

CHARACTERISTICS AND USE OF MINERAL WATERS AND THERAPEUTIC MUDS FROM GRID VILLAGE AREA (BRAȘOV COUNTY)

Rodica MEREȚ¹, Liliana ZAHARIA², Florina GRECU²

ABSTRACT. – Characteristics and use of mineral waters and therapeutic mud from Grid village area (Brașov County). This paper present some physico-chemical characteristics of mineral waters and therapeutic mud in the Grid Village area, as well as aspects regarding their use. The study is based on the data collected from relevant bibliographic sources and field investigations and measurements carried out between 2012 - 2016. Chemically, the mineral waters from Grid Village area are chlorosodic (salinity 50 g/l), bicarbonated, and calcium-rich. The mineral salt deposit build-up on the soil stratum led to the formation of therapeutic mud, which has a compact granular structure with evenly-distributed chemical elements (except for sodium and chlorine) and high concentrations in oxygen and silicon. At present, the use of mineral waters and therapeutic mud from Grid village area is underdeveloped and strictly local.

Key words: mineral waters, physico-chemical characteristics, therapeutic mud, Grid Village.

1. INTRODUCTION

The healing properties of natural mineral waters and therapeutic mud are known since ancient times (Sukenic *et al.*, 1999; Fraioli *et al.*, 2011). Due to their benefits for human health, the use of these natural resources became very popular for medical purposes such as prevention, treatment, and rehabilitation t of various diseases (Gutenbrunner *et al.*, 2010; Bender *et al.*, 2014). In Brașov region, the use of mineral waters began at the end of the 18th century, in a time when the territory was still under Austro-Hungarian rule (part of the “Székely Land”), and the waters were considered to be Transylvania’s “gold”. This “richness” was being used in small spas – specially-designed bathing establishments – where tourists could enjoy the healing power of mineral waters. The Second World War put an end to spa activity, as the local infrastructure was completely or partially destroyed. After the nationalization process (initiated in 1948), efforts were put into restoring certain treatment centres (i.e. *Băile Homorod*, *Băile Perșani*, *Băile Rodbav*, and *Băile Zizin*). After the revolution in 1989, there have been continuous efforts to restore the most important spas (i.e. *Băile Rodbav* and *Băile Perșani*), while some were left (*Băile Homorod*, *Băile Zizin*).

¹ Secondary School No 19, Aleea Lăcrămioarelor 2, Brașov, Romania, e-mail: kanord2908@yahoo.com (corresponding author)

² University of Bucharest, Faculty of Geography, Bd. Nicolae Bălcescu 1, 010041, Bucharest, Romania, e-mail: zaharialili@hotmail.com; florinagrecu@yahoo.com

This paper aims to highlight the physico-chemical specificities of mineral waters and mud in Grid Village area, as well as certain aspects regarding their use. Given the recent data, collected as a result of the authors' measurements of the Grid mineral and waters mud's physico - chemical parameters, and the information regarding their use, we believe the paper is relevant for supplementing and updating the existing scientific information on Grid's mineral waters and therapeutic mud.

2. DATA AND METHODS

The paper made use of three types of data: 1) information obtained from the analysis of scientific papers and cartographic documents; 2) data obtained from archival documents (monographies, photographs etc); 3) information obtained from field investigations carried out between 2012 and 2016. The last category included: observations on mineral water springs and on the current state of the old well called "Slatina"; measurements performed with a Hanna 9828 multiparameter for several physico-chemical parameters of mineral waters; water and therapeutic mud sampling, subsequently analysed at specialized laboratories (Water Management System Company, in Braşov; National Mineral Waters Society, in Bucharest; Institute for Multidisciplinary Scientific and Technological Research, in Târgovişte); interviews with locals. The main methods were: analysis, synthesis, observation, spring mapping, water and therapeutic mud sampling. The appropriate software programs were used for graphic and cartographic representations: Arc GIS 10.1, Global Mapper 12 and PhotoImpact, Excel.

3. GENERAL GEOGRAPHICAL DATA ON THE GRID VILLAGE AREA

Grid Village is located in the vicinity of *Băile Perşani* (~5 km northeast) and approximately 50 km northwest of Braşov City. The small village, part of the Pârău township, can be reached via county road DJ 130 B, which branches from national road DN 1 (E 68).

Geographically, it is located on the Perşani (*Băile Perşani*) - Grid - Veneţia de Jos line, and in the contact area of Făgăraş Depression and the western part of Perşani Mountains (Fig. 1); the alignment is also highlighted by the mineral water springs that emerge along the fault lines parallel to the mountains.

The Perşani - Grid - Veneţia de Jos area is located in a diapir formation section on the eastern side of the Transylvanian Depression, where Tortonian salt formations (Miocene) influence the properties of underground and surface waters. The geological formations in the Grid Village area are consistent with the general characteristics of the Perşani - Grid sector, and the springs emerge in the greenish- or whitish-coloured dacitic tuff zone ("Perşani tuff"). The mineral waters originate from infiltrated precipitation water that washes over salt grains embedded in the earth's crust (Ciupagea et al,1970). The village is crossed from east to west by a

creek called Grid, a right-side tributary of Perșani Creek; in the vicinity of the chlorosodic mineral spring, captured in a well called “*slatină*” in Romanian, there is another creek that flows in the same direction (east-west) – it is called Stearașu, and it is characterized by sharp meanders, which is why this sector was named “Unghiuri” Valley (Modorcea, 2002).

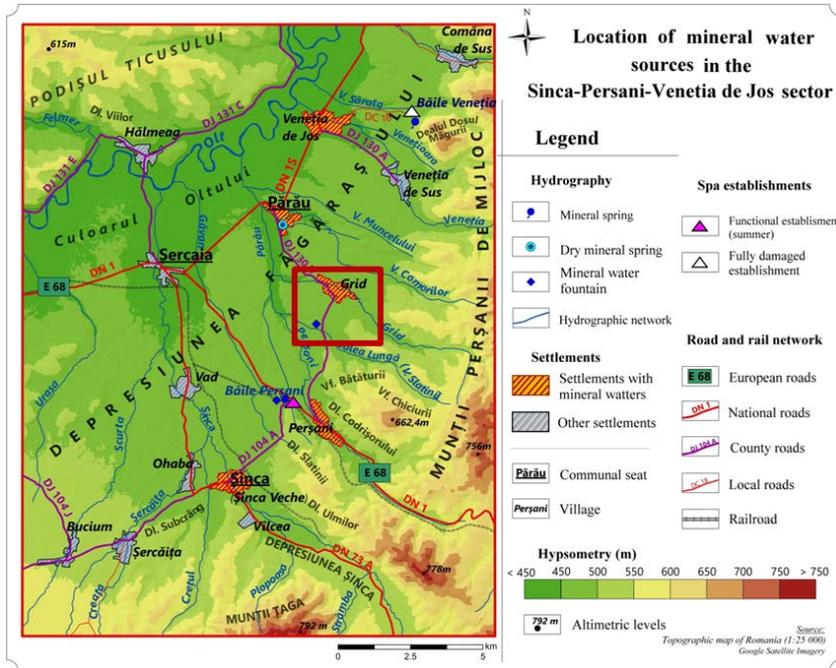


Fig. 1. Location of the Grid Village area (the red rectangle)

The mean multiannual air temperature in Grid Village is 8.3°C (climate parameter values cover the period 1961-2013 and were obtained by processing information from ROCADA database, Dumitrescu and Bîrsan, 2014). The average value for the warmest month (July) was 19.1°C, and that of the coldest month (January) was – 4.06°C. The highest temperature (absolute peak) for the overall period was 37.8°C (August 2012), and the lowest was -30.8°C (January 1985). In terms of precipitation amounts, the mean value was 610 mm/year; the peak month was June (87 mm), and the driest was February (28.5 mm). According to the Köppen - Geiger climate classification system, the Grid Village area has a humid continental climate (Dfb type), characterized by mean temperatures below 22°C in July (warm summers) and below 3°C in January (Fig. 2). No significant precipitation difference between seasons (year-round precipitation).

Air temperature is directly influenced by sunshine duration, which can favour the extension of optimal conditions for sunbathing and therapeutic mud treatments. In the analyzed period, sunshine duration had a multiannual mean value of 1987 hours. July had an average of 259.6 hours, and December had 58.1 hours,

while cloud cover values resulted in multiannual means of 6.2 tenths for December, and 5.0 tenths for August, with an annual mean of 7.6 tenths.

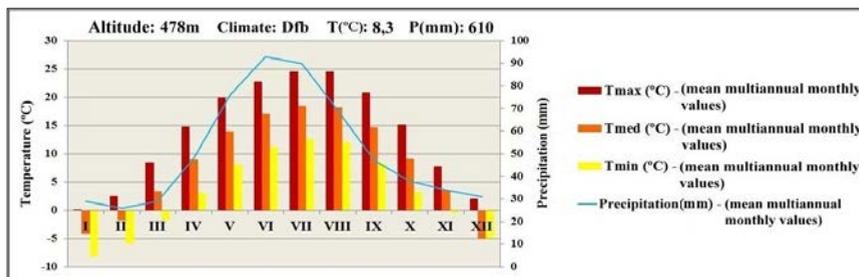


Fig. 2. Variation of monthly air temperature and precipitation values in Grid Village between 1961 and 2013 (Data source: Dumitrescu, Bîrsan, 2014)

Another important climate parameter for determining bioclimatic indices is the air's relative humidity. In the analysed period, the mean multiannual value was 79.7 %, which is close to what was recorded in Perșani and Veneția de Jos. The month with the highest relative humidity was December (88.2%), while the lowest values were recorded in May (73.5%). The direction of prevailing winds in the area is west, northwest.

Vegetation primarily consists of secondary grasslands that alternate with agricultural lands. Hydrophilic and halophytic plants, which prefer humid (hydrosols) or salt-rich (aquisalids) soils, can be found sporadically.

The mean values obtained for the analysed climate parameters (air temperature, precipitation, sunshine duration, etc.) and for the other environmental elements (vegetation, soils) are close to the ones recorded at *Băile Perșani*, which leads us to believe that Grid, too, has a sedative - indifferent hilly woodland climate, similar to that of *Băile Perșani* (Berlescu, 1971), with comparable bioclimatic index values (Ionac and Ciulache, 2008). This type of bioclimate does not require any special efforts in terms of the patients' adaptation to the local environment, regardless of the region they come from (Berlescu, 1998).

4. LOCATION OF THE MINERAL SPRINGS IN GRID, AND THEIR CURRENT STATE

Pascu (1927) mentioned two salt water springs in Stearașu creek's valley (Valea Slatina/Valea Sărată), of which one was on the creek's right side and was the property of Grid Village, and the other was on the left side and was the property of Perșani Village (Fig. 3 a). At present, in the vicinity of Grid, only the spring captured in the well on the right side of Slatina creek still remains. The well is located approximately 40-50 m from the road (DJ 130 B) that connects villages Perșani and Grid, and ~1.4 km from Grid Village. It is located at an altitude of 457 ma.s.l. (± 0.9 m), and its geographic coordinates are: lat. N: 45° 48' 31.097 "; long. E: 25° 12' 38.113". The well used to be protected by a wooden shed, which has

since been destroyed. Its stone walls form a rectangular shape (2 m long/1.70 m wide), and are 1.30 m-deep (the drilling depth is however greater). The water surface is 0.15 – 0.20 m from the concrete edges around the well (Fig. 3 b). It features a small drainage, so that the water in the well can reach nearby puddles. In July 2016, the well was covered with a “lid” – a board secured with several wooden planks – locals improvised in order to avoid accidents (Fig. 3 c). The spring water has not been analysed physically and chemically; in the past, it was only mentioned it was salty, used for household activities and to water animals (Pascu, 1927, discussions with locals, 2013).

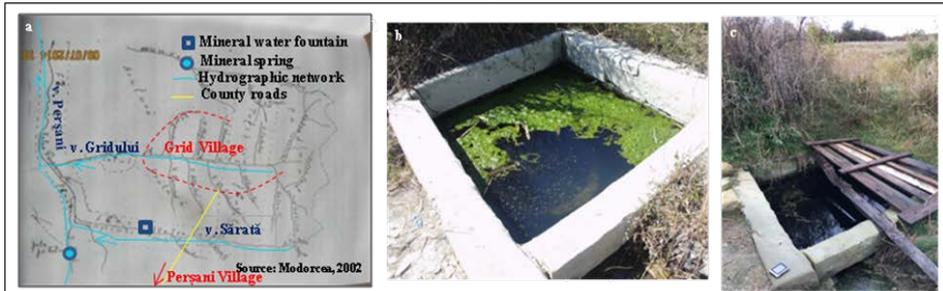


Fig. 3. The mineral water well in Grid Village: a) location map; b and c) current state (Source: a - Modorcea, 2002; b, c - Mereș, 2012, 2016)

5. PHYSICO - CHEMICAL PARTICULARITIES OF THE MINERAL SPRING

Between 2012 and 2015, water samples were collected from the spring captured in the well, and analysed at specialized laboratories (Water Quality Laboratory of the National Mineral Water Society – SNAM, in Bucharest, and at the Physico - chemical analyses laboratory of the Water Management Society - SGA, in Brașov). Additional field measurements were performed using the Hanna 9828 multiparameter. A therapeutic mud sample collected in October 2016 was analysed at the Institute for Multidisciplinary Scientific and Technological Research (ICSTM) in Târgoviște. For the water sample analysed at SNAM, report results showed that the water is chlorosodic, bicarbonated, calcium-rich, with a pH of 6.97 pH units (neutral character), conductivity of (69.400 mS/cm, total dissolved salts (TDS) of 34.700 mg/l, and a carbon dioxide concentration (free CO₂) of 184.8 mg/l. In terms of anions, the highest recorded values were chlorides (Cl⁻) with 29,672.34 mg/l bicarbonates (HCO₃⁻) with 616.1 mg/l, and sulphates (SO₄²⁻) with 406.96 mg/l. Nitrates (NO₃⁻) and nitrites (NO₂⁻) exceeded quantification limits, i.e. 4.63 mg/l for nitrates, and 0.07 mg/l for nitrites. With regard to cations, higher values were found for sodium (Na⁺) with 19.190 mg/l, and calcium (Ca²⁺) with 202 mg/l. The results of the S.G.A. Brașov's analysis indicated a bicarbonate concentration (HCO₃⁻) of 607.56 g/l, while carbon dioxide (CO₂ liber) was 184.8 mg/l, which are close to the values obtained in the analysis performed by SNAM, Bucharest. Hanna 9829 multiparameter measurements indicated a constant water salinity of about 50 g/l (Fig. 4). The average pH was 8.19 (values ranged from 7.70

to 8.48 upH), mean water conductivity was 72.46 mS/cm (values ranged between 69.0 and 74.1 mS/cm), TDS had a mean value of 36.54 g/l (ranging from 35.60 to 37.41 g/l), and the average salinity was 50.15 g/l, and ranged between 48.70 and 51.50 g/l. While the mean water temperature was 11.23°C, it must be mentioned that measurements were performed in the summer season, when air temperature reached 20°C. Water temperature was lower (10.5°C) in April 2015, when air temperature reached 7.5°C (Fig. 4).

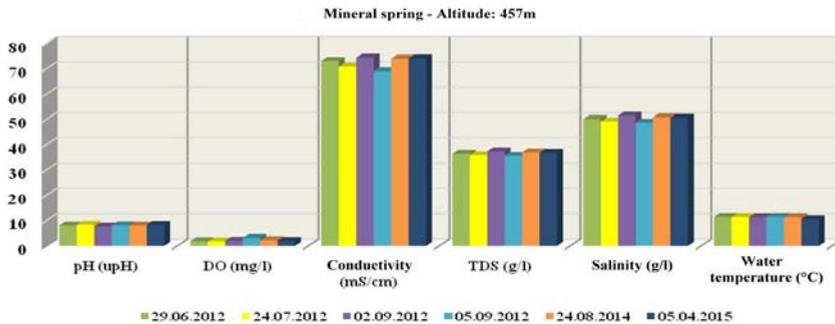


Fig. 4. Variation of physico-chemical parameters in the mineral water well in Grid, in the period 2012 - 2015

Compared to other mineral water springs in Braşov County, it was noticed that the mineral spring in Grid, alongside the ones in Mercheaşa, Racoş and Perşani, can be classed in the high mineralization category, which is determined by their geographic positioning in the salt grain-rich diapir region.

6. THERAPEUTIC MUD

Within the administrative limits of Grid Village there are also numerous emergences of salt-rich mineral waters, and the mineral salt surface deposits and vegetation decomposition resulted in the formation of a sapropelic mud that is similar to the one in *Băile Perşani*. The morphology imagery, obtained upon analysis of therapeutic mud samples at ICSTM in Târgovişte, using a scanning electron microscope (SEM) SU-70 coupled with an energy dispersive spectrometer (EDS), showed, for the Grid sample, a granular, compact structure, with no impurities (leaves, rocks, roots etc.), while the Perşani ample had a granular structure with coarse inclusions and other impurities: roots, various species of algae (*Epithemia sp.*, *Navicula sp.*, *Cymbella sp.*, which is also probably due to the not entirely convenient sampling location. The EDS-based data (element distribution maps) also showed that, in terms of chemical composition, the Grid sample is homogeneous, the elements are distributed uniformly, except for sodium and chlorine (sodium chloride), which had granular distributions, while the *Băile Perşani* sample was fairly homogeneous, with evenly-distributed elements, except for sodium, chlorine, calcium and potassium, which had granular distributions. The

atomic and mass percentages of the main chemical elements indicated the highest concentrations for oxygen and silicon (52% and respectively 22%).

7. USE OF MINERAL WATERS AND THERAPEUTIC MUD IN THE GRID VILLAGE AREA

Grid Village's therapeutic factors (mineral waters, therapeutic mud, similar bioclimate to that at *Băile Perșani*) have never been used in a spa. There haven't been any spa facilities, although Grid locals have submitted such proposals (Modorcea, 2002). However, locals and inhabitants of nearby settlements and Brașov come to Grid because, unlike *Băile Perșani*, everything is "free" here. People dig their own "tubs" in the therapeutic mud (Fig.5 a), which are then filled with salt water that warms up and is used for baths, alongside therapeutic mud baths, as attested by the interviews the authors conducted with locals (Fig. 5 b, c). The conditions that can be treated or ameliorated using the local chlorosodic mineral waters and therapeutic mud are mainly rheumatism, various forms of spondylosis (cervical, lumbar), gynecological disorders, arthroses, etc. (Berlescu, 1998). The area's natural therapeutic potential would thus be exploited in an entirely superior manner, instead of exclusively during the summer season. Also, spa tourism could be complemented by other forms of tourism for which the area is fitted (cultural/religious etc.), given the natural, historic and religious sightseeing objectives of the Perșani – Hoghiz area, which include the Fates' Temple cave complex, the Sf. Nectarie Monastery in Șinca Veche, and the historic sites and natural reservations found in the Comăna – Hoghiz area (Hoghiz castles, Comăna Cave, etc.).



Fig. 5. Use of the therapeutic potential of therapeutic mud and mineral waters in the Grid Village area a) "tubs" for salt water collection; b and c) interviews with locals in the therapeutic mud area (Author: Simion, 2014)

8. CONCLUSIONS

Grid Village, located in the vicinity of the tourist site *Băile Perșani*, features therapeutic factors (mineral waters, therapeutic mud and gentle, calming bioclimat) that have only been used in an isolated and rudimentary manner. The few specialized studies conducted in the area placed the local mineral water springs

in the chlorosodic mineral water category, which was confirmed by the analyses performed in our study, in the 2012 - 2016 period. Given its therapeutic properties, chlorosodic mineral spring water can only be used externally and, paired with the Grid therapeutic mud, can ameliorate rheumatic conditions that affect, most notably, the population around Braşov. Ample specialized studies and significant investments from local and county policy makers, brought together in a coherent regional development program, are necessary in order to fully tap into Grid's spa potential and, perhaps, have it added in the tourist circuit of local importance. To this end, a highly important source could be the European Structural and Investment Funds, made available to Romania under Regional Operational Programmes.

REFERENCES

1. Bender, T., Bálint, G., Prohászka, Z., Géher, P., Tefner, I. K. (2014), *Evidence-based hydro- and balneotherapy in Hungary—a systematic review and meta-analysis*, International Journal of Biometeorology 58, 311–323.
2. Berlescu, E. (1971), *Spa resorts in the past and present day*, Medical Publishing House, Bucharest.
3. Berlescu, E. (1998), *Encyclopedia of Romania balneoclimatology*, All Publishing House, Bucharest.
4. Ciupagea, D., Paucă, M., Ichim, Tr. (1970), *Geology of the Transylvanian Depression*, R.S.R. Academy Publishing House, Bucharest.
5. Dumitrescu, A., Bîrsan, M.V. (2014), ROCADA: a gridded daily climatic dataset over Romania (1961- 2013 for nine meteorological variables. *Natural Hazards* 78(2): 1045-1063 DOI: 10.1007/s11069-015-1757-z.
6. Fraioli, A., Serio, A., Mennuni, G., Ceccarelli, F., Petracchia, L., Fontana, M., Grassi, M., Valesini, G. (2011), *A study on the efficacy of treatment with mud packs and baths with Sillene mineral water (Chianciano Spa Italy) in patients suffering from knee osteoarthritis*, Rheumatology International 31,10, 1333–1340.
7. Gutenbrunner C, Bender T, Cantista P, Karagülle Z. (2010), *A proposal for a worldwide definition of health resort medicine, balneology, medical hydrology and climatology*, International Journal of Biometeorology 54, 495–507.
8. Ionac, N., Ciulache, S. (2008), *Bioclimatic atlas of Romania*, Ars Docendi Publishing House, Bucharest.
9. Modorcea, V. (2002), *Monography of Grid Village in Țara Făgăraşului*, Tibo Publishing House, Bucharest.
10. Pascu M. R. (1927), *Quarries and mineral waters in Braşov County*, Bucovina Graphic Arts Institute, I.E. orouţiu, Bucharest.
11. Petit, Al. (1922), *Monography of Braşov County and City*, Unirea Cartographic Institute Publishing House, Braşov County.
12. Sukenik, S., Flusser, D., Abu-Shakra, M. (1999), *The role of spa therapy in various rheumatic diseases*, Rheumatology Disease Clinics of North America 25, 4, 883–897.
13. *** File 1- 208 (Zizin 1887 - 1949; 481/1944), National Archives Braşov County Department.