THE DISTRIBUTION OF SALT MASSIFS AND THE EXPLOITATION OF ANCIENT AND CURRENT RESERVES OF MINERALIZED WATERS WITHIN THE SIRET HYDROGRAPHICAL BASIN (ROMANIA) – CASE STUDY FOR THE EASTERN AREA OF THE EASTERN CARPATHIANS

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ABSTRACT

The present study proposed to underline the importance of salt-water reserves in the life of the local communities and to quantify the value of certain basic elements that can affect their chemical properties. The salinity does not produce pollution, but only a restriction of water use in certain domains. There is a close connection between the genesis of salt reserves and the emergence of springs, the type of rock, the regional and local climatic regime, the type of hydrographical network supply, and the liquid discharge. The waters within the Carpathian mountainous and sub-mountainous area can be influenced directly by the emergence of salt deposits on the surface. The poorest springs are situated in the area of the Moldavian Subcarpathians, where there are diapiric outcrops. The Neolithic settlements in the east of the Eastern Carpathians attest the oldest use of salt springs in the world. Some springs may be underlined by the humans through animals, mostly the sheep, which looked for salinized fields for their optimal water intake. The salt-water springs are used on a local scale; in this sense, there is a traditional popular management (ethnomanagement). There are numerous ancient and current settlements which have occupied the salinized areas for the exploitation and commercialisation of mineralized waters or of salt in its native state.

Keywords: ethnoarchaeology, ethnomanagement, salt springs, salt deposits, Romania, salinity.

INTRODUCTION

The salt deposits in Romania are extremely large and they are situated in the Transylvanian depression (the largest reserves) and the extra-Carpathian area situated between the Moldavian valley to the north and the Motru valley to the east (the Moldavian Subcarpathians, the Curvature Subcarpathians, and the Getian Subcarpathians) [1]. The salt massifs in the east of the Eastern Carpathians have recorded the oldest exploitations, dating to the Neolithic [2], [3], [4].

The present study follows the relation between the salt massifs in the east of the Eastern Carpathians and the way the salt springs emerged (by the degree of salinity). At

the same time, the study dealt with the way human communities—mostly the rural ones—have exploited and used salt waters (especially springs). The current ethnomanagement is underlined as an inheritance of the preindustrial management. The connection between the aquatic setting in the Eastern Carpathians and the use and traditional processing of salt waters (springs and streams) is pinpointed. Taking into account the range of non-industrial use of salt springs by the rural communities, ethnomanagement can be seen as an operational concept in this case [5]. In this sense, besides the field observations, surveys were conducted in order to assess the importance of the salt waters in the life of the local communities and their use on a local and regional scale. When applicable, the study emphasizes on certain traditional activities that should be conserved in the cultural, traditional patrimony of the rural communities, though they may not be economically lucrative.

The salt springs, just like the mineral springs, have been protected and intensely exploited by the local population and by the State institutions. They become visible on the surface following the dissolution of the salt within the substratum or the direct dissolution of the compact salt deposits. They usually emerge on the foot of slopes, on top of the impermeable layers [6]. The discharges depend on the amount of precipitations and on the value of evapotranspiration specific to the area where they are formed. Most salt springs in Romania have reduced discharges because they emerge within the temperate-continental climate of transition, which records mean precipitations ranging between 600 and 800 mm/year.

The bibliography referring to the ethnoarchaeology of salt-water exploitation is relatively recent [7], [3]. Salt has played a defining role in diet, human and animal health, food preservation for unproductive seasons, in the stability and development of human habitat, etc. [7]. This led to the tendency to control (including by military means) the deposit salt within the continental regions. In Romania, mostly in the Moldavian Subcarpathian area, the tracks of the oldest salt exploitations on the European territory are found, starting with the Starčevo-Criș culture [4]. The ethnographic, ethnohistorical, and ethnoarchaeological approaches on the issue of salt have been studied; they have led to notable outcomes, including on an international level.

REGIONAL SETTING

The streams in the east of the Eastern Carpathians belong exclusively to the Siret hydrographical basin. The Siret River collects the waters of the Eastern Carpathians, of the Moldavian Subcarpathians, of the Curvature Subcarpathians, on the right side, and of the Moldavian Plateau (weakly developed basin), on the left side. The Siret River is the most important tributary in the lower watershed of the Danube River. From an economic viewpoint, the Siret River represents the most important hydrographical highway for the eastern part of Romania. The mean multiannual discharge of Siret is 220 m^3/s [8].

The Subcarpathian area analysed as case study is situated between the State frontier of Romania with Ukraine, to the north and the Buzu valley, to the south. It comprises two subunits of the mountainous landform: the Eastern Carpathians per se and the Subcarpathians (the entire Moldavian Subcarpathians and a part of the Curvature Subcarpathians (Fig. 1). This is the most extended area where the salt deposits develop in the east of Romania.

MATERIALS AND METHODS

The field measurements included summer campaigns in all landform units and in the hydrographical basins in the east of the Eastern Carpathians (the historical region of Moldavia). They targeted the large hydrographical basin of Siret. The sampling campaign took place between 2004 and 2007 and between 2008 and 2011, in the month of August, when the highest temperatures are recorded in Romania and when the liquid discharges (of springs and of streams) are the lowest. For the expeditionary measurements, the HACH Multiparameter meter was used, for the following parameters: temperature, salinity, pH, total dissolved solids (TDS), turbidity, dissolved oxygen, nitrates, nitrites, etc. In this case, the salinity—the most important qualitative parameter—was analysed and underlined.

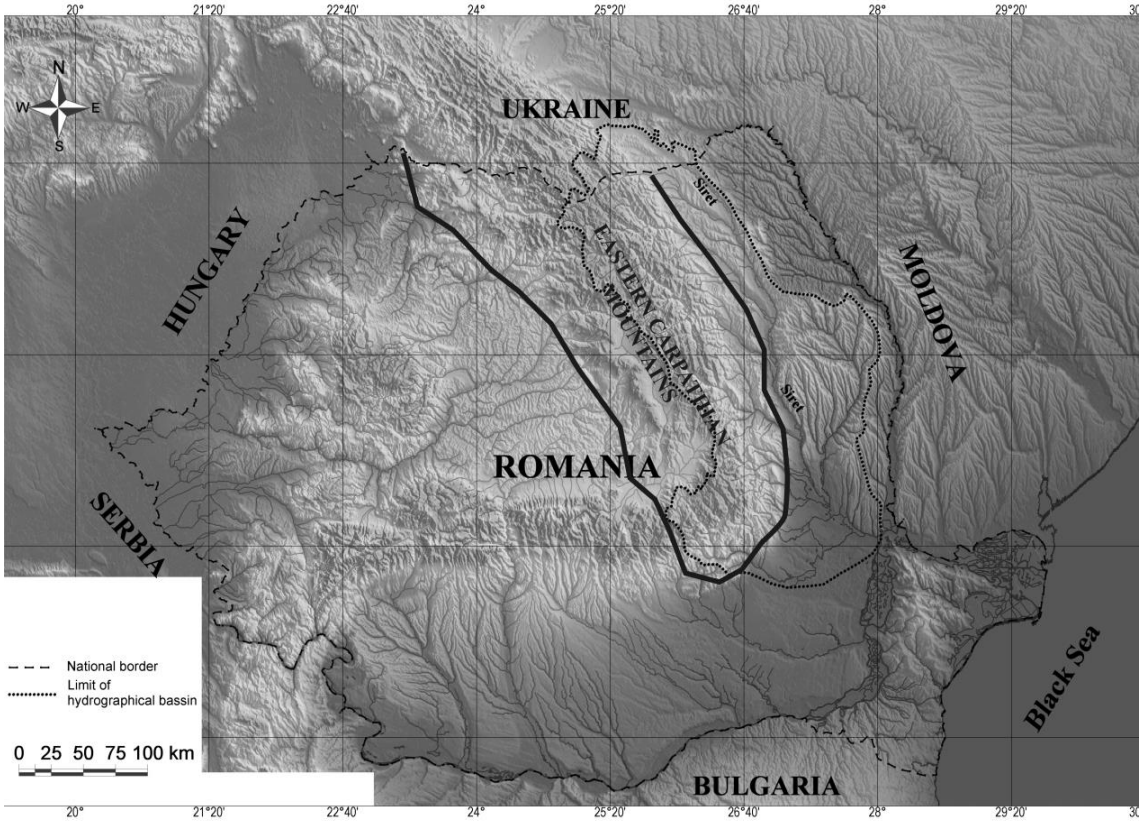

Fig. 1 The geographic location of the Siret hydrographical basin and of the eastern sector of the Eastern Carpathians

221 springs within the Carpathian and Subcarpathian area were targeted. Most springs were located by using information from the locals. Only some of them were located based on cartographic information. Some springs were located by consulting the spatial distribution of the salt deposits featured on specialized maps. Not all the springs analysed have a high degree of salinity. Some of the springs are also freshwaters; they are used to other ends, usually as drinking water or water for households. Some samples have also been analysed in the laboratory, especially those with high degree of salinity, in order to determine the chemical composition by elements. For this study, the salt

springs used by the local human communities currently or in the past have been inventoried and analysed. Only the exploited springs, situated in accessible locations, have been analysed.

Based on the questionnaires and on interviewing the population, the isochrones of salt as merchandise were elaborated. In this case, the export "routes" were identified, as well as the localities where the commercial transactions took place. The method of spatial analysis—specific to geographic research, with applicability to the ethnoarchaeological domain—is tested. The plan is to extend this method to the level of the entire Carpathian and extra-Carpathian space in the future.

RESULTS

The range of the Carpathian Mountains began consolidating since the Lower Cretaceous. The tectonic, structural, and petrographic complications expressed themselves by three morphogenetic trends: the structural consolidation of the Mesozoic-Crystalline units and the formation of the levelling surface since the Upper Cretaceous-Oligocene; intense epirogenetic movements, with opposite directions, which raised the Carpathian branches and sunk the depression areas; neo-tectonic elevations and subaerial modelling (Fig. 2).

The ancient Carpathian stage led to the subsequent folding and volcanism. In the interval middle Cretaceous–Palaeogene, the Borescu levelling surface was modelled. It comprises two orogenetic phases: Austrian and Laramian. The neo-Carpathian stage led to the formation of the newest landforms. The levelling surfaces of Rau Ses and Gornovita were modelled. The Styric and Moldavian movements led to an accentuation of the morphotectonic inversions and to the disappearance of the geosynclinal characters. The Attic movements during the Upper Sarmatian left the final mark on the tectonic style of the Palaeogene flysch units. The Rhodanian movements imposed the withdrawal of the waters from the Transylvanian Depression and the Moldavian Plateau. The Wallachian tectonic phase affected the Subcarpathian area, which it raised as wide, faulted folds, in which diapirism played a decisive role. Practically, it is the most important phase in the creation of salt deposits within the lagoon areas. The current modelling of the landform is the track of the Quaternary era.

The landform of the Eastern Carpathians is influenced by the evolution of the East-European plate and of the Transylvanian and Pannonian microplates. At the crossroad of the three, two phenomena occurred concomitantly: the subduction and the volcanism of the western area [9]. The Eastern Carpathians present three longitudinal structural bands, distinct from a lithological and tectonic perspective: the central crystalline, the eastern flysch, and the western volcanism. Within the flysch unit, one can distinguish the Subcarpathian nappe, which harbours the most important salt deposits in the Eastern Carpathians.

The Neptunists stated that salt comes from the continental deposits or from the seawaters. Some ideas—with no scientific basis—even support that salt comes from the steppe continental deposits. Other ideas that circulated for a while in the scientific world were that salt comes from the secretion of plants and animals or from the salts washed away by the rivers and deposited within the steppes. A basic condition for the

emergence of salt was the existence of a lagoon or of epicontinental seas and of a steppe climate [10].

The unanimously accepted idea is that salts come from the dissolution of the geological layers and from their accumulation within the seawaters. The evaporation of the epicontinental seas and of the lagoons favours the deposition of salts as compact sediments with variable thickness. Their existence between the geological layers is explained by the covering after surface erosion and by the deposition of sedimentary rocks in aerial or subaerial conditions [11]. The emergence of the salt layers on the surface is explained by the existence of a tectonics specific to the salt deposits: salt has high degree of plasticity; hence, it migrates and it elevates the covering sedimentary layers. In the conditions of the existence of certain thick geological deposits—which exert a strong pressure and emit a high temperature—the deposit salts start moving towards the marginal areas. If they reach the alignment of hard rocks, they rise towards the surface and they carry along the sedimentary layers, which they fold. In this case, the diapiric folds appear; they are specific to the Transylvanian depression or to the Subcarpathian (extra-Carpathian) areas.

The issue of salt genesis and evolution is treated by both geology and geomorphology (the physical geography field). The geographic literature underlines the origin of salts from ocean waters: they come from the earth's crust, after the dissolution through streams. On principle, the primordial water was a freshwater. Hence, salt follows a geological cycle: it is dissolved from the earth's crust, carried by rivers, accumulated in seas and oceans, re-set under the form of deposits, covered by recent sediments. Its emergence on the surface is due to tectonics and to lateral movements, as a result of plasticity. On the Romanian territory, the diapiric folds are the characteristic feature, because the salt cores can elevate the sedimentary layers to the vertical [12].

The Eocene and Miocene deposits of salt on the Romanian territory are specific to the lagoon and coast facies, and only rarely to the pelagic one (Fig. 2). These testimonies indicate clearly the marine origin of an epicontinental sea, such as the Sarmatian Sea in the east of Europe [13]. The salt springs are due to the washing away and dissolution of salt cores (from deposits) or to the dissolution of salts from the sedimentary deposits (loams, clays, gravelly sands, sandstones, etc.). In the Transylvanian depression alone, in the diapiric area, there are over 800 salt springs [13].

In the years 1960-1970, the chemical differentiations between the salt deposits in the Transylvanian depression and those in the outer Carpathian arc were explained. Those within the depression are pure, while those of the Subcarpathians are mixed with carbonates and sulphates. That was the period "of the great scientific disputes in the field of salt": what is the palaeogeographic appearance of the Carpathian regions during the deposition of evaporites? Under which circumstances did the various categories of evaporates from the complex of salts dissolved in the seawaters separate? Where is the connection route of the seawaters towards the Transylvanian depression, whose evaporation led to the creation of evaporites? What are the amounts of evaporites resulted from the main structural units and what are the causes of their repartition? Why is there only one salt layer (400 m thick) in the Transylvanian depression, while outside the Carpathian arc, there are 2-4 salt layers, of different ages [13]? The deposition of a 400 m-thick layer could have taken 2,000 years (or 5,000 years) [13].

The different deposition—from one region to another—of halite or of potassium or magnesium salts depends on the local physico-geographic conditions. On a 35‰ mean concentration, the following categories of salt are deposited: 78% halite, 17.7% complex potassium and magnesium salts (chlorides, sulphates, etc.), 3.6% gypsum, 0.4% dolomites and minute amounts of bromides, iodides, etc. [13] The various proportions of these elements make the differentiation between the salt massifs in Romania.

The existence of isolated or large lagoons determined the emergence of the salt deposits. The positive or negative tectonic movements favoured the connection of the lagoons with the sea or the temporary interruption of the link with the outside. In the main lagoon—represented by the Transylvanian depression—halite was deposited, while in the intermediary lagoons—crossed by the sea currents in their way to the central arc—other categories of salts were deposited. The intermediary lagoons played the role of traps [13]. The significant thickness of the gypsum and dolomite deposits in the outer region of the Curvature Carpathians proves the existence of a major water current.

The alignment of the intermediary lagoons overlaps the area represented by the Curvature Subcarpathians and by the south of the Moldavian Subcarpathians (Fig. 3). These lagoons had the role of retaining the seawaters (with low concentrations and high temperatures) in their way towards the Transylvanian depression. In these areas, the calcium and magnesium carbonates (the least soluble and, at the same time, thermophilic) are deposited as dolomites. In the next stage, the calcium sulphate (thermophilic) is deposited. In this case, only the waters loaded with sodium chloride and complex potassium and magnesium salts managed to reach the Transylvanian depression, which appeared as a large lagoon. The waters of the Transylvanian lagoon were colder (higher water amount), reason for which halite—a relatively cryophilic mineral—managed to deposit [13].

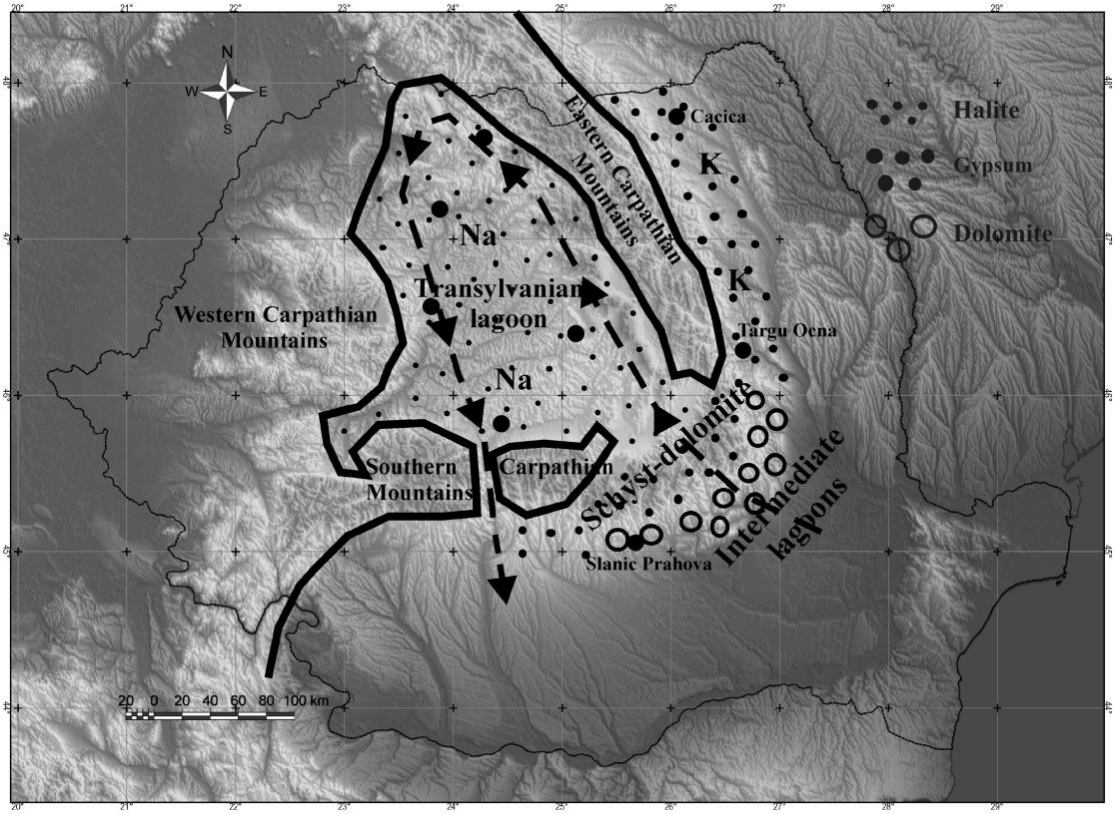

Fig. 2 The Vrancea Gate and the Olt Gate as contact sector of the Planetary Ocean with the lagoon of the Transylvanian depression (adaptation after Ciupagea et al., 1970). The existence of intermediate lagoons and of the sea current within the Transylvanian depression.

The complex potassium and magnesium salts are present in small amounts only in the Miocene of northern Trotus, where the lagoons reached high concentrations because they were not in the way of the currents heading towards the Transylvanian depression. In the Transylvanian depression, the research conducted for the discovery of potassium salts (1909) led to the discovery of marsh gas, but the searched elements were not found. The lack of potassium and magnesium salts in the Transylvanian depression is due to the existence of two connection routes with the open ocean: an entry way in the curvature sector and an exit way of the current, in the Olt corridor (Fig. 3). In this case, the large lagoon eliminated the waters with high potassium and magnesium concentrations. A second cause is represented by the existence of large water mass, which did not evaporate completely; hence, the potassium and magnesium salts were taken over by the circular current. The lack of these salts is a consequence of the fact that the depression waters were never concentrated enough to deposit such soluble elements.

Most specialists pinpoint the impressive salt reserves on the Romanian territory and, at the same time, their exceptional quality (99.9% NaCl) — one of the purest on Earth. This is why the extraction profitability is maximum, mostly considering that the most important lodes are situated near the topographic surface: 300 salt massifs are inventoried, as well as over 3,000 salt springs [14]. In 2010, there were only six active

exploitations: Targu Ocna, Cacica (the Siret basin), Praid, Ocna Mures (the Transylvanian depression), and Slanic Prahova, Ocnele Mari (the Curvature and Getian Subcarpathians). For touristic purposes, the same points were exploited, except for the salt mine of Ocna Mures.

The salt deposits within the Siret hydrographical basin accompany the Curvature Subcarpathians, the Moldavian Subcarpathians, and the contact area between the Suceava Plateau and Obcina Mare. They are easily exploitable in mines because they are situated at small depths and they contain a high concentration of NaCl: Cacica, Targu Ocna, Slanic Moldova, etc. The eastern extra-Carpathian area comprises three landform subunits that are part of the Siret hydrographical basin: the Suceava Plateau (the Suceava County), the Moldavian Subcarpathians (the counties of Neamț and Bacau), and partially the Curvature Subcarpathians (the Vrancea County). The salt reserves are significant, but the exploitation level is very low. For the Siret hydrographical basin, 64 salt deposits have been identified in the upper and lower geological layers [15].

In the corresponding extra-Carpathian area, 221 salt springs and freshwater springs have been identified, distributed as follows: 50 in the Suceava County, 70 in the Neamt County, 78 in the Bacau County, and 23 in the Vrancea County. Almost all of them are distributed in the immediate vicinity of the salt deposits (Alexianu et al., 2011). It is worth mentioning that the salt springs influence only the salinity of small-sized streams, which dry up in most of the cases. The only permanent brooks—highly influenced by salinity—are Sarata (in the area of the local balneary resort of Oglinzi, the Neamt County) and Sarata, in the Depression of Soveja (the Vrancea County).

Most salt springs within the eastern extra-Carpathian unit belong to the deposit salt (NaCl) development area, which often outcrop by the day. Around the salt springs, there is no industrial exploitation for deposit salt. Currently, the only industrial exploitations of deposit salt are those in the mines of Targu Ocna and Cacica. Considering the low discharge of salt springs, there is only a traditional exploitation of salt water (which washes away the salt of the substratum and which emerges on the surface as highly salinized waters).

The salt within the eastern extra-Carpathian area is used in both solid and liquid state. Until the first half of the 20th century (by applying the brine thermal processing), people usually obtained recrystallized salt, popularly called *husca*, from the salt in liquid dispersion. Today, this procedure is barely ever used. The brine is used to prepare many types of food, on the household level, as well as on the community level (rural restaurants, monastic establishments), to prepare cheese products, to preserve animal and vegetal products, to process the sheepskins, etc. The brine is also used for the diet of the livestock, by splashing salt water over fodder or by adding it to the gruel for pigs [16]. Haycocks (especially those made of oats) are often splashed with brine, as a prevention measure against rodents.

There are close connections between the prehistoric places belonging to the Starčevo-Cris and Cucuteni cultures (6000–3500 BC) and most salt springs. The same goes for the Subcarpathian area of the Neamt County [17], for the sector Lunca–Oglinzi–Targu Neamt [4], for the sector of Poduri in the Bacau County [2], [18], and for the sector Cucuteni–Cetatuia, with the spring of Bals–*Arcaci* (Iasi). The spatial relations are supported by the presence of Cucuteni briquetage within high settlements: Oglinzi–

Cetatuia and Raucesti–*Munteni* [17]. It appears that the Cucuteni high settlements—fortified or not—play a central role in the control and the exploitation of salt. They ensure the visual control of the main access routes to the salt springs and the diffusion of the salt "loafs of bread" produced. By using a reversed procedure compared to classical archaeology, the implemented archaeological approach is mainly interested in the natural resources, not in vestiges. The focus in on the optimal reconstitution of the history of the prehistoric communities and of their sociocultural options; the criterion is an irreplaceable substance, condition of life and source of enrichment, whose origin is inscribed among the myths of the first agricultural societies: salt [5], [18].

For an exact determination of salt-water exploitations from springs and of their use, field surveys have been conducted. They focused on questioning the subjects that lived near the springs (58), in the villages around the springs (105), and in the sheepfolds (13). On small areas, the surveys were conducted in two distinct periods: 2004-2007 and 2008-2011.

DISCUSSIONS

The Romanian Subcarpathian—a transitional one, between mountain and plain—is weakly populated because the soil resources are limited. Usually, the sectors of transition provide optimal habitation conditions. In this case (the Moldavian Subcarpathians and the Curvature Subcarpathians), there is a limitative factor: salt. In this sense, the most important track was given by the structural diversity of the geological deposits and by the existence of the salt deposits. Under these circumstances, there is still an ancient habitation on the fields affected by salinization, too. This phenomenon is due to the exploitation of salt waters or deposit salt. In the lack of food products, salt was traded for grain or other goods.

The influence of salinized deposits or of deposit salt is dominant only in case of groundwaters, which are loaded with salts. The high loading is also determined by the weak circulation of water in the underground (fine granulometry) or by the reduced pluvial supply. It is worth underlining that the salt springs have low discharges. The lowered amounts of water represent the consequence of reduced precipitations and of short slopes. In this case, the underground circulation is weak (Fig. 3).

People have been using the salt waters from springs and more rarely from streams (as a crust formed after the summer dry up). The springs have much saltier waters than the streams. This is precisely why they have been exploited intensely. The springs represent the main source of supply for rivers, but not the salt ones particularly. The relatively low salt content of the rivers is due to the reduced underground discharges and to a dilution produced by the meteoric waters. The dilution power is apparent in case of large-sized hydrographical arteries. An important degree of salinity is recorded only for small-sized hydrographical arteries, with low discharges, which can often dry up.

The nature of the geological deposits has a special influence on the salinity of groundwaters and on that of the surface waters, as well. Salt deposit massifs are situated in the area of the Moldavian Subcarpathians and of the Curvature ones. This is why a part of the surface waters has higher salinity than those in the Moldavian Plateau. In the Moldavian Plateau, there are several hydrographical arteries with an important degree of

salinity, but they do not exceed the value of those in the Subcarpathian area. Within the Moldavian Plateau, there are no salt deposits, but only saliferous sandy-clay deposits, which originate in the waters of the epicontinental seas that used to cover these surfaces. Salt comes from their dissolution after the circulation of groundwaters.

There is a close connection between the position of the salt deposits and the emergence of springs with high degree of salinity. Most salt springs are situated in the immediate vicinity of the salt deposits. There are also springs that emerge relatively far away from the saliferous area, but their existence is due to underground circulation, along the geological layers. The springs that emerge in the sedimentary deposits with fine granulometry have high degree of salinity. This is due to the reduced velocity of groundwaters. The emergence of salt springs is favoured by the existence of an elevated slope — a consequence of the diapiric folds.

Most springs are monoclinal layer descending (on diapiric folds) springs or valley-descending springs. They emerge at the foot of the slopes. From a geological perspective, they are part of the category of springs vadose from stratified sedimentary fields, on monoclinal terrains. By their flow, they are divided into two categories: perennial and intermittent. They are included in the category of chlorided (salt) mineral springs, where the ion weighting consists of Na^+ and Cl^-. The total mineralization is 1 g/L NaCl, which means 393 mg Na^+ and 607 mg Cl^-. These mineral waters emerge in localities such as Cacica, Slanic Moldova, Targu Ocna, etc.

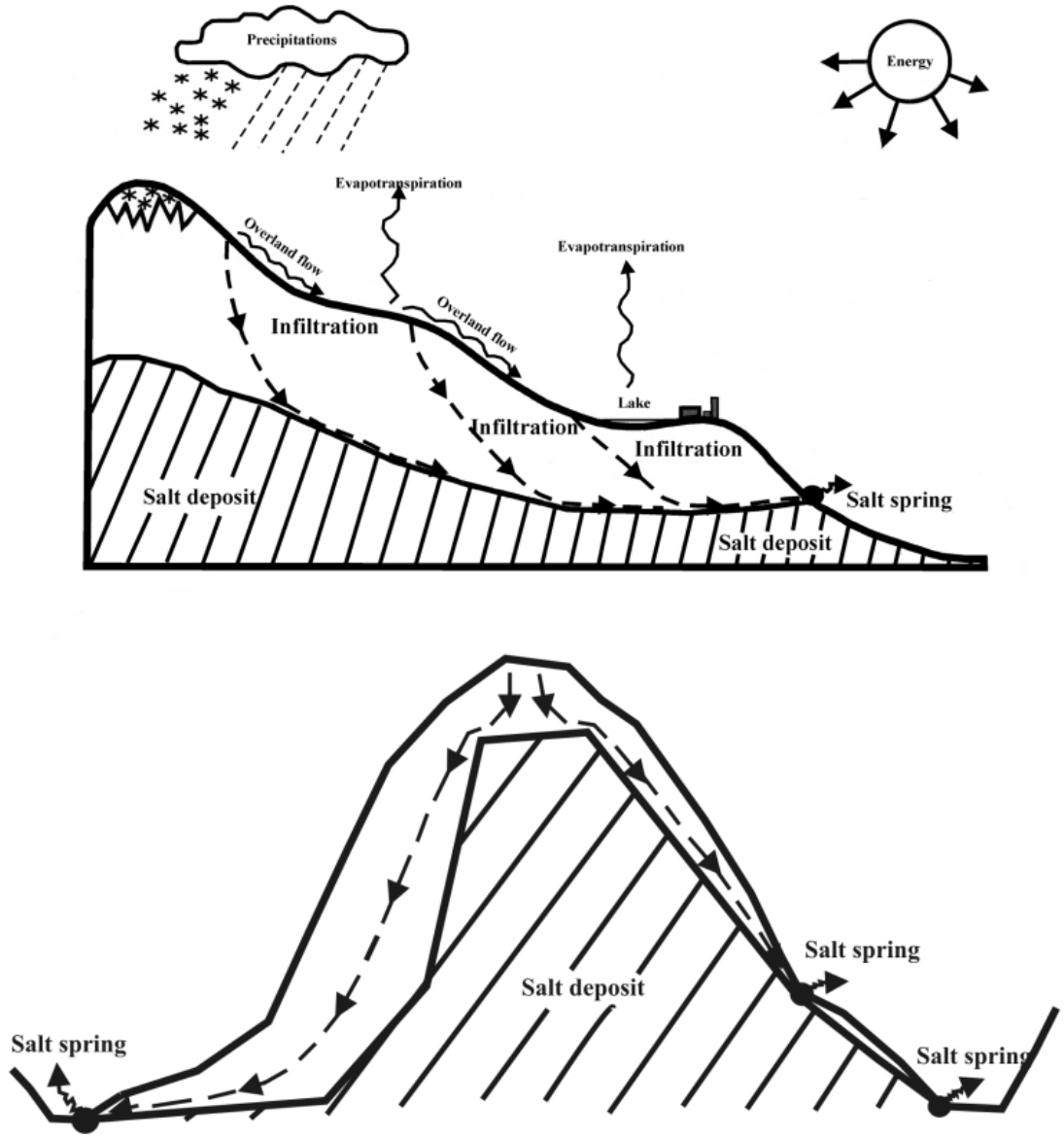

Fig. 3 The formation of slightly ascending and descending layer springs

Though they record low discharges, the salt springs are identified and most of the times used by the local population. Some springs have been discovered through animals. The wild animals and the livestock are attracted by places where there is higher salinity. The salt need made certain fields rich in salt extremely attractive for the animals, as they benefit from some of it through salt waters or by licking the soil. Such cases are reported in China. Organisms need salt, depending on their climatic region. The wild animals and the livestock (sheep have contributed to the discovery of salt springs) ensure their salt intake by consuming products with high amounts of salt, by licking salt cores or salinized soils; in the Moldavian Subcarpathian area, most often they consume salt waters from the pseudokarst or clastokarst springs. The proper salt intake ensures the osmotic balance necessary for a proper body functioning. The lack or reduction of salt may endanger the life of organisms. The reduced salt intake damages

the vital physiological functions, the behaviour; it leads to losing weight, fertility, or even lactation.

Taking into account that the northeast of Romania is the poorest region of the European Community, many of the ancient crafts have been preserved. Hence, starting from the current situation, one can reconstitute—on historical phases—the use of water resources (in general), and of the salt resources (especially). The salt-water exploitation traditions have been preserved, considering the isolation of the rural communities and the lack of proper infrastructure, as well as the high quality of the water from salt springs. The exploitation of salt waters and the local ethnomanagement are still of actuality, first because of the particular sapidity of the water from salt springs. The notions of ethnomanagement and ethnoecology have been used successfully to treat subjects related to the local production and to the development of communal or regional territories [19].

For the European prehistory, the Moldavian area is particular and it distinguishes clearly from other European or global areas by the fact that the ancestral salt exploitation and valorisation practices have continued to be highly used in the absence of mechanisation, economic organization, and legal regulations [5]. Though the refrigeration era has reached even to the most isolated places on the Romanian territory, the food preserving technique by using salt is still present in the Moldavian Subcarpathian area. In some cases, in the rural setting, surprising uses of both preservation systems have been reported, in the sense that, for instance, the bacon preserved by brine immersion is then placed in the refrigerator.

The Poiana Slatinei point, in Lunca (the commune of Vanatori-Neamt, Neamt County), is the most representative salt-water exploitation in Moldavia and a reference point for the European prehistory. In this area, three zones with archaeological depositions have been identified. Zone A—the most important one—is situated near the current salt spring. The archaeological materials belong to the Neolithic and to the Chalcolithic (the cultures of Starčevo-Criș, of linear pottery, Precucuteni, Cucuteni), to the Bronze Age (the cultures of Costisa-Komarov, Noua), and to the Early Middle Ages (the 10^{th}-12^{th} centuries) and the 19^{th} century.

The information regarding the manner of exploiting and using the salt waters has underlined the ethnoarchaeological potential of Moldavia. The identification of the exploitation perimeters and of the traditional uses of salt springs presents numerous practical implications from various domains: public health (by identifying the harmful trace elements in the salt waters); halotherapy (contraindications of traditional halotherapeutic practices); sustainability of rural economy (determining the parameters of parallel economy); archaeological and ethnographic tourism (totally non-valorised touristic potential).

The streams with high salinity are not used because their salt concentration is low. Because they feature high salinity only in the upper stream sectors, near the springs, the preferred method is to use only the latter. Only the salt crusts that remain after the summer dry up are used. Considering even only this aspect, it can be said that the salt from streams is used traditionally, too.

From a cultural perspective, this approach saves from oblivion the invisible patrimony generated by the existence of salt springs. Paradoxically, the exploitation of salt springs has flourished after the encouragement of the private initiative specific to

the period after the 1989 Revolution, when the foundations of the capitalist economic in Romania were set. It is beyond doubt that soon this phenomenon will disappear, as it occurred in the entire European space. From this perspective, it is worth emphasizing on the initiative of certain entrepreneurs to build cu salt-water pools, small precincts for baths, in balneary resorts, to use salt water as food supplement in pig farms, for the preservation of the *telemea* by brine immersion (in micro-companies), etc.

Nowadays, the preservation of salt-water exploitation and use is also encouraged by the "ecologist" current of food consumption. Agro-tourism promotes the idea "just like mom used to make", where food is prepared following ancient recipes, often transmitted orally (from generation to generation). At first sight, the exploitation of salt springs seems to be specific to poor people. The research conducted thus far has demonstrated that consumers with a decent living standard, to say the least, have been using the water from salt springs; actually, its tasting qualities have played the most important role in the continuation of the traditional salt supply practices. This change of values can be encouraged only if the government takes decisions in the favour of ethnomanagement and ecotourism. In this case, the dispute popular management popular versus modern management arises [5].

Though Romania is in the stage of industrial-agrarian development, its territory has been witnessing numerous examples of traditional behaviour preservation. This expression is present mainly in the rural environment, while in the urban one, it is on the verge of extinction. From an economic perspective, Moldavia comprises two distinct regions: the eastern extra-Carpathian unit, represented by the Subcarpathian unit (the Moldavian Subcarpathians and the Curvature Subcarpathians, to which the Suceava Plateau can be added), more developed; the unit of the Moldavian Plateau (the Moldavian Plain, the Barlad Plateau, and the Lower Siret Plain), poorer. Of course, the difference is made by a cumulus of factors, mostly the existence of natural resources (on and in the soil), but the transition unit represented by the Subcarpathians is more developed economically also because it has always used two categories of water: freshwater and salt water. The existence of salt waters has facilitated the local and regional development of certain traditional economic branches, based on their exploitation and use.

CONCLUSIONS

The nature of the geological substratum in the east of the Eastern Carpathians (the Siret hydrographical basin) has a special influence on the salinity of groundwaters and surface waters. The saltiest springs are situated in the area of the main salt deposits or at the foot of diapiric folds. The salt deposits belong to the lagoon systems, which have allowed a massive accumulation of sea salts. The human activities related to the exploitation of salt resources as salt-water source are influenced to the same extent.

There is a close connection between the distribution of the salt deposits and the emergence of salt springs. At the same thing, there is a one-to-one relation between the salinity and the alkalinity of surface waters. Most salt (and alkaline) waters are situated in the Curvature Subcarpathians. The high salinity is specific to springs. The small rivers—with low discharges—are highly influenced by salinity. The large streams contain freshwater because the dilution power of the water is significant. The salinity is

not an indicator of pollution, but it may alter the chemical properties of waters and, at the same time, it may limit their use.

The archaeological traces indicate that the local populations have used the salt waters even since the Neolithic and the Chalcolithic. These are the oldest testimonies of this type on the European continent and among the first on the entire Globe. The manners of exploiting and using salt waters are still of actuality in most ancient settlements. Unfortunately, because of the modern technique implemented in almost all industrial and household domains, these ancestral crafts will disappear soon. The ethnomanagement of salt waters is the inheritance of preindustrial management.

The emergence and development of human settlements were influenced by the existence of springs and of freshwater streams. The localities which also benefitted from salt waters flourished more, because salt waters were, at a certain point, highly valuable in the local and regional economy. The eastern extra-Carpathian region (of a Subcarpathian type) has recorded a much more significant economic development compared to the other regions in the east of Romania. Besides the fact that they represent a transition landform, between mountain and plateau or plain, with diverse natural resources, it also encompasses the most important salt reserves, exploited and traded since time immemorial.

The salt "commerce" (barter)—carried on in the past on a regional level (physical-geographic units or historical regions)—is practiced today only on a local scale, around the salt springs. It is also worth underlining a surprising aspect: the transmission and preservation of the ancient occupations related to the exploitation of salt from brine. From this standpoint, the touristic resource, based on the method of exploiting salt from brine, can represent an important source of revenue.

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