

MINERAL WATERS AND RADIOACTIVITY

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***Abstract:** One of the important resources that can be found in Romania is mineral waters and thermal waters, some of them being known and exploited since Roman times. The use of these waters in spa tourism is conditioned by the properties of each reservoir and this is the reason why durability is essential. Spa tourism in Romania needs significant investments, reorganization and orientation towards spa and wellness.*

***Key words:** mineral waters, spa tourism, radioactivity, durability*

Introduction

A first step in towards the durable development of tourism would be making people aware of environmental protection. It is a well known fact that tourism is based on the environment and durable tourism relies on the exploitation of tourist resources so that it satisfies tourists' requirements, both at present and for future generations.

In order to have tourism develop towards this direction, plans are conceived in order to gather tourism agencies, people inhabiting a certain region and ecologists.

Spa tourism has been recorded for a very long time, as people's health has determined its development. Mineral waters have been appreciated since Heracles, Herodotus and Aristotle's times, who have also tried to describe the effects of these waters on people's health.

In the Roman Empire mud baths were very usual, as were showers and inhalations to treat various wounds and tiredness caused by frequent battles and military campaigns.

Empirical knowledge has switched to scientific knowledge as far as the use of mineral and thermal waters are concerned. An attempt in this respect was made by the Swedish chemist Berzelius in the 18th century.

At present, the forms of this type of tourism have been improved, while the essence remains the same. Spa and wellness tourism are two major forms that use natural resources to treat various diseases. Spa tourism is based on the curative effect of mineral waters. The use of these waters is based on the quantitative and qualitative analysis of thermal and mineral waters.

Qualitatively speaking, total mineralization, the content of chemical elements and dissolved gases, emergency temperature, osmotic pressure and radioactivity are measured. Quantitatively speaking, we take into consideration the admitted deposits and the B or C balance category.

Mineral waters and radioactivity

On Romanian territory there are numerous resources of mineral and thermal-mineral waters which have various therapeutic indications. Some of them are known and exploited since ancient times.

The success of spa tourism has been a development factor for many regions in Romania. The procedures that are included in touristic offers are internal treatments – aerosols, mofette, and external – baths.

During the past ten years, there have been no correlations between the real situation of mineral water pools and their effect on people's health. The economic advantages have been put forward and the scientific recommendations have been concealed. Thus, our studies show that:

- The majority of underground mineral waters have been affected by mining activities that have penetrated into pools and have affected the quality of water. However, abandoned mines do not represent a stop to the negative effect. Abandoning mining activities means that we can no longer control their effects.
- Rain water, which controls the level of phreatic mineral water, is exposed to pollution with nutrients, heavy metals or radioactive metals.
- Protected areas are no longer respected.

Analysis of bottled water supports our theory:

- Gamma global 80 – 31.000 mβq/l
- B global = 220 – 2.470 mβq/l
- $U_{\text{nat}} = 0,50 - 75$ mβq/l
- $U_{238} = 0,35 - 35$ mβq/l
- $Ra_{226} = 2 - 1000$ mβq/l
- $Th_{\text{nat}} = 0,05 - 5,5$ mβq/l
- $Th_{232} = 0,04 - 4,4$ mβq/l

There were many sources of water in areas that were declared mining areas. In many cases the water source became insufficient, but after the closing of mines water levels increased. Water proved to have a high concentration of radioactive elements. This phenomenon can be seen in many regions where there were mining exploitations.

The same changes occurred in the case of CO₂ treatments – mofettes. Radioactive gases such as radon and thoron infiltrated in many underground sources of carbon dioxide. The infiltration has not been controlled, due to the lack of balance produced by abandoned mines galleries.

The companies that bottle mineral water are faced with the issue of water contamination. However, they are protected by regulations that do not specify that technical descriptions should be compulsory. Our studies note the fact that some elements are not clear enough or are missing from the product label. Our calculations show that there are:

- $U_{nat} = 0,135 \pm 0,03 \mu\text{Sv/year}$
- $Ra_{226} = 13,5 \pm 10 \mu\text{Sv/year or}$
- $U_{nat} = 12,5 \pm 2 \text{ m}\mu\text{Bq/year}$
- $Ra_{226} = 9 \pm 0,5 \text{ m}\mu\text{Bq/year}$

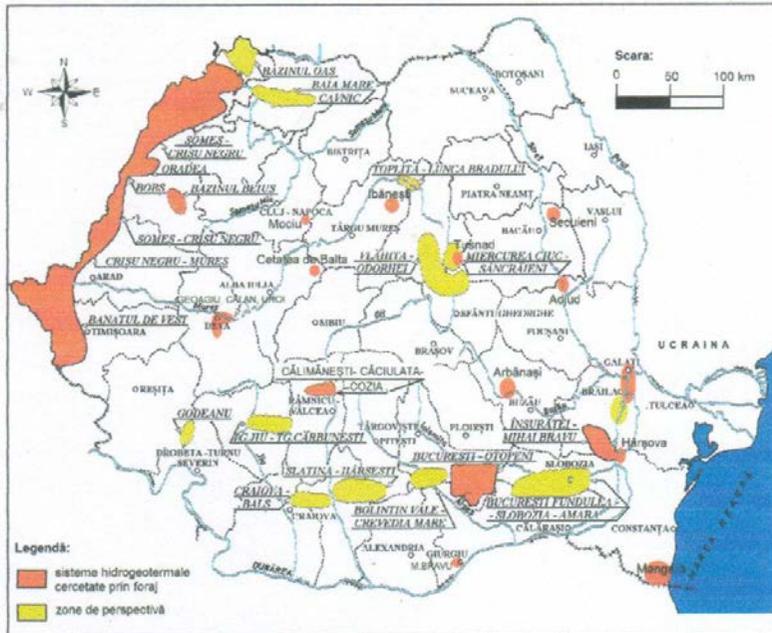


Fig.2. Resursele geotermale cercetate prin foraj și zonele de perspectivă, modificat după Negoită 1970, Bandrabur et al. 1982, Cadere 1985, Cohut și Bendea 2000.

Fig. 1. Geo-thermal resources researched by drilling and areas for future research. Map taken from Negoită, V (1970).

These are only some of the average values identified by our study. Maximum values are around 10². Comparatively, German regulations state that the uranium level should be 1μgr/l, which is much lower than Romanian regulations impose.

Another aspect is that of thermal waters. The drilling process started in 1885 at Baile Felix, at 51 meters deep, and identified underground thermal waters. In 1893, at Caciulata, and then, in 1902 at Timisoara the drilling process continued to identify thermal waters.

Capitalizing on geo-thermal water also included a project to use these waters for heating houses. However, the project stopped due to the fact that pipes became filled with silt. Nevertheless, medical treatment remained the highest potential for these waters. The high content of radioactive gas is another issue. Outdoor pools should be filled with waters at maximum level. However, due to the fact that the thermal water level is conditioned by consumption or weather conditions, the pools are filled with water below the maximum level (about 0.3 – 0.5 meters below), without taking into consideration the problems created by the accumulated radioactive gas.



Fig. 2. Conditions of accumulations of radioactive gases in a covered pool.



Fig. 3. Pool with thermal water at Baile Felix, Romania.

Radon and thoron are harmless if they do not enter the human body by inhalation or osmosis. The study that were carried on the health of people who work with thermal and radioactive waters shows that there is a high rate of diseases and deaths.

If we compare the map of aquatic potential with the map of mining exploitations and we add geothermal anomalies, we will conclude that studies should be made on radioactive substances in these areas. However, at the moment economic studies are a priority. Figure 4 shows an anomaly in the development of vegetation in radioactive waters.



Fig. 4. Vegetation in radioactive waters

Avoiding negative effects on tourists' health should become a priority. In order to respond correctly and clearly to tourists' questions about exposure to radioactive gases, two studies are necessary and urgent:

- Tourists' exposure to all types of irradiation – medical, accidental, professional, involuntary;
- The real situation of medical treatments on necessary doctor prescriptions.

The nongovernmental organization “Hobby Club Jules Verne” has gathered numerous data on this issue and interdisciplinary studies are the basis for future researches.

Conclusions

Measurements have indicated the fact that radioactivity in various concentrations of mineral and thermal-mineral waters may constitute an issue for tourists' health. Acknowledging real values of radioactivity offers the possibility to exploit waters accordingly, diminishing the dangers to which tourists and consumers of bottled water are exposed.

References

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- ONG Hobby Club Jules Verne, baza de date proprie.

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