

NATURAL AND ANTHROPIC RISKS IN THE AREA OF DURGĂU-VALEA SĂRATĂ TURDA SALT LAKES

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Abstract

The purpose of this study is to analyze and emphasize the risks induced to the area of salt lakes from Valea Sărată-Durgău by the natural and anthropic factors. In time these factors have generated massive transformations of the entire area, even leading to the disappearance of one lacustrine units and structure modifications in the case of other ones. The main risks are caused by the dynamics of the geomorphologic processes and touristic exploitation of waters. The compared analysis of lakes highlights the modifications of the morphometric parameters, the main characteristics being depth reduction and growth of water volumes and surfaces. Because of intense water exploitations by an increasing number of tourists and uncontrolled bathing we can observe a great diminishment of heliotherm phenomenon.

Keywords: natural and anthropic risk, salt lakes, geomorphological processes, anthropic influence.

INTRODUCTION

Lying on the lower course of Arieş river, at the junction with Valea Racilor, the city is historically recorded in 1197, being situated on the ancient roman settlement Potaissa (Potavissa), castrum of the 5th Macedonica legion. Its fame is also given by diapir exploitations, salt being present at the surface on the alignment of the localities Ocna Mureş – Turda – Cojocna – Someşeni – Sic – Dej. These kind of exploitations have begun in ancient times. The land on which there are salt massifs is situated on the north-eastern part of the city. The territory that we study belongs, from a tectonic point of view, to simetric anticline and syncline alignments, running north and south, which are associated with the moving area „Turda Depression” (Pânzaru, 1974), coming into contact with Trascău Mountains. Two important vaultings underline the salt massifs at Turda: the massif at „Băile Sărate” (Roman) embedded in the anticline that goes through the middle of the town to Ploscoş locality and the one at „Ocnei” (Valea Sărată) embedded in the anticline structure Mihai Viteazul – Pârâul Sărat.

If we take into consideration the area of Durgău-Valea Sărată or Ocnele Turzii we can say that the anthropic influence has generated larger basins, which conferred longer viability to this lakes, from 7 lakes at the beginning (Pânzaru, 1974) only 5 remainig in the present days. These lakes are grouped in the southern extremity of the massif, where the Sărată Valley is enclosed by the Alaşmal Hill. The northernmost point is Lake Sulfuros, continuing in the south, almost in a similar line, with Lake Ocnei, Lake Rotund, Lake Marinel and Lake Durgău (figure 1).

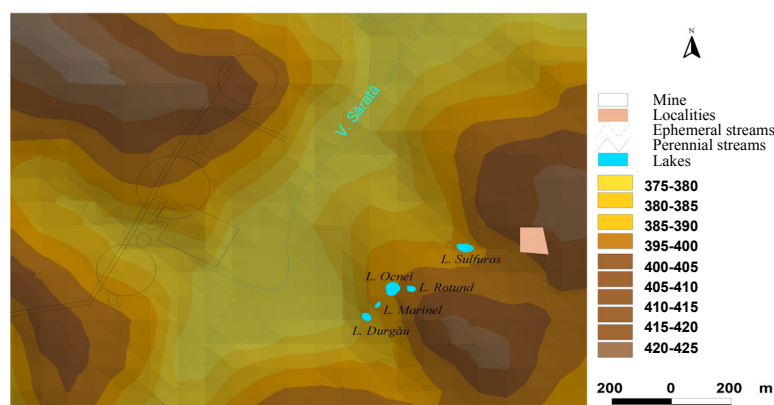


Figure 1. Spatial arrangement of Turda Salt Mine and Valea Sărată lacustrine complex

The purpose of this paper is to analyze and emphasize the risks induced to these salt lakes by the natural and anthropic factors. In time these factors have generated massive transformations of the entire area, even leading to the disappearance of one lacustrine units and structure modifications in the case of

other ones. The main risks are caused by the dynamics of the geomorphologic processes and touristic exploitation of waters.

RESULTS AND DISCUSSIONS

The presence of salt and crumbly deposits, combined with the action of some dynamic factors (climatic, hydrologic, bio-pedologic, tectonic, anthropic) have determined the appearance of some geomorphologic processes, which induced high transformations in the landscape of diapiric areas. Most of the salt lakes are situated in areas with high geomorphological risks. The gravitational processes are favored by a series of factors: lithological, versant, intermittent vegetation layer. Linear processes, very dynamic in the lakes perimeter, produce lesser modifications than areal processes with a huge impact, which in certain situations have led to the disappearance of some lacustrine bassins (figure 2). On the slopes around the lakes streaming runs differentially in terms of rock, being materialized in ditch, temporary river course, clough on deluvial și coluvial deposits, covering salt.

On the basin slopes which "shelters" the salt lakes, linear erosion forms (gully erosion, rills, temporary river courses, clough, torrents) co-operate and combine the formation of torrential shaping. The appearance of temporary river courses and clough is also conditioned by suffosion (chemical and hydrodynamic) and subsidence processes, which enter the areal erosion. The most representative scenes in the salt massifs area are given by landslide, creep and weathering, which lead to land degradation and appearance of badlands.



Figure 2. Forms of linear and areal erosion in the lakes perimeter - Valea Sărată, Turda

An other important factor is the anthropic influence by overloading the land with buildings. When these processes increase they can play a decisive part in the evolution of lakes. It was the case of Lake Carolina undone by a landslide in 1998, which affected the Almaș Hill, with a precipice detachment of 60 m and 150 – 200 m in length. This landslide continues its course towards Lake Durgău affecting the houses nearby at the same time. This lake develops under the disappearance of Lake Carolina which supplied it with salt water through an emissary. After losing the water supply source we have observed the entrance of Lake Durgău into an other phasis, nowadays being in a sweetening process because of the fresh water sources in the southern part of the border. The main direction of salt lakes formed in old mines is that of spatial expansion and depth reduction. To be able to catch these transformations regarding morphology and morphometry of lacustrine basins in time, we have appealed to topo-bathymetric surveys of all the salt lakes in the studied area. Then we have compared the results with the ones obtained in older measurements and displayed them in the chart beneath (table 1). Analyzing the morphometric elements we can observe a certain resemblance from an evolutive point of view, concerning gradual drawdown (figure 3), because of natural conditions and in certain cases because of human actions.

Morphometric elements	Perimeter (m)	Surface (m ²)	Maximum depth (m)	Average depth (m)	Length (m)	Maximum width (m)	Average width (m)	Quotient of sinuosity	Volume (m ³)	
Lake Durgău	1972	373,5	6031,3	4,4	2,16	120,5	81,0	50,05	1,36	13034,5
	2005	365,9	7178,1	3,5	1,74	125,9	86,3	57,01	1,22	12493,0
Lake Marinel	1972	78,75	588,8	35,7	2,04	32,0	27,25	18,06	1,02	2202,7
	2005	118,5	917,6	31,2	3,53	37,6	31,6	24,40	1,10	3238,6
Lake Ocnei	1972	151,5	1653,8	34,7	11,67	53,75	45,75	30,64	1,05	19289,1
	2005	176,4	2134,3	33,3	12,30	59,7	51,3	35,75	1,08	26249,4
Lake Rotund	1972	78,15	470,0	15,6	4,86	28,75	23,25	16,35	1,02	2243,3
	2005	97,0	624,8	13,8	3,28	32,8	25,5	19,05	1,09	2050,6
Lake Sulfuros	1972	182,7	1738,8	46,05	4,19	76,75	35,5	22,66	1,24	7277,9
	2005	154,9	1439,0	45,2	3,45	61,3	32,8	23,47	1,15	4962,6

Table 1. Dynamics of the main morphometric elements of salt lakes in Valea Sărată - Durgău

Generally we can make a clear difference between karsto and anthroposaline salt lakes, on one hand and other types of lacustrine units (natural or anthropic), on the other hand, concerning silting process. There are no predetermined physical laws according to which salt lakes silt faster or slower than other kind of storages, this phenomenon varying in terms of lithology, morphometric characteristics of lakes (especially surface and depth), the shape of cuvets, presence or absence of immisaries etc. In the category of salt lakes the greatest dynamics is in the case of the anthroposaline ones, cavings and subsidences making the difference in relation to other types of lakes, including the karstosaline ones. Silting of anthroposaline lakes can be influenced, even “hurried”, by human actions on these genetic types of lakes. When silting appeared in a natural way, it had a rather low rhythm, only on the bottom of Lake Marinel the thickness of accumulated sediments exceeds 4 m than the previous measurements (1972). Lake Ocnei and Lake Rotund have been designed for bathing and after the bank consolidation the anthropic influence has brought to morphologic changes, amplifying the decreasing of lacustrine depths.

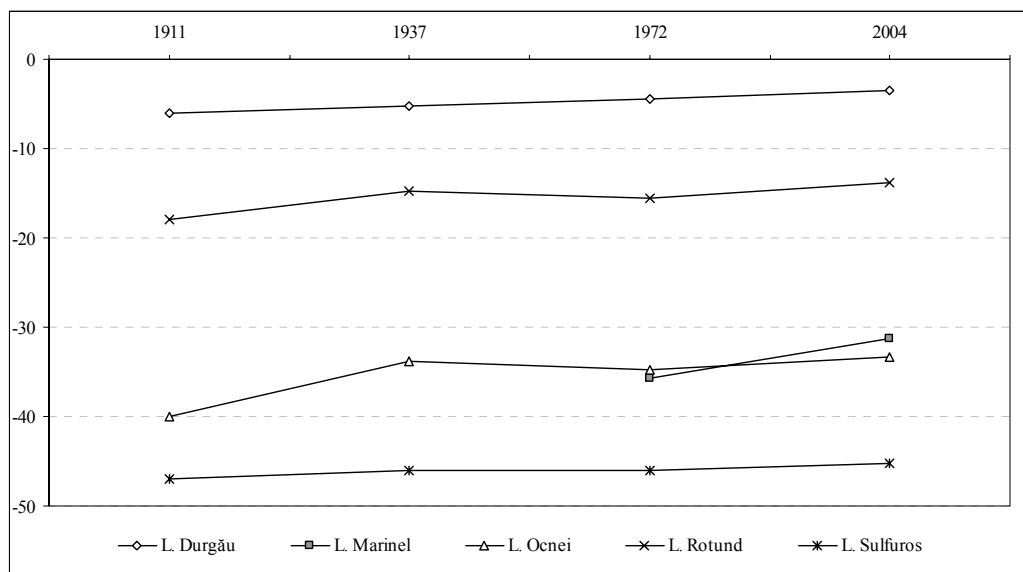


Figure 3. Variation of lakes depths from Valea Sărată – Durgău area

A distinctive characteristic of salt lakes is heliothermy, due to salt distribution and thermic dynamics of water layers. As a result of the evolution of lacustrine units from the salt massifs, through caving, subsidence or erosion, and also because of the anthropic influence caused by a longer bathing programme, influencing the haline distribution, there are many cases when lakes that once have been heliotherme could not maintain this peculiarity or situations when this phenomenon is acting a short period of time.

Variation in time of thermic stratification of the most representative lakes in Durgău complex has been realized by using a comparative analysis of data coming from older measurements and those achieved in field surveys in 2005 (figure 4).

Thus, if in the past times after some observations the highest values of water temperature have occurred in the case of Lake Rotund being around 49.5°C, at 1 m deep, (July, 1933, I. Al. Maxim), these temperatures have decreased, in present time maximum being 28.8°C at 1.5 m deep. The same trend in the diminishing of vertical thermic variation is observed in the case of Lake Ocnei, with lower values (1.6° C). The main factor of temperature decreases in the heliotherm layer is thought to be the intense exploitation of waters through bathing and usage of waters in treatment bases. To “preserve” this phenomenon the bathing programme should be well controlled, with a break of some hours to reestablish the normal distribution of the layers, as we can see in the case of Lake Ursu (Sovata).

CONCLUSIONS

Risk has to be understood as a resultant of the relationship human-environment, whose resources they use and a relation between process or processes – society. Geomorphologic processes are generated by a series of factors: lithology, versant, intermittent vegetation layer, when these are amplified they can play a decisive part in the evolution of lakes. It was the case of Lake Carolina, destroyed by a landslide in 1998, which is not yet stabilized and probably will also affect the lake nearby (Lake Durgău). In time the modifications of the lacustrine cuvets have been emphasized after morphobathymetric measurements, observing a decrease of the main morphometric parameters. Concerning the anthropic risks generated by balneo-touristic exploitation,

we can see the impact on curative properties, and also the risk of degradation of these resources because of intense and uncontrolled bathing. After comparing the vertical thermic profiles we have observed a sag of the values in the heliotherm horizon. If the dynamics of the active geomorphologic processes in the lakes perimeter could be reduced by border establishments and reinforcements, and bathing would be controlled, the durability of lakes would spread, preserving the curative properties of waters at the same time.

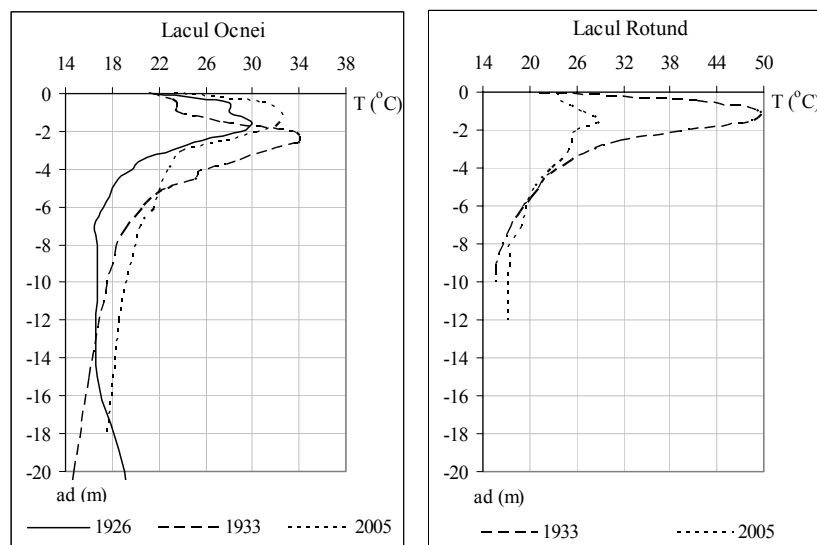


Figure 4. Vertical thermic profile of Lake Ocnei and Lake Rotund

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