

SALT DEPOSITS IN THE ROMANIAN SUBCARPATHIANS - GENESIS, REPARTITION AND ETHNOMANAGEMENT

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Abstract

Subcarpathians represent the transition unit between mountain and plateau and they are rich in salt deposits. They are situated between the Valleys of Moldova (N) and Motru (V). Mine salt has been exploited since the Neolithic and it still represents an important source of raw materials for the rural population. Salt deposits were created in the lagoon areas situated near the mountain frame. The local climate favoured water evaporation and the depositing of salt, which was covered by eroded materials from Eastern and Southern Carpathians. The high degree of salinity was provided by the warm and dry climate. Local factors led to a chemical differentiation between the Subcarpathian deposits and Transylvanian Depression deposits. Ancient exploitations, dating back in history, have recorded continuity until nowadays. Most amounts of salt are used in chemical industry. In terms of ethnomanagement, it is worth reminding household uses: for preserving vegetables, meat; for making cheese; for sprinkling hays, etc. On local level, it is distributed on short distances and only rarely transported on long distances (dozens or hundreds of kilometres). Maps were generated for the main salt deposits within the Romanian Subcarpathian area.

Keywords: *Exploitation; Lagoons; Spatial repartition; Resource; Utilization.*

Introduction

Subcarpathians represents the hill landform that makes the transition from mountain to plateau. In terms of altitude, they are hills, while in terms of genetics they are mountains. They alternate in anticlines (hills) and synclines (depressions) that correspond to geological structures that are not evenly tectonized. In their subsoil, there are important reserves of halite, in the form of salt deposits. The area of Romanian Subcarpathians unfolds along the external margin of Eastern and Southern Carpathians.

The importance of oil and natural gas – both closely related to the existence of salt – determined the emergence of early and highly detailed studies regarding the genesis and repartition of salt on the Romanian territory [1-6]. Subsequent studies concerned the assessment of salt resources and the exploitation manner [7-18]. The richest subsoil resources of Romania are represented by the halite within the Subcarpathians and within the Transylvanian

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Depression. The impetuous development of chemical industry during the communist period stimulated studies regarding the assessment of resources and the chemical characteristics of salt.

Modern, interdisciplinary studies followed the space and time evolution of salt exploitation on the Romanian territory. They copied the models applied to other regions or they brought their own contributions to the completing of methodology [19-38]. Most appraisals were conducted by archaeologists, especially in the areas of Neamț and Bacău counties, with some annotations for the Transylvanian basin [39-56]. In Romania, this approach imposed a new interdisciplinary study direction in Romania: ethnoarchaeology.

This study explains the origin of salt deposits in the Romanian Subcarpathians and their usages over time. Furthermore, it includes graphic illustrations of areas comprising mine salt.

Regional setting

This Subcarpathian unit unfolds along the external margin of the Carpathians, between the Valley of Moldova (to the North) and the Valley of Motru (to the West) (Fig. 1). To the North of the Valley of Moldova, a small unit of transition seems to continue the Moldavian Subcarpathians. However, this sector comprises an important salt deposit at Cacica. Romanian Subcarpathians comprise the following sub-divisions: Moldavian Subcarpathians (between the Valley of Moldova to the North and the Valley of Trotuș to the South); Curvature Subcarpathians (between the Valley of Trotuș to the North and the Valley of Dâmbovița to the West); Getian Subcarpathians (between the Valley of Dâmbovița to the East and the Valley of Motru to the West).



Fig. 1. Geographical location of Romanian Subcarpathians

Materials and methods

The scientific literature (physical geography, geology, archaeology, chemistry, economy, etc) on Subcarpathians is extremely rich [57]. Most materials regarding the genesis [1-13, 15-16, 54] and repartition of salt deposits were found in the scientific literature on this topic. At the same time, data obtained in the field and analyzed in the lab by the authors of this study were used.

Geological maps were generated considering the information provided by the Romanian Institute of Geology [58-61] and our personal observations concerning the localization of salt

rock outcrops within the Moldavian Subcarpathians. Data on ethnomanagement and archaeological records came from both the scientific literature and personal observations, mostly due to research grants where the authors had a role [8, 11, 17-26, 37-56].

Results and discussions

The salt within the terrestrial crust and seawaters comes from the following sources: the primordial atmosphere of Terra; the inside of the Earth through volcanism; the decomposition of minerals comprised within the terrestrial crust. The average salinity of the Planetary Ocean is 35‰ [36]. At the upper level, the average salinity of the Black Sea is 18‰. Mine salt comes from seawaters.

The stage of Laramian orogeny during the Carpathian is included in the upper Senonian-Paleocene interval that completed the structure of the Crystalline-Mesozoic zone within the Oriental Carpathians and the folding of the Cretaceous flysch. The folding movements within the Carpathian geosyncline of the neo-Carpathian stage also led to the elevation of the Subcarpathians. Styrian and Moldavian movements amplified the morphotectonic inversions and determined the disappearance of characters with geosyncline. The Mio-Pliocene foredeep was emphasized and the Moldavian Subcarpathians formations were folded. Attic movements (upper Sarmatian) led to the folding of foredeep formations between Slănicul Buzăului and Dâmbovița. The Walachian tectonic stage manifested strongly in the Curvature Subcarpathians and the Getian Subcarpathians, creating diapiric folds and faults. The quaternary modelling finalized the general appearance of the landform within the Subcarpathian unit [57].

The most important depression corridors within the Subcarpathians correspond to synclines and to subsiding depression areas (Tismana - Runcu, Polovragi - Horezu, Mislea - Podeni, Drajna - Chiojd, Apostolache - Cislău, Nișcov) or to wide synclinoria (Tazlău - Cașin, Cracău - Bistrița). Hilltops correspond to anticlines and anticlinoria (Sporești - Băleni, Voitești - Săcel, Măgura Slătioarei, Istrița, Ciolanul, Pietricica, Pleșu etc.). The “buttonholes” on the diapiric folds favour the emergence of salt grains to the surface: Gura Ociștei, Slănic, Sărata-Monteoru, Târgu Ocna, Ocele Mari, Praid, Cacica [57].

The salt within the Subcarpathians belongs to the lagoon and coast facies (Fig. 2). It represents the marine origin within the Sarmatian Sea (epicontinental) [9]. The chemical differences between salt deposits in the Subcarpathians and in the Transylvanian Depression are due to local conditions. Salt deposits within the Subcarpathians are mixed with carbonates and sulphates, while the salt within the Transylvanian Depression is pure. In the Subcarpathians, there are 2-4 layers with different ages, while in the Transylvanian Depression only one, with thicknesses of 400 m [9]. Considering an average seawater concentration of 35‰, the following salts are deposited: 78% halite; 17.7% complex potassium and magnesium salts (chlorides, sulphates, etc); 3.6% gypsum; 0.4% dolomites and infamous amounts of bromides, iodides, etc. [9]. The different percentage of these elements determines the differentiation of salt deposits in Romania.

In the Transylvanian Depression lagoon, halite has been deposited. In the intermediate lagoons within the Subcarpathians, which marine currents crossed in their way to the central arc, other types of salts have deposited. The Subcarpathians also comprise gypsum and dolomite deposits, which involves the existence of a lacustrine or marine current. Intermediate lagoons are comprised within the areas of Curvature Subcarpathians and of the southern sector of Moldavian Subcarpathians. Lagoons retained marine waters with low concentrations and high temperatures. In this case, calcium and magnesium carbonates deposit as dolomites. In the next stage, the calcium sulphate – which is thermophilic – deposits. Only waters rich in sodium chloride and complex potassium and magnesium salts reach the Transylvanian Depression. The halite, which is cryophilic, deposited in the colder waters of the Transylvanian Depression [9].

Magnesium and potassium salts are underrepresented in the northern sector of the Trotuș River. The lack of magnesium and potassium salts in the Transylvanian Depression is due to the existence of connection pathways with the open ocean (waters with high concentrations of magnesium and potassium are evacuated from the Transylvanian lagoon).

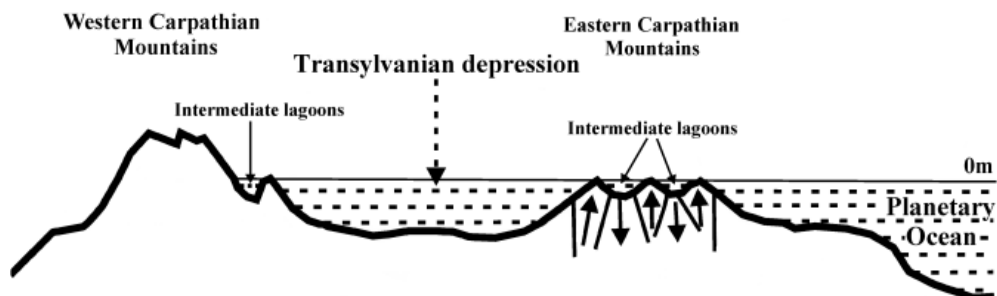


Fig. 2. Creation of salt deposits in Romania (adaptation after [9])

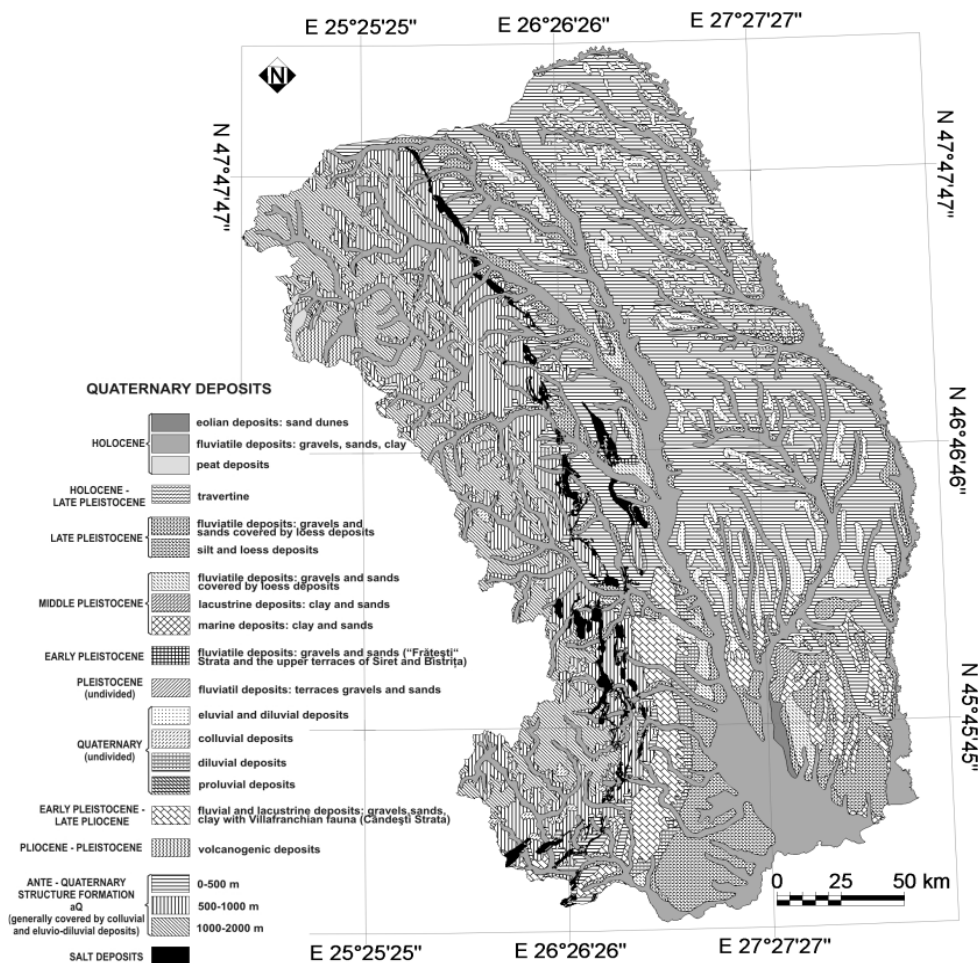


Fig. 3. Geological map of Moldavia and repartition of salt deposits within the Subcarpathians (adaptation after [58-61])

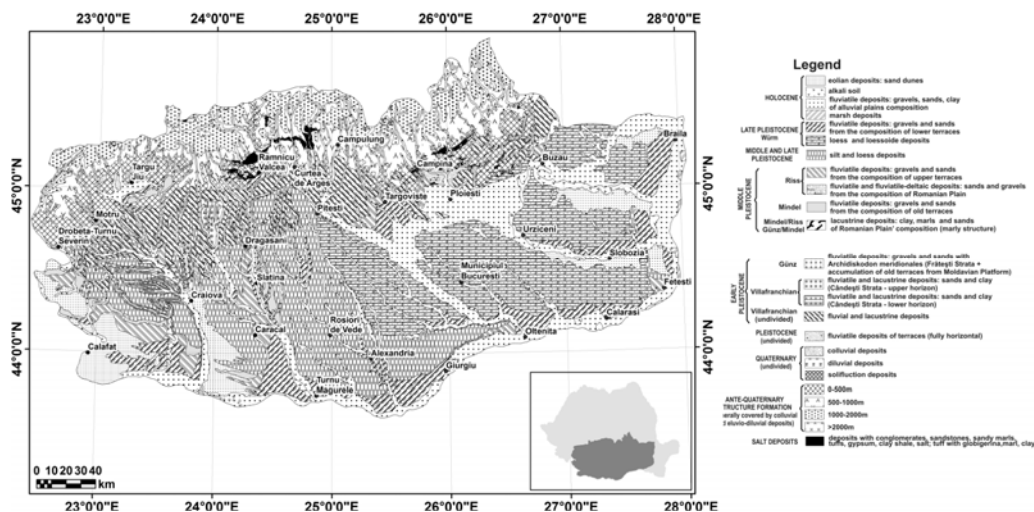


Fig. 4. Geological map of catchment basins in the south of Romania and repartition of salt deposits (adaptation after [58-61])

The sediment formations of the Subcarpathians comprise important amounts of halite (Aquitanian and Badenian deposits), as follows: between Ozana and Trotuș; between Buzău and Dâmbovița; between Olt and Jiu. The thickness of salt layers in the outer Subcarpathian area reaches up to several dozens of metres. The Badenian halite within the Transylvanian Basin can reach, locally, a thickness of 1,000m [57].

Salt deposits are cantoned as long areas along the Carpathians or they are isolated in the former sectors occupied by the lagoons (Figs. 3 and 4). There are important exploitations in the mines of Cacica, Târgu Ocna, Slănic Moldova, Sărata Monteoru, Slănic Prahova, Telega, Ocnele Mari, Govora, etc. Most such centres are also used for the treatment of respiratory diseases or for tourism.

Industrially, salt has been used in chemical industry for the fabrication of hydrochloric acid (HCl), chloride (Cl₂), sodium hydroxide (NaOH, commonly known as caustic soda), metallic sodium; it has also been used in tanneries, for cans, etc. On a local scale, it has been used for preserving foods (vegetables, meat, cheese, etc), making cheese, sprinkling hays for animals, improvised balneary treatments, etc.

The importance of salt for humans was also proved by archaeological finds discovered near salt deposits or salt springs. Within the Subcarpathians, it is worth underscoring numerous exploitations points dating back thousands of years: Monteoru (Neolithic), Slatina Mare - Solca (early Neolithic), Cacica, Grozești-Bacău (Daco-Roman), Ocnele Mari (Neolithic - Neolithic), Slănic Prahova (Daco-Roman), Telega (Daco-Roman), Târgu Ocna, etc. [45].

Conclusions

Salt deposits on the Romanian territory are situated in two large areas: the Subcarpathians and the Transylvanian Depression. From a chemical perspective, there is a differentiation between the two areas: Subcarpathians are rich in carbonates and sulphates, while the salt within the Transylvanian Depression is pure. In the salt lagoons at the foot of the

Carpathians, important amounts of salts deposited, thus creating the largest such deposits in Eastern Europe.

The entire alignment of the Subcarpathians comprises an interrupted “ribbon” of saliferous deposits. The biggest exploitations are still situated around the old salt mines: Cacica, Târgu Ocna, Slănic Prahova, Monteoru, Ocnele Mari, etc. The oldest records of salt exploitation are ascribed to the Neamț County.

The largest amount of salt is used by the chemical industry. Locally, in traditional settlements, salt is often used for food preserving, for sprinkling hays, etc. Industrially, salt is exploited within salt mines, many of which are used nowadays also for treating certain diseases or for recreational tourism: Cacica, Târgu Ocna, Slănic Prahova, etc.

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