

## Salt Mining Lake Pits in Romania, a Sustainable Heritage

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### Abstract

A particular aspect of post-mining activities in Romania is related to the frequent occurrence of salt mines, wherein numerous lake pits occur as a result of ancient salt exploitation. Filled with meteoric water or due to groundwater rising, they are now extensively used for balneology. It is to be mentioned that Romania contains the largest salt resources/reserves throughout Europe. This potential of about three billion tons could supply salt for the whole world population for over four hundred years. The paper presents the present state of the salt pits lakes, and facts related to the sustainable use of balneology features as well as case studies of most relevant occurrences.

### Summary

A large number of salt lakes formed in depleted salt deposits are found in Romania. They are considered of anthropo-genetic origin, or more specific, anthropo-salted. These lakes are widely distributed throughout the Transylvanian depression, in the area of the diapire folds (i.e. Sovata, Ocna Sibiului, Ocna Muresului, Cojocna, Turda, Ocna Dejului), and of the Sub-Carpathians, where various salt massifs (i.e. Ocnele Mari – Valcea, Sacele-Gorj, Gura Ocnitei – Dambovita, Telega and Slanic – Prahova) are intensively used for balneology purposes.

In some areas with surface salted springs small helio-thermal pools have been emplaced.

Variation of temperature is from 40-50°C at the surface to 5°C at the bottom. Unfortunately, many areas with helio-thermal potential encountered problems due to the over-exploitation of the salt resources instead of a sustainable use of the combined spa and curative features.

### Case study of a salt mining lake pit, over-exploited by mining activities

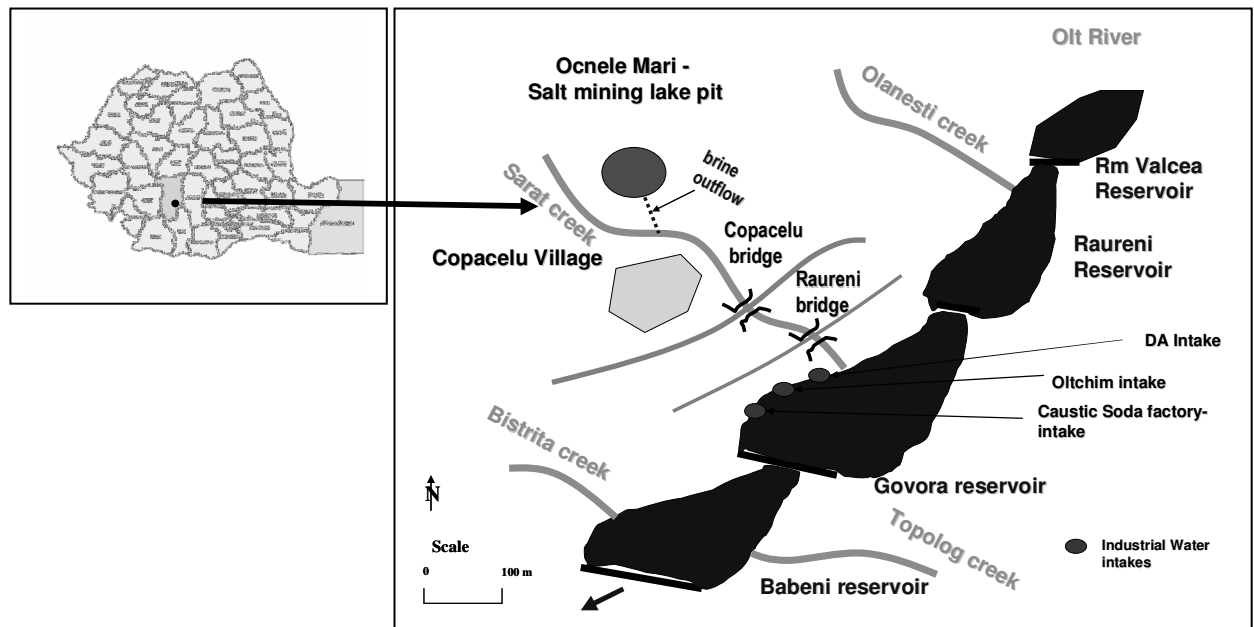
An important ancient salt extraction region of Romania, located in Sub-Carpathians, Valcea county, is nowadays at risk of collapsing. This is due to the over-exploitation by water injection since 1960, underground accumulations of brine, and utilisation for caustic soda manufacturing and other processes, at the nearby chemical plants. The affected area is a part of a Natural Park, under protection of salt natural formations, forests and salt springs and lakes, with a total of 21 buildings included in a list of historical monuments, including several churches which are endangered of collapsing due to the land instability because of the subsequent effect of the uncontrolled industrial dissolution of the underground salt deposits.

The area is located by an important water course, the Olt river, impounded and transformed since the '70s in a chain of accumulation reservoirs, down to the confluence with the Danube River (Fig. no. 1).

A cavern appeared suddenly in the area of Ocnele Mari town on 12 September 2001, following a period with heavy rains which weakened the structure around the over-exploited underground salt deposit (fig. no. 2). When the roof of the cavern collapsed, the excess of the shallow salted water flowed down to a nearby creek, and afterwards reached the river Olt. The outflow of brine water from the new formed cavern severely polluted the downstream water reservoirs of the Olt River, which is the main water resource for the industrial area of the Ramnicu Valcea municipal town. Several chemical plants, among them the major producer of caustic soda from Romania, Govora SA, and another two plants, had to reduce the production activity by 30% because of the improper quality of the water intakes from the Olt River. Until the uncontrolled brine evacuation diminishes from the salt

cavern, due to temporary collapse stabilization and dilution measures from upstream reservoirs, the water salt content from Olt exceeded 30 times the maximum admissible values. Following this, urgent measures for diluting the excess salt content were taken by the national water authorities, i.e. releasing supplementary discharges from upstream artificial lakes.

**Figure 1** Location of the Ocnele Mari salt mining lake pit, upstream of the main industrial intakes from Ramnicu Valcea municipal town



Following the first event, in the next year many other collapses, triggered by the extreme weather conditions with increased rain over the affected area, gave rise to a large crater-like area, filled with a salt lake with a total surface of 3000 sq. m, and 80 m diameter.

Each time when the meteorological conditions are deteriorating large amounts of brine, several 100 thousand of c. m., have been discharged into the Olt River, through the local tributaries. Measures have been taken by emergency since the cavern occurred in order to minimize the impact on the surrounding human settlements, and to the intakes from the local chemical industry, such as: the continuous surveillance of the endangered zone; the resettlement of the affected households and peoples; construction of a retention dam, with almost 80.000 c.m. for the brine in order to avoid direct spill into the Olt River; clean up of the affected area by the spilling brine.

### Conclusions

The impact of the mining industry in Romania often constitutes an impediment to the development of any recreational or rehabilitation activity, both from the landscape and environment quality point of view. Consequently, such an impact is an important issue to be taken into consideration, in order to create sustainability in terms of mineral resource management and natural heritage preservation (like Ecomining principles). The authorities, supported by the local stakeholders, with public consent, are to be involved to speed up the assurance of safety mining activities, in order to fulfil the European and worldwide standards of environmental protection. Overall mining activities should be carried out by appropriate allocation of financial founding, and by imposing the legislation for the whole range of mining operations.

**Figure 2** Massive landslides collapsed into the salt lake pit often triggering huge amounts of brine over the edge and threatening the neighbouring inhabitants and tourists

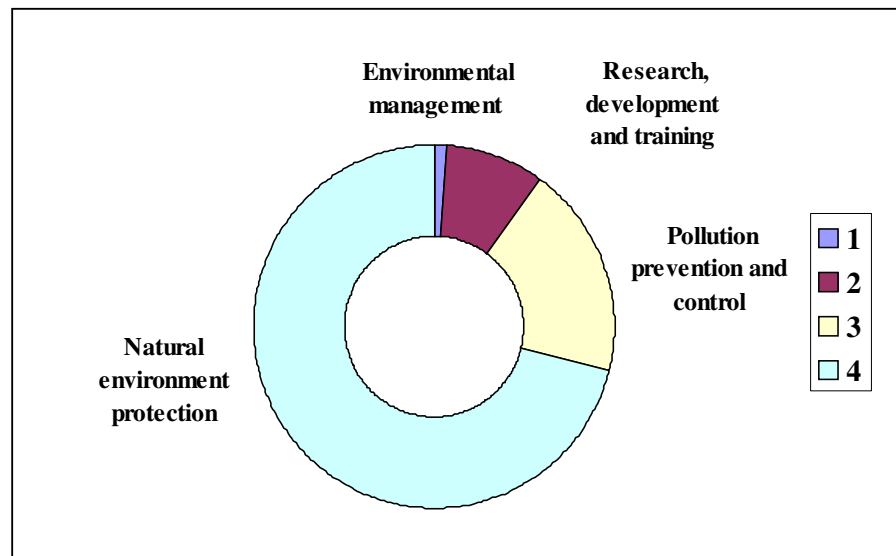


The most important aspect regarding the degree of innovation in the mining industry refers to the demands of harmonizing the mining operations with international main policies of the environmental protection. The key components for an environmental friendly mining industry stem from the management of wastes of the extractive industry and the decontamination of adjacent air, waters, ground and underground. Due to the actual needs of expertise in the field of ongoing mining activities, closure and conservation, including the clean up of the abandoned areas, the priority in the actual framework of academic research for environmental impact mitigation of the mining activities, is to meet the EU environmental protection requirements.

Therefore, in order to achieve a sustainable use of the natural heritage given by numerous salt pits lakes, urgent measures and allocation funds for rehabilitation and conservation should be taken in order to mitigate the impact of possible disrupting activities over the rational use of this welfare (fig. no. 3).

The Ministry of Environment and Sustainable Development (MESD) has engaged to speed up the assurance of mining activities safety, in order to respect the European and worldwide standards for environmental protection. Overall activities concerning the mining industry are carried out by allocation of financial resources, also by imposing the legislation to mining industry (new mines, mines in operation, closed mines). A significant initiative led to the approval of contracting by the Ministry of Economy and Finance of a significant amount of funds, about 400 millions euro for closing down and cleaning up the mining areas. Complementary, by the Sectorial Operational Program – Environment, the funding is already established through European funds during 2007 – 2013, i.e. 5 projects on contaminated mining sites of 171 millions Euros. Furthermore, the MESD issued the Governmental Decision for recovering affected mining perimeters, which force the mining operator, public or private, to support the recovering environmental measures. In addition to the above mentioned Governmental Decision, another important document, the Strategy for Management of the Contaminated Sites and the methodological guidelines for recovering the geological environment of the contaminated sites (including rehabilitation of the mining lake pits) are under preparation.

**Figure 3** Romania's annual mining sector's expenditures categories on environmental protection (before joining the EU)



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