

MINERAL WATERS IN RUPEA CITY: PHYSICOCHEMICAL FEATURES AND USE

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ABSTRACT. – **Mineral waters in Rupea city: physicochemical characteristics and use.** This paper aims to analyse and highlight certain specificities of mineral waters in Rupea city (Braşov County): physicochemical characteristics, a short history of their use, and future use options. The article is based on the synthesis and analysis of information obtained from scientific papers, archival sources, and field investigations conducted between 2010 and 2015. Rupea City is located in the area situated at the contact between the Transylvanian Subcarpathians the Hârtibaciului Plateau, at 64 km northwest of Braşov and 53 km southeast of Sighişoara. The presence of the salt layer in the Tortonian deposits (Miocene) at different depths and thickness accounts for the occurrence of concentrated chlorinated-sodic waters, discovered as early as the second half of the 19th century. The first analyses of the Rupea mineral waters were conducted by Henrik Muller (1856), who considered the mineral waters at Băile Cohalm (old name of the Rupea city) to be “among the few chlorinated-sodic-sulphated waters of Transylvania”. The measurements conducted on physico-geographical parameters in the study period and the analysis of water samples performed in specialized laboratories showed that these mineral waters preserved their physicochemical characteristics (chlorosodic, sulphated, hypertonic, athermal) and, consequently, can be used for therapeutic purposes as was the case in the past. The pavilions of the old spa establishment “survived” until the year 2003 when they began to be gradually demolished, and the mineral water storage basins were consolidated and covered. The only one which is still currently being used (for household activities or sheepfold cheese processing) is the “muriatic” salt water from the well locals call “Slatina”, located 1.5 km east towards Homorod, in close proximity to Cozd River (ancient name of the Valea Mare River).

Keywords: mineral waters, physicochemical features, use, Rupea City.

1. INTRODUCTION

Mineral water springs in Braşov County have been discovered and described since the end of the 18th century. However, most of the information was collected in the first half of the 20th century, when research activities in this field was intensified in Romania. The following mineral waters have been studied in Braşov County: 1. carbonated springs in the southeast (west of Eastern Carpathians), where post-volcanic phenomena occur (at Zizin-Tărlungeni); 2. chlorosodic waters in the county’s central region, i.e. where diapirs come into

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contact with the eastern mountainous area (at Perșani, Veneția de Jos, Rupea-Homorod, etc.); 3. the western gas dome area, where mineral water occurrence is connected to hydrocarbon deposits (at Rodbav) (Ciupagea et al., 1970, Pricăjan, 1972, Pricăjan, Airinei, 1979, etc.).

The discovery of the physicochemical properties of Brașov County's mineral waters led to the development of several spa establishments of local importance, such as the one at Târgul Cohalmului (Rupeni), old names of the Rupea city. This paper aims to analyse and highlight the specificities of Rupea's mineral waters, to present the way they were used in the past, and to identify future use options.

Given the data and new information on the waters' physicochemical parameters, the history of their discovery and use, as well as the future use proposals, we consider the paper is relevant for supplementing and updating the existing knowledge on Rupea's mineral waters.

2. DATA AND METHODS

The paper is based on the use of three types of data: 1) summarized information from scientific and cartographic documents (geologic map of Romania 1:200.000, topographic map of Romania 1:25.000, 1981 edition); 2) information obtained from archival sources (official reports, statistical documents) of the Brașov County Department of National Archives; 3) information obtained through field investigations conducted between 2010 and 2015: interviews with Rupea City Hall representatives and locals, measurements of some physicochemical parameters of the mineral waters, analyses of water samples in specialized laboratories, observations on the current state of the former spa establishment. The main methods employed were: mapping of mineral springs, observation, analysis, comparison. The cartographic representations were obtained with specific techniques and software: Arc GIS 10.1, Global Mapper 12, Arc Map and Photo Impact.

3. GENERAL GEOGRAPHIC DATA ON RUPEA CITY

The old "borough" of Cohalm/Rupeni, presently called Rupea, where mineral springs were discovered in the second half of the 19th century, is located in the north-west of Brașov County, on the E60 (DN13) European road, 64 km northwest of Brașov and 53 km southeast of Sighișoara. The city is located in the Transylvanian Subcarpathians, landform unit which makes the transition from the eruptive Neogene of the eastern Oriental Carpathians to the Hârtibaciului Plateau (subdivision of the Transylvanian Basin) in the west (Posea and Badea, 1982). I. Mac (1972) considered the city location in the Rupea-Homorod Basin, which is part of the Hoghiz Basin, a contact depression that resulted due to the erosion of Olt River and its tributaries on the Rupea-Homorod fault line. The city is located at an altitude of 451 m and is crossed by two rivers – Valea Mare (Cozd) and Fișer (Fig. 1).

The geological formations in the area are either Miocene or Sarmatian (early and middle), well established in the south-east of the Transylvanian Basin, bordered to the south by the northern slope of the Old Valley, up to Făgăraș and on to the Rupea-Odorheiul Secuiesc alignment (Vancea, 1960; Ciupagea et al., 1970).

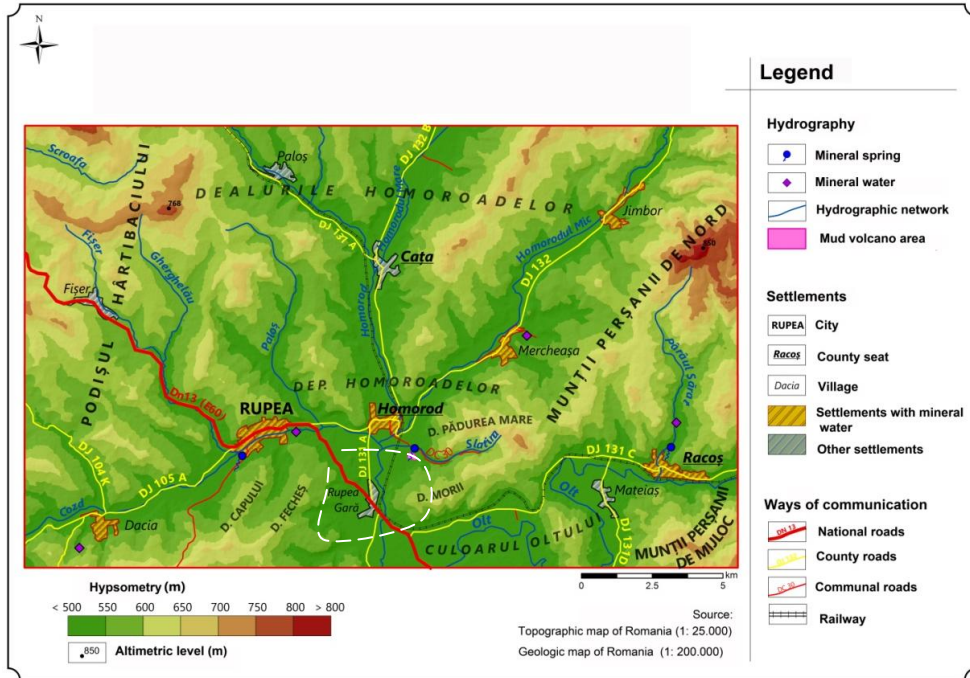


Fig. 1. Geographic location of Rupea city and of mineral springs

The area in which mineral springs were discovered is made up of silty clay with sand and marl clay, sand, conglomerates and thin intercalations of dolomitic limestone, and tuffs with spiralis of different thickness levels in the Rupea-Cața-Mărtiniș anticline (Ciupagea et al, 1970) (Fig. 2).

The presence of salt in the Tortonian deposits (late Miocene) accounts for the occurrence of chlorosodic mineral waters at Rupea, while the Neogene volcanism in the western Oriental Carpathians, which influenced the chemical composition of mineral waters in the area (Pricăjan and Airinei, 1979), is evinced by the basalt cliff on which Rupea Fortress was built.

Rupea City has a hillock depression climate. The mean multiannual temperature for the 1961-2013 period was 7.03°C, the mean multiannual temperature of the warmest month (July) was 17.32°C, and that of the coldest month (January) was - 4.46°C (Fig. 3). The mean multiannual sunshine duration was 2012.30 hours, and the mean value of the relative air humidity for the study period was 80.6%. In terms of precipitation, the multiannual mean was 635.48 mm/year, with 6.23 mean nebulosity.

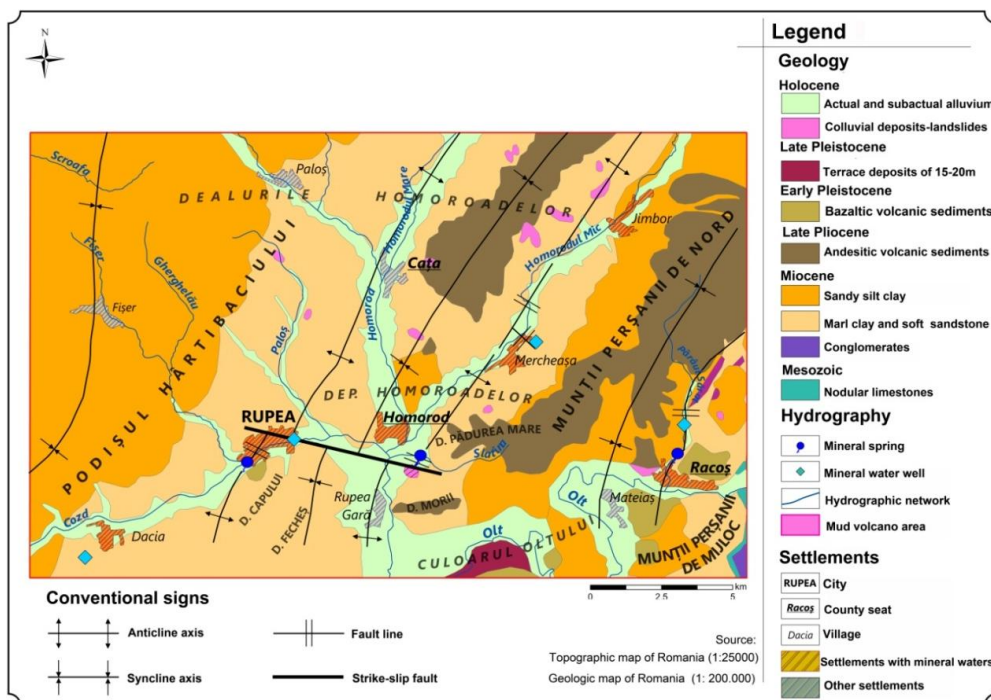


Fig. 2. Geologic map of the Rupea-Homorod-Racoș sector

The predominant movement of air masses is from the north-west, and the area is sheltered from strong winds. The natural characteristics of Rupea are specific to a sedative-indifferent bioclimate, which would not force tourists coming to visit Rupea to make an effort in order to adapt to the area's climate (Berlescu, 1996).

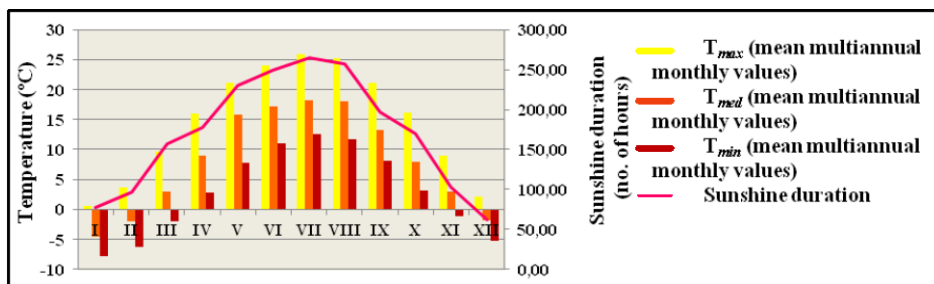


Fig. 3. Variation of air temperature and sunshine duration between 1961 and 2013 (Data source: Dumitrescu and Bîrsan, 2015)

4. HISTORY OF DISCOVERY AND USE OF MINERAL WATERS

Balázs Orbán (1868) mentions that the Franciscan monastery in Kohalm (Reps) had set up a spa called Budoskutfonek ("foul smelling well"), owned by Jacobi. The mineral springs were discovered and used therapeutically by merchant Martin Jacobi,

owner of the land, and the first to benefit were the locals (Hankó, 1914). To this end, a special spa chamber was built, where the water was heated “with steam” (Orbán, 1868).

In the beginning of the 20th century, Rupea/Rupeni City was already renowned for its mineral waters, described by Vilmos Hankó in the brochure *Rupeni (Cohalm) Spa*. The spa was located close to “the Rich Valley (Valea Bogății), at the foot of the ruins of the best preserved fortresses that have been and still are the treasure of the Ardeal region” (p. 4) and owned by Rudolf Jacobi. Rupeni Spa had two fountains in which water was captured for warm baths, and another basin used for cold baths, for which two other fountains were used. There were 13 category I and II cabins for warm baths, and the season began on May 15th and ended on September 30th. Doctors E. Țeposu and L. Câmpeanu (1921), in their paper titled *Mineral waters and spas in Ardeal*, also presented the Cohalm (Rupea) Spa and mentioned that only warm baths were available in the 10 cabins set up in the main building.

In 1926, 147 warm baths were recorded (Pricăjan, 1985). M. R. Pascu (1927) talks about the Spa located at the foot of the Fortress Hill, where the 7 springs (with a flowrate of 20 m³ in 24 hours) were only used for warm baths, but also about the salt water spring located east of the city, which was captured in a well.

Țeposu and Pușcariu (1932) mentioned the Rupea (Cohalm) Spa, which was owned at the time by the City Hall. By consulting archival sources, important information was found for the 1938-1950 period, during which, although the spa existed, the city was not officially recognized as a spa resort.

In August 1938, the Chamber of Commerce and Industry of Brașov submits to the Rupea City Hall, with letter no. 3651/1938, the list of trading companies in Rupea that had uninterrupted activity for the past 25-30 years, and asked the local government to confirm whether or not they were still active. The list also mentions Rupea Spa (Borough area, no. 111), owned by Jacobi Rudolf.

The City Hall replied with letter no. 1493/1938, sent to the Brașov Prefecture, which mentioned that the Ministry of Health had a “table” (list) of spa resorts that also included Rupea City, even though the City Hall Archive did not possess any document attesting to the fact that the city had been declared spa resort of local interest, nor was there any intention to take on such an endeavour. The number of people who came in for treatments was quite small (80-100) and they were mainly poor citizens who could not afford to travel to other areas. As such, the city would not have been able to meet the obligations the law specified for spa resorts and was therefore requesting that it be removed from any such lists (“table”).

Ten years later, the Rupea City Hall mentioned the existence of an iodo-sulphurous spa in the reply sent to the Rupea Magistrate (February 10th 1948). Moreover, the archival documents provide information on the spa’s equipment, accommodation and tourist flows in 1945, 1946, 1947, as the data was requested by the National Tourism Office in Bucharest. In 1948, the Spa Division of the Ministry of Health requested, with letter no. 201434/09.10.1948, the necessary information for classifying the resort (resort of national, regional or local importance), as well as for authorizing/monitoring future activities. The reply drafted by the Rupea Workers’ Union, which owned the spa at the time, resulted in

its being classified in category IV – spa resorts, and the rates for treatment, accommodation in hotels, villas and private houses were set depending on the duration of the stay and in accordance with Decree no. 3/949 (DJAS, Braşov).

The Rupea spa resort was operational until August 1950, when 179 people came in for treatment, which totalled 3245 baths. It appears that the spa was shut down in 1950 due to the reduction of the mineral springs' flowrate and to the need of certain maintenance works that would ensure the proper future functioning of the spa. The spa manager requested that the fountain be repaired and cleaned up, the 30-year old steam locomotive used for water heating be replaced, and that the taps, valves (made of wood), the bell system of the 11 cabins and the roof be repaired. Also needed were a thermometer (of 1-120°C) for the tank and 2 thermometers (of 1-60°C) for the cabins, as the old ones were broken (Official Report, Rupea, 31st July, 1950, DJAS, Braşov).

It is not known whether or not all these maintenance works were completed, as no other documents were found on the iodo-sulphurous spa after August 1950. However, in the paper titled Spa resorts of the R.P.R. (1955), Rupea is mentioned as a settlement of balneal interest. Between 1970 and 1974, the spa's were inhabited by flood victims of Roma ethnicity (following the 1970 floods), and in 1980 the inside of the building was destroyed by a fire (according to locals). The spa's pavilion, left to decay, has progressively deteriorated (Fig. 4. a, b ,c), and all that remains today is the memory locals have of a once fully functional spa complex.



Fig. 4. Rupea Spa buildings – interior/exterior (Source: <http://amfostacolo.ro>)

In the autumn of 2012, consolidation works and the covering of the wells and tank were started (Fig. 5.a, b), as the entire area had become highly unsanitary and was a real danger especially for children; all that was left was an old drainage channel (Fig. 5. c). The works were finalized in 2014.

5. PHYSICO-CHEMICAL FEATURES OF THE RUPEA MINERAL WATERS

Some of the first recorded data on the characteristics of the Rupea mineral waters are found in the paper titled Description of Székely Land (Orbán, 1868), which mentioned that “the water had a salty taste and smelled like rotten eggs” (p. 191).

Vilmos Hankó (1891) presented the analysis conducted by Henrik Muller (in 1856), the results of which showed this was one of the rare chorosodic sulphated waters. In the beginning of the 20th century, Vilmos Hankó (31 May 1914) conducted analyses and tests on the physicochemical parameters of the

Rupea mineral waters, and stated they belonged to the “rare class of mineral waters that, as they spring, are cold and contain salts and sulfur. The chemical composition of this mineral water mainly consists of salt and hydrogen sulphide (p. 10). He also compared the salt water at Rupea with the one found at the Szobranz spa (Hungary), and said the former was “richer in salt” (p. 10).



Fig. 5. The old wells and tank (a, b) and drainage channel (c) nowadays (Pictures: Meret Rodica)

Ionescu and Costin-Deleanu (1963) conducted a physicochemical study on the mineral water at Rupea, and defined its chemistry: sulphurous, chlorinated, sodium-rich, concentrated water. Ciupagea et al. (1970) presented the chemical composition of Rupea’s mineral springs: sodium chloride, sulfates and bicarbonates, sodium, potassium, calcium, magnesium, lithium, iron and bromine of various concentrations, and, in addition, carbonic acid of volcanic origin. Pricăjan (1972) mentioned the presence of high quantities of metaboric acid (126.2 mg/l), at a total mineralization of 20,885 mg/l. The subsequent studies have therefore confirmed and supplemented the results of the first chemical analyses, thus classifying Rupea’s mineral waters as chorosodic, sulphated, hypertonic, athermal waters (Berlescu, 1975).

The analyses and tests conducted in 2004 by the management team of Rupea City Hall, which were part of an effort to rebuild and reopen the former spa, proved that the water chemistry had not changed over time (Monitorul Expres, 2005). The water samples we collected and analysed at the Water Quality Laboratory of the National Mineral Water Society (SNAM), Bucharest, and at the Water Management Society’s laboratory (SGA), Braşov, showed that the water is neutral in terms of hydrogen ion concentration, and also that it is concentrated/salty in terms of dissolved mineral salt contents.

The measurements we conducted with the Hanna 9828 multiparameter between 2011 and 2015 at the spring located in the vicinity of the former spa, showed physicochemical parameters that were close to previously recorded data, i.e. pH of 7.8 (mean value), water conductivity of 34,466 $\mu\text{S}/\text{cm}$ (mean value), salinity of 23‰ (mean value), total dissolved solids of 17.234 g/l, with varying water temperatures depending on the season (Fig. 6).

The value of the bicarbonate anion determined in September 2015 by SNAM Bucharest laboratory, based on our water samples, was 1006.5 mg/l, and that of free carbon dioxide (CO_2) 66 mg/l, while the mineral water sample analysed by the SGA Braşov laboratory (in August 2014) indicated a bicarbonate (HCO_3^-) level of 598.4400 mg/l (which is relatively close to the

one mentioned in specialized literature – 805 mg/l, according to Pricăjan and Airinei, 1981), while the value of free CO₂ was 1100 mg/l.

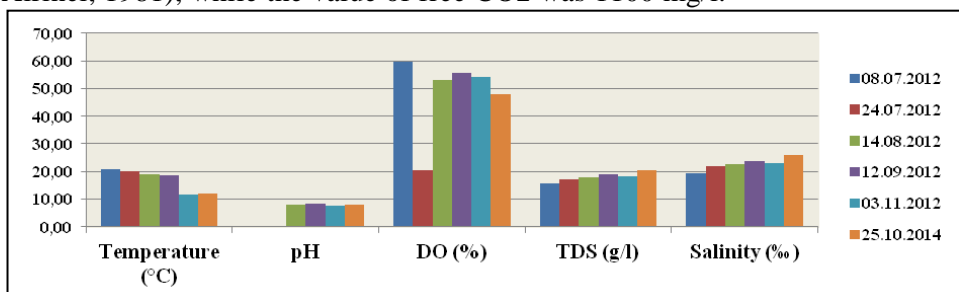


Fig. 6. Physicochemical parameters of the mineral water spring of the former spa (2012-2014)

The (significant) difference is probably due to the fact that the free CO₂ was not measured directly in the field, and also to the different methods of analysis used by the 2 laboratories (e.g. for HCO₃⁻, SNAM Bucharest laboratory used the SREN ISO 9963-1/2002 method, while SGA Braşov laboratory used the SREN ISO 29963/02; for CO₂, SNAM Bucharest laboratory used the SR 4450/1997 method, and SGA Braşov laboratory used the STAS 3263/61 method). Moreover, in locations which are closer to the mountainous area (as Zizin or Tărlungeni), where postvolcanic phenomena are more intense, the concentration values of bicarbonates and carbon dioxide in mineral waters are higher (Fig. 7).

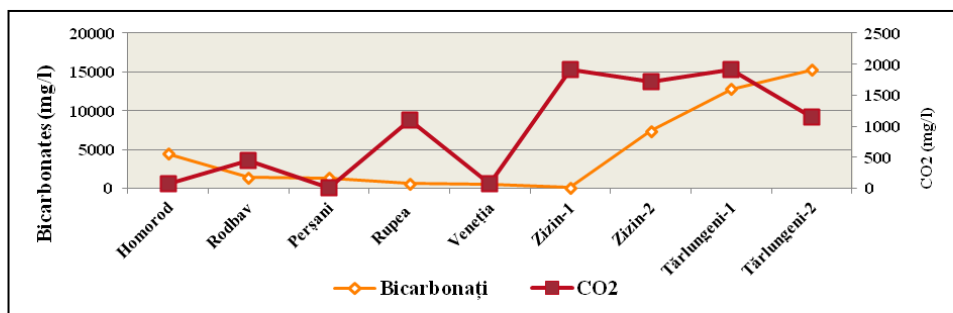


Fig. 7. The variation of concentrations of bicarbonates and carbon dioxide in locations with mineral waters in Braşov County (in 2014)

The high salinity and mineralisation of mineral water in Rupea City is due to the high concentrations of chlorine and sodium ions: 13.475 g/l, and respectively 8.330 g/l (values determined by SNAM Bucharest laboratory, in September 2015).

6. THERAPEUTIC RECOMMENDATIONS AND MINERAL WATER USE

Hankó stated, as early as 1914, that the therapeutic effects of the mineral waters at Rupea were apparent in all instances in which doctors had recommended such treatments. As they were highly concentrated, the Rupea mineral waters were only used for external treatments, for rheumatic, gynaecological and post-traumatic

disorders, peripheral neurological diseases and certain dermatological conditions, as mentioned in several scientific papers (Staționi, 1955; Berlescu, 1975), and, to that end, the water was heated in a “locomotive boiler” (Țeposu and Câmpeanu, 1921; E. Cociașu, 1963, talks with locals, 2013-2014).

At present, only the “muriatic” salt water well is being used, located 1.5 km east towards Homorod, in the vicinity of the Great Valley/Cozd Valley. The well is in good condition, compared to others in the area (at Mercheașa or Jimbor), and, according to locals, the water is being used for household activities (mainly for the preparation of meat) and by shepherds for cheese processing.

The future use of the mineral waters at Rupea would first of all entail changing the location of the former spa resort, as after 1950 apartment buildings for workers were constructed in the vicinity of the spa. The first project to rebuild the spa was written designed by the management team of Rupea City Hall in 2001-2002 and submitted to Region 7 Center, Alba Iulia. However, as the financing request was drafted only on behalf of the City Hall and did not include partnerships with other institutions, the project was rejected. The Rupea management team remains confident and hopes that, once the project is improved, it will be successful.

7. CONCLUSIONS

The mineral waters at Rupea city were discovered and used as early as the second half of the 19th century, and reached their peak during the first decades of the 20th century. Studies conducted by chemists and especially by doctors classified them as chorosodic, sulphated, hypertonic, athermal waters.

Due to their therapeutic properties, they were used for the external treatment of rheumatic, gynaecological and post-traumatic disorders, peripheral neurological diseases and certain dermatological conditions. The main beneficiaries were the inhabitants of the old borough, Cohalm (nowadays, Rupea city), but many others benefitted from their effects.

The reintroduction of the city in the tourist circuit requires specialized studies and significant investments, which could be covered by accessing European funds. Creating a viable project, based on complex feasibility studies (capture and transport infrastructure, so that the physiochemical properties of mineral waters do not change when the water is channelled to the point of use, ensuring the environmental protection of the area, etc.), could potentially result in the transformation in Rupea city into a spa resort of local importance.

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