological microclimates in a habitat through controlled air purification by de-stabilizing the toxic smoke into powders and positive aeroions (through electro-neutralization and extinction);
- cleansing and anti-inflammatory effect on the respiratory system;
- decrease in the inflammation of the respiratory tract, based on more alveolar macrophages and stimulation of the local immune response, as well as on the improvement of biocoenosis (removal of pathogenic agents, speed-up of mucociliary transport and abatement of bronchial inflammation);
- decrease or disappearance of lung-disease symptoms in the pulmonary system;
- prevention of common cold, hay fever and certain skin diseases;
- prevention and restorative treatment of pulmonary diseases;
- elimination of the airborne pollen particles and cigarette-smoke particles from airways (leading to a decrease in the allergic reaction to pollens and positive aeroions);
- improvement of the activity of skin cell ion channels and stimulation of the electrophysiological activity that determines skin protective properties;
- normalization of the skin composition, by improvement of the bacteriostatic, anti-edematous and anti-inflammatory effect.

The advantages of the dry NaCl aeroions are: the scientific basis of the action mechanisms, high efficiency, adaptation to diverse medical and health-improving approaches, no invasiveness, no side effects, comfort and convenience combined with relaxation, removal of physical and psychic emotional discomforts, novelty and attractiveness for the patients. Dry NaCl aeroions also bring

natural medicine-free treatment of respiratory and skin problems, cleansing and sanitation of the airways, enhancement of defence mechanisms of airways, improvement of the biological and immune host-defence mechanism, and decrease in the base medication load.

There are two types of beneficial effects: *physical* and *mental*.

*The physical effect* can be obtained by people with the following discomforts: chronic pulmonary diseases (asthma, chronic obstructive pulmonary diseases, pneumonia, bronchitis, cystic fibrosis); allergies with an effect on ear, nose, throat, sinuses (e.g. hay fever); ENT-diseases (rhinitis, sinusitis, pharyngitis, laryngitis); common cold; respiratory discomfort due to harmful airborne and tobacco-smoke particles; dermatological disorders (acne, neurodermatitis, psoriasis, cellulite); heart and vascular problems (especially in combination with lung diseases); autonomic nervous system disorders; inability to lose fat tissue due to disturbed metabolism.

*The mental effects* can be obtained by people with the following discomforts: chronic fatigue, overstrain and exhaustion, depression, low resistance to stress, nicotine withdrawal.

## Conclusions

Through the comparative analysis of the ancient literary sources in the Mediterranean area and of the ethnographic information, we can point out that the validity of the prescriptions mentioned by ancient authors who referred to the medical cures based on salt is partially confirmed through the fact that halotherapeutic practices still exist in today's Moldavia. The validity under discussion is also confirmed through the biochemical scientific analysis of such practices, which constitutes an important part of the ethnoscience to be taken into account in the case of both ancient authors and current users in Moldavia. In some instances, very recently patented techniques actually continue ancient halotherapeutic practices and current traditional ones of eastern Romania. Thus we must admit that, besides the well-known role of salt in nutrition and food preservation (the latter being essential before the

refrigeration era), salt also has a great therapeutic role. As we know for sure that current traditions in the therapeutic uses of salt/salt water are not derived directly from ancient authors' texts, we clearly have a case of concordances over space and time. Such correspondence were demonstrated for spaces with little cultural contact (we may mention that the territory of today's eastern Romania was not included in the Roman Empire) and for periods separated by two thousand years. That is why we can assume that halotherapeutic procedures were in use during diverse phases of history and prehistory in all areas with salt water springs. In consequence, in the holistic evaluation of the evolution of diverse archaeological cultures and populations in areas with salt water springs, archaeologists and anthropologists should take into account the halotherapeutic aspect. The latter is very important in maintaining the health of human communities. Of course, we should not mechanically refer the halotherapeutic practices mentioned in ethnographic surveys or in ancient authors' texts to prehistory. Nevertheless, the persistence of certain halotherapeutic prescriptions throughout two millennia can lead to the idea that such prescriptions have their roots in prehistory, and that halotherapy actually stands for a human invariant in areas rich in salt around the globe.

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