

## Balneoclimatology - where to?

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Vol. 30 / 2020, 42-64



*Published:*

*22 December 2020*

**ABSTRACT:** The beneficial effects of natural healing factors (mineral or thermal waters, mud, topoclimate and microclimate) have been known ever since antiquity. In our country there are proofs of the presence and effects of mineral/thermal waters ever since the Dacian period. They used mineral waters for therapeutic purposes or for their healing effects. The first doctor in Dacia Felix was Marcus Valerius Longinus. The use of mineral and thermal waters continued during the Roman period, but also after the departure of the Roman legions from Dacia. In the Middle Ages the use of natural healing factors was in profound decline, but the interest in balneology on our territory was reborn since the 18<sup>th</sup> century. The beginning of the scientific stage of balneology was marked by studies of mineral waters and coincides with the middle of the 19<sup>th</sup> century. Most scientific studies appreciated internationally were conducted in the late 19<sup>th</sup> and early 20<sup>th</sup> centuries. Thus, the Society of Medical Hydrology and Climatology was established in 1922. Its activities were carried out from 1922 to 1943, then from 1943 to 1946 it was called the Romanian Balneoclimaterical Society having Professor Sturza as the President. Under the patronage of this society was also printed the magazine of the society called 'Balneoclimaterical Magazine'. In 1924, Professor Teohari organised the Balneology Institute in București. He was the founder of the Romanian modern balneology by introducing experimental research whose results were published in the Bulletin of the Balneology Institute. In 1949, the Institute of Balneology became the Institute of Balneology and Physiotherapy. Unfortunately, at the end of the 20<sup>th</sup> century and the beginning of the 21<sup>st</sup> century, balneology started to be slightly in decline. However, in recent years there was revival of interest in balneology, materialized through a large number of published studies, restoring spas and inserting them into the spa circuit, increasing spa flows. As we know our balneary past, it is our duty to continue tradition and to use correctly the spa resources that are so numerous and so valuable in our country.

**KEY WORDS:** balneary resources, natural physical factors, spas.

## 1. Introduction

There is a millenary continuity on the Romanian territory to use well the natural factors in order to strengthen the population's health or to treat many health conditions.

Ever since ancient times, the beneficial effects of natural healing factors on the treatment of certain diseases have been known on the Dacian territory. Whether there were bioclimate elements, mineral waters (Herculaneum, Geoagiu etc.) or mud, there are studies that certify their healing effect and their role in helping people to be healthy. After a period of economic and social decline (the migration period) in the Middle Ages, the natural healing factors and treatment for the benefit of people were used sporadically and on a small scale. In the 19<sup>th</sup> century, the balneoclimatic activity was revived due to the general development of the human communities in the Romanian Countries. The first scientific studies certifying the therapeutic value of the mineral and thermal springs, of the mud and bioclimate were also published. In the 20<sup>th</sup> century, the capitalization of Romania's balneoclimatic resources was institutionalized according to principles based on the indications from doctors and other categories of specialists. This field is currently a reconfiguration period of the entire activity and specific organization. The objectives of this study are to present the evolution of scientific approaches to research of Romanian balneoclimatic resources - by pointing out researchers and studies that have been landmarks in consolidating this field, and also to synthesize through a synthetic approach, accompanied by a synthesizing cartographic material, the variety and richness of the balneoclimatic resources that formed the foundation for the network of climatic and balneoclimatic spas in Romania. Last but not least, based on this radiograph, we intend to outline the trends of the future evolution of Romanian balneoclimatology and to propose some measures to direct the registration of this sector on the coordinates of an economically sustainable development and environmental protection.

## 2. Study area

Romania has a geographical location that is climatically beneficial (temperate transition climate with positive values for housing and tourist activities, layered on three major climatic floors), hydrological (a multitude of rivers, lakes, Black Sea, springs etc.) and biogeographical (almost one third of the country's territory is covered with forests that have a specific topoclimate and bioclimate), a geological structure (composed of platform and orogen units) and a varied relief, but proportionally divided on the major steps, which explains both the diversity and the richness of natural therapeutic factors on its territory.

On the Romanian territory there is the volcanic chain Oaş-Gutâi-Țibleș-Călimani-Gurghiu-Harghita, and in its space, was formed the so-called mofetic halo where there are gas emanations used therapeutically due to the natural chemical compounds contained (spontaneous natural emissions of carbon dioxide with or without gaseous sulfur compounds, mainly hydrogen sulphide).

The 'climate' factor positively influences the life of living organisms through its various components called climatic factors, elements or phenomena: solar radiation, atmospheric temperature, air humidity, duration of sunlight, atmospheric pressure, air movements in the form of winds or currents, etc. The relationship between climate and the human body is reflected in the dynamics of homeostasis reactions at different levels of integration and regulation. The most convenient example is the homeostasis of thermoregulation. The bioclimate (exciting demanding

in the plain and at the seaside, sedative - regardless of sparing and tonic - mountain stimulating) is considered a natural therapeutic factor that depends on the local conditions of relief, altitude, certain climatic parameters, hydrography and vegetation of Romania (Munteanu and Cintează, 2011). These bioclimatic therapeutic factors can be used by standing and well-known climatherapeutic procedures (Mihăilă, 2014) or in association with other procedures such as hydrotherapy, crenotherapy and mud therapy (Munteanu and Cintează, 2011; Mihăilă, 2014).

Among natural cure factors and treatment, we mention salinas, thermal and mineral springs, salty lakes, marine seaside, mud (minerals/ sapropelic) etc. Romania has approximately 8500 mineral and thermal springs (one third of the European mineral and thermal springs, of which only 10 % are used) (Feru, 2012). Therefore, Romania can sustain a high quality spa tourism. From the point of view of the spa resource, Romania is considered by many specialists as the richest country in Europe. (Teleky *et al.*, 1984; Munteanu, 2012, 2013; Teodoreanu and Gaceu, 2013; Mihăilă, 2014).

### 3. Methods

The research methods focused on pointing out relevant research or spa studies that marked a real progress in the development of Romanian balneology and that contributed to increasing the notoriety of some spas developed near resources that gained medical recognition on a large-scale throughout time. General aspects of the relationship between natural healing factors and human health were pointed out by quoting studies published in scientific journals or presented at national and international conferences. The spatial distribution of balneoclimatic resources was synthesized by modern cartographic methods by using the ArcGIS software. Our attention has focused temporally more on the period of the 19<sup>th</sup>, 20<sup>th</sup> and early 21<sup>st</sup> centuries.

### 4. Results and discussion

#### 4.1. Mineral waters and the treatment and therapy procedures associated with their use

People have always looked for good healing water. In Romania there are 91 approved mineral water deposits, but only 2 % of them are used. Romania has over 2000 mineral springs and the largest mineral water reserve (Feru, 2012).

Mineral waters continued to be used for therapeutic purposes until the 19<sup>th</sup> century that was considered 'the golden age' for the use of mineral waters, during which many spas were modernized, scientific studies of mineral waters recorded a significant increase whereas balneophysiotherapy became a distinct branch of the medical sciences (Feru, 2012).

The beginning of studies on the mineral waters of Transylvania took place when Marco della Frata published in 1678 the data related to the therapeutic effects of the mineral waters of Transylvania. (Marco Antonio, 1678).

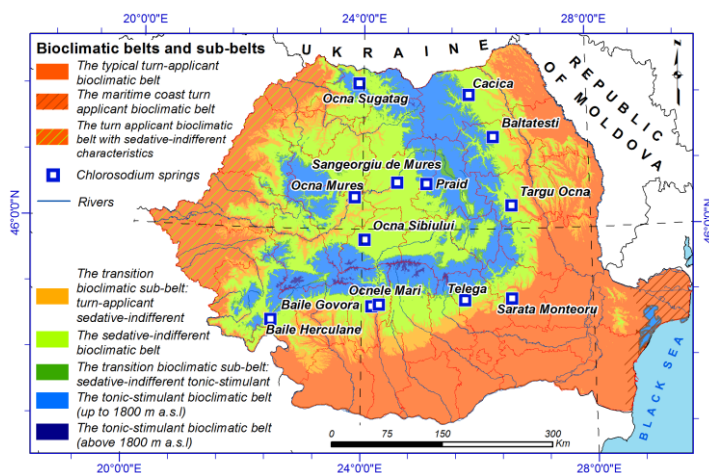
Doctor Lucas Wagner printed in Vienna in 1771 a work about the areas with mineral waters of Romania (Disertatis inauguratis medico chimica de aquis medicalis Magni Principatus Transilvania - 1771) (a work quoted by Feru in 2012).

As for the actual use for consumption, the first water bottling station in Romania was established in Borsec in 1806 by Anton Zimmenthausen. When Borsec mineral water had received the gold medal at the International Fair in Vienna, Emperor Franz Joseph I awarded it the title 'Queen of Mineral Waters'. In 1938 in Romania there were about 56 bottling stations among which Vâlcele (1841), Buziaș, Bodoc (1848), Biborțeni (1871), Bobâlna (1880), Malnaș, Covasna (1909), Lipova

(1912), Vatra Dornei (1923), Zizin, Tuşnad, Slănic Moldova and Căciulata (1936). In the beginning of the 20<sup>th</sup> century, even if Romania had a large number of bottling sections, it imported over 1 million liters of mineral water. After the Second World War, there were new mineral water resources that contributed to the increase of production. Then, from 1949 to 1970, the production of mineral waters increased 50 times from 3.1 mil. l/year to 164 mil. l/year (Feru, 2012).

Scientifically, in the second part of the 20<sup>th</sup> century, there were two major works by Pricajan that presented the value of mineral waters in Romania, namely: 'Mineral and thermal waters in Romania' in 1972 and 'Therapeutic mineral substances in Romania' in 1985.

Then followed a stagnation period and even a decrease in the production of mineral water whereas statistics show that about 120 million liters were bottled in 1993. The capitalization of this resource was restructured, the PET bottle appeared and the plain natural mineral waters entered on the market, so that the production of mineral waters increased to 1 billion liters in 2006 and to maximum 1.35 billion liters in 2008 (Feru, 2012).



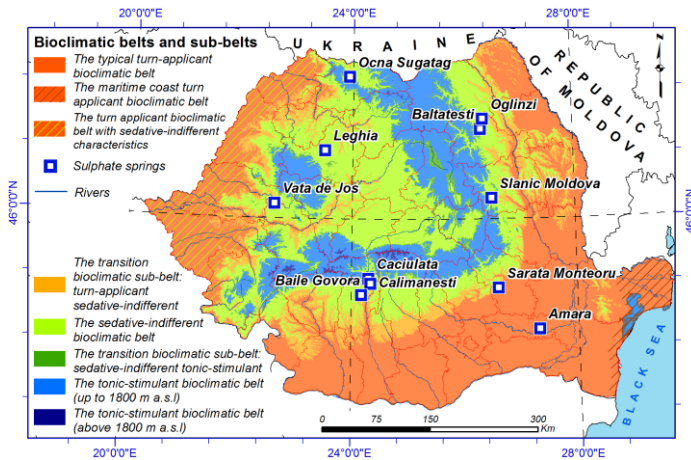
**Figure 1** The distribution on the Romanian territory of the tourist spas where the chloride-sodium or salty waters are capitalized - the bioclimatic floors and sub-floors can be seen on the colored background.

Sibiului, Ocna Mureş etc.

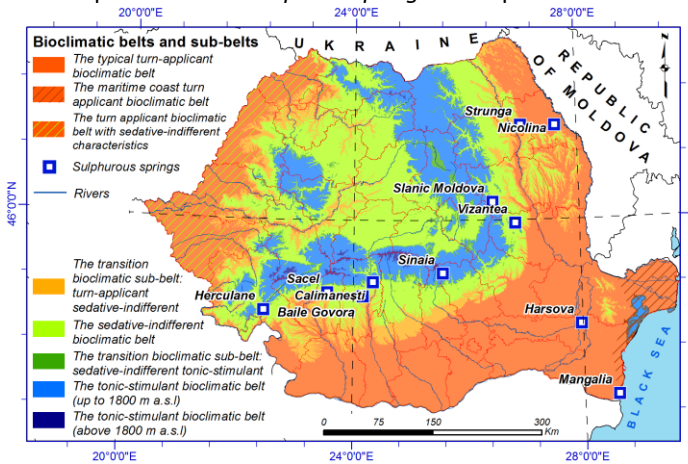
**Sulphated waters** (1 g ‰ sulphates). They are sodium or glauberian sulphate waters, magnesium or bitter, calcic or gypsum and vitriolic (with Fe and Al). These waters are used only in the internal treatment and in digestive disorders (intestinal or hepato-biliary) (Munteanu, 2013). They are drunk in the morning on an empty stomach, in chronic constipation, cholecystonia (gallbladder atony) and obesity etc. They can be found in the following spas: Ocna Şugatag, Oglinzi, Băltăteşti, Slănic Moldova, Sărata Monteoru, Amara, Călimăneşti, Căciulata, Băile Govora, Vaţa de Jos, Leghin etc. (Fig. 2).

**Sulphurous waters** (1 mg ‰ H<sub>2</sub>S). Sulfur is an element with important roles in the body. Sulfur waters are used in: internal treatments (cautiously, up to H<sub>2</sub>S concentrations of 50 mg/L), sprays or aerosols, vaginal irritation, external treatment). Sulfur is part of the amino acids, indispensable to the body (cysteine, arginine etc.). Hence the importance of sulfurous waters in chronic lesions of the mucous (bronchitis, chronic rhinitis) - sprays and aerosols. Sulfur is the element that forms the conjunctive tissue. Rheumatic disease is treated by external treatment with sulfurous waters. Sulfur is part of the insulin whereas sulfurous waters are indicated in the internal treatment to treat diabetes mellitus. Sulfur also has a desensitizing antiallergic role, having indications in the treatment of asthma (aerosols) and in some dermatoses

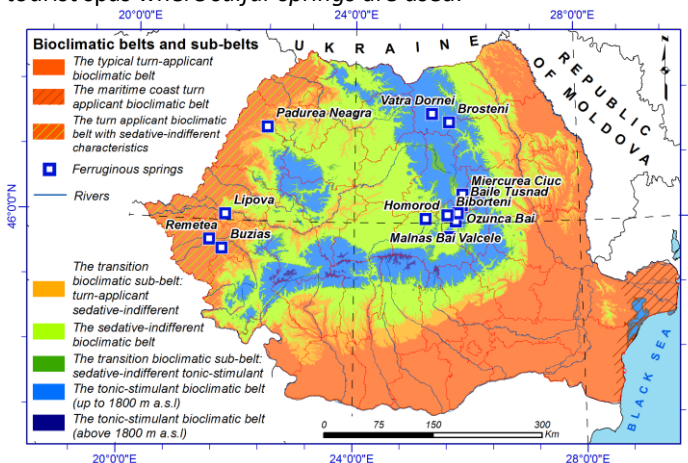
**Sodium chloride or salt waters.** They are exploited in many places (Fig. 1) and are used in the internal treatment if they have a concentration of up to 15 g/L (in digestive diseases - hypoacid gastritis, in chronic bronchitis or chronic rhinitis) or in the external treatment, when their concentration exceeds 15 g ‰ (it can reach up to 250 g ‰). They are indicated in rheumatic diseases. They can be found in the following spas: Ocna Şugatag, Căcica, Băltăteşti, Sărata Monteoru, Telega, Ocnele Mari, Băile Govora, Băile Herculane, Praid, Sângeorgiu de Mureş, Ocna



**Figure 2** The distribution on the Romanian territory of the tourist spas where the *sulphate springs* are capitalized.



**Figure 3** The distribution on the Romanian territory of the tourist spas where *sulfur springs* are used.



**Figure 4** The distribution on the Romanian territory of the tourist spas where *ferruginous springs* are capitalized. Cozia, Bazna (salty and iodized) etc. (Fig. 5).

- external cure. There are sulfur springs: Strunga, Nicolina, Slanic Moldova, Vizantea, Hârsova, Mangalia, Sinaia, Călimănești, Băile Govora, Săcelu, Băile Herculane (Fig. 3).

*Ferruginous waters* (10 g ‰ iron). They are always carbonated, but can also be salty, alkaline, calcium etc. Ferruginous waters are administered, in the internal cure, only starting from spring, during meals, otherwise the iron in contact with the air becomes inactive. Only bivalent iron is active, being resorbed in the presence of HCl and vitamin C (Munteanu, 2013). Indications of ferruginous waters: iron deficiency anemias (lack of iron in the blood), gastric achilles (absence in the gastric juice of hydrochloric acid and gastric enzymes), operated stomach etc.

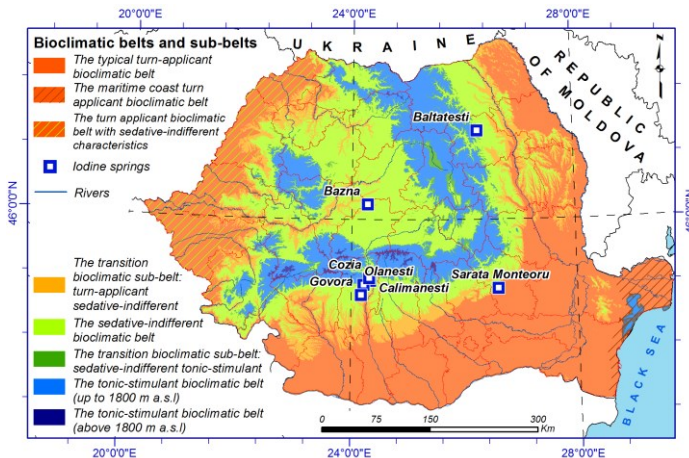
There are ferruginous waters in the following spas: Vatra Dornei, Broșteni, Miercurea Ciuc, Băile Tușnad, Malnaș Băi, Vârghiș, Ozunca Băi, Vâlcele, Biborțeni, Homorod, Buziaș, Remetea, Lipova, Pădurea Neagră etc. (Fig. 4).

*Iodized waters* (1 mg ‰ iod). Iodine, whose metabolism is controlled by the thyroid gland, has long been used in the treatment of chronic rheumatism, atherosclerosis, hypertension etc. These waters are used in internal and external cure. The spas with such waters in our country are: Bălțătești, Sărata Monteoru, Băile Govora and Olănești (iodized, salty, sulphurous waters), Călimănești,

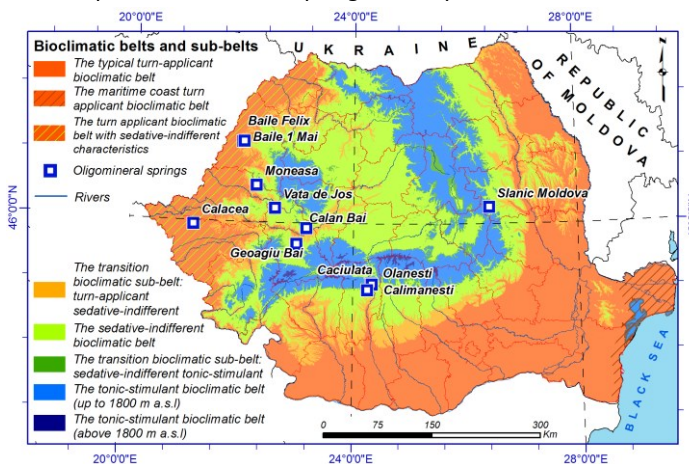


*Oligomineral waters* are poorly mineralized waters with total mineralization below 1 g/L. They come from the infiltration into rocks of rainwater and, according to their temperature, can be thermal oligominerals. They can be found in Băile Felix, Băile 1 Mai, Geoagiu Băi, Vața de Jos, Călan Băi, Moneasa and Călacea etc. (Fig. 6).

They are used in external treatments in pools or bathtubs, having a sedative calming effect on pains, relaxing for muscles and resorbing on chronic inflammatory diseases. They are used in painful syndromes, joint inflammations, muscle atrophies, muscle contractures, osteoporosis, genital diseases, rheumatic diseases and peripheral nerve diseases. In the internal treatment, oligomineral thermal waters are used to treat digestive and metabolic disorders (having antialgic, antispasmodic, resorbive effects) in biliary dyskinesia or colitis etc.



**Figure 5** The distribution on the Romanian territory of the tourist spas where *iodized springs* are capitalized.



**Figure 6** Distribution on the Romanian territory of the tourist spas where *oligomineral springs* are capitalized.

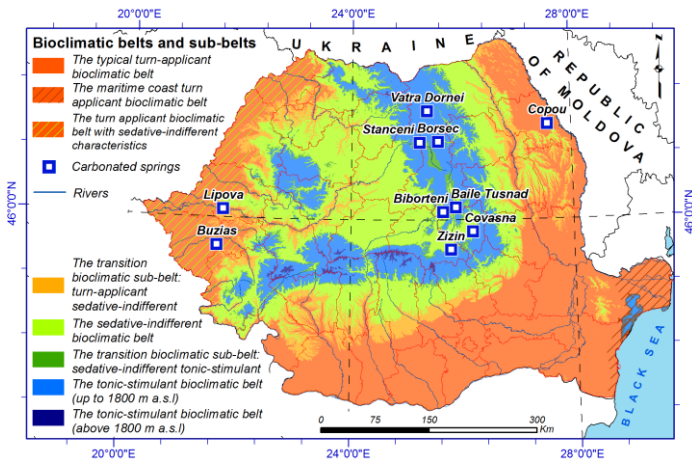
They are used both in the internal treatment and in the external treatment (Fig. 7).

In the internal treatment, carbonated water was used to treat chronic hypoacid gastritis, gastrointestinal dyspepsia, chronic enterocolitis, biliary dyskinesia, metabolic, renal and urinary disorders because it stimulates digestion, secretion and gastric motility. Carbonated waters are used not only for therapeutic purposes, but also as meal water because they stimulate appetite and digestion and have diuretic effects. In the external treatment (baths), carbonated waters

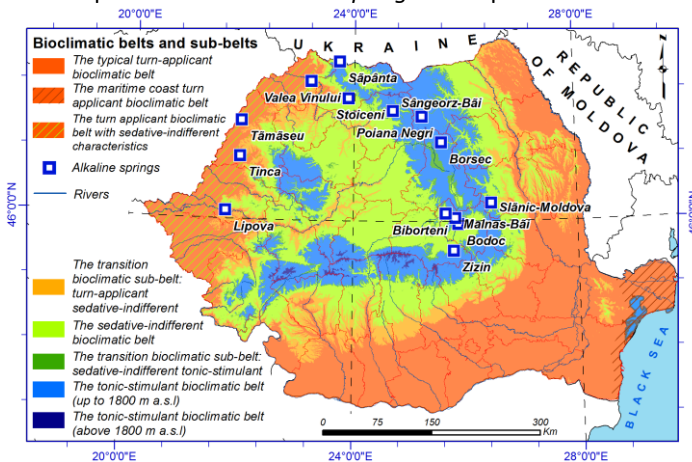
*Cold oligomineral springs* can be found in Slănic Moldova, Călimănești-Caciulata, Băile Olănești, Călan Băi, Geoagiu Băi, Vața de Jos, Călacea, Moneasa, Băile Felix and Băile 1 Mai (Fig. 6). They are used in the internal treatment to treat diseases such as urinary stones, urinary tract infections, gout, obesity due to the effect of washing the tissues and diuresis caused by these waters.

*Carbonated waters* contain at least 1 g of carbon dioxide / liter and are formed by the dissolution of carbon dioxide, a gas of volcanic origin, in the rainwater infiltrated into the crust of the earth

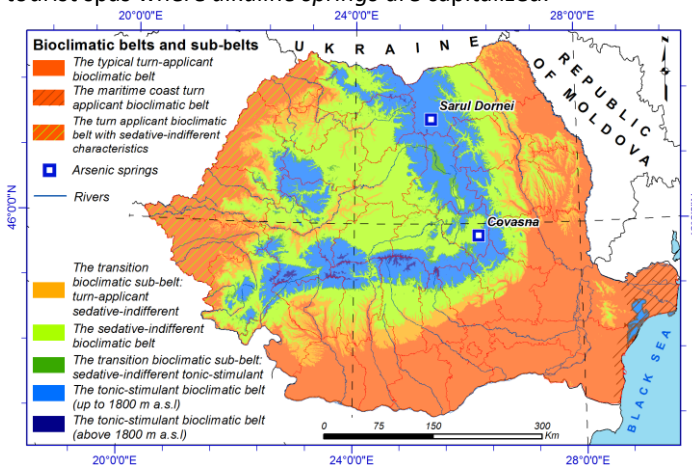
*Pure carbonated waters* are very rare because carbon dioxide has a high solubilization capacity of mineral salts from the rocks they cross on their way to the surface, the reason why they are alkaline, ferruginous alkaline-ferrous, chlorinated, sodium, etc. Such waters can be found in Borsec, Tușnad, Biborțeni, Covasna, Zizin, Vatra Dornei, Buziaș, Lipova etc.



**Figure 7** The distribution on the Romanian territory of the tourist spas where *carbonated springs* are capitalized.



**Figure 8** The distribution on the Romanian territory of the tourist spas where *alkaline springs* are capitalized.



**Figure 9** The distribution on the Romanian territory of the tourist spas where *arsenical springs* are capitalized.

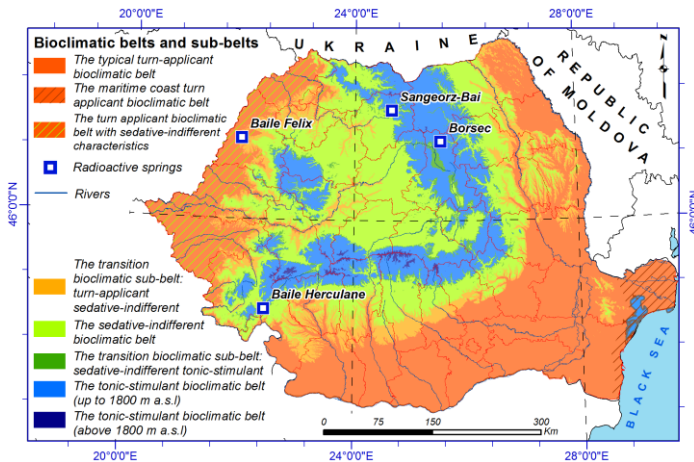
mg arsenic ion/L. They are formed on crystalline rocks of eruptive origin that accompany the metalliferous veins and also contain iron. Compared to the past, at present they are less

excite the skin, stimulate reflexes and blood circulation. They also contribute to reduce the effort of the heart and blood pressure. It is recommended in the treatment of cardiovascular diseases (in hypertension and poor peripheral circulation) hyperthyroidism, ovarian failure, polyneuritis and neuralgia.

*Alkaline waters* are poorly mineralized and contain at least 1 g of sodium bicarbonate / liter of water. These waters emerge in carbonate sedimentary rocks. The pure alkaline waters are very rare in nature, but in the form of mixed alkaline waters (calcium, magnesium, ferruginous, carbonated). They occur frequently and are used in the internal treatment or as aerosols. In the internal treatment the alkaline mineral waters stimulate the pancreatic -intestinal secretion, they are used in chronic gastro-duodenal disorders, ulcers, gastrointestinal dyspepsia, chronic enterocolitis, chronic cholecystitis, biliary dyskinesia, gout, diabetes, acid urinary stones and posthepatic sequelae. In the form of inhalations or aerosols, alkaline mineral waters are indicated in chronic rhinopharyngitis, chronic laryngitis and chronic tracheobronchitis. In Romania these waters can be found in: Săpânța, Sângeorz Băi, Poiana Negri, Borsec, Slănic Moldova, Biborteni, Malnaș Băi, Bodoc, Zizin, Lipova, Tinca, Tămășeu, Valea Vinului, Stoiceni etc. (Fig. 8).

*Arsenic waters* have at least 0.7

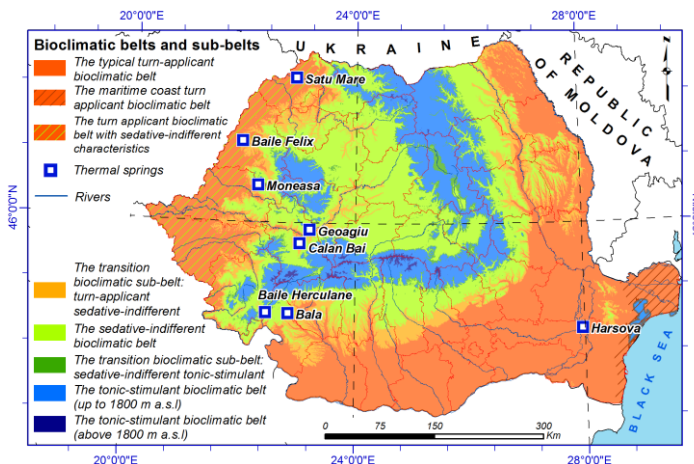
recommended (according to the sanitary norms, drinking water must not contain arsenic) in the internal cure in the convalescence state, weakness or thyroid hyperfunction. In Romania they are found in Șaru Dornei and Covasna (Fig. 9).



**Figure 10** The distribution on the Romanian territory of the tourist spas where *radioactive sources* are capitalized.

*Radioactive waters* contain  $10^{-7}$  mg of radioactive salt / litre coming from the decomposition of uranium or thorium that turns into radon, a gas that emits alpha radiation (less beta and gamma) with a half-life of 3.82 days. According to the analyses performed in Romania, there are no pathogenic radioactive mineral waters because the springs from Băile Herculane, Băile Felix, Borsec, Sângeorz-Băi have concentrations below the international limit imposed for this type of water (Fig. 10).

The waters from the mentioned Romanian spas are used only in the external treatment and act on the human body through their radioactive component that stimulates the adrenal glands, the nervous system and the metabolism (they reduce glycemia and uricemia). They are indicated in the treatment of inflammatory and degenerative rheumatic disorders, peripheral neurological disorders, dermatoses and endocrine functional disorders. Due to the increasing exposure of the human body to various forms of radioactive radiation, doctors currently recommend cautious external treatment with such waters. Internal treatment, inhalations and irrigation were completely abandoned.



**Figure 11** The distribution on the Romanian territory of the tourist spas where *thermal springs* are capitalized.

*Thermal waters* are classified according to temperature in hypothermal (20-31°C), thermal (32-38°C) and hyperthermal (over 38°C). On the Romanian territory there is an obvious asymmetry of the distribution of these resources (Fig. 11) whereas the western half of the country has reserves and spas that capitalize these waters.

#### 4.2 Therapeutic mud, procedures of treatment and therapy associated to their use

Due to the geographical location and the complex geological structure of the crust, Romania also has therapeutic muds besides lakes and mineral waters. The beneficial effects of therapeutic mud have been known since antiquity, but only in the past two centuries there were studies published on the mud treatment (peloidotherapy) and its effects.



The most common muds are the ones in mud deposits in saline basins (in the salt lakes or on the seabed) (Munteanu, 2007). The physical-chemical and microbiological analyses of the mud were generally interpreted in the laboratories of the National Institute of Recovery, Physical Medicine and Balneoclimatology where its composition, properties and scientific effects were studied. (Aniței et al., 1986). Research has been conducted on the therapeutic efficacy of the use of muds in balneary spas (Govora, Geoagiu Băi, Vatra Dornei, Amara, Lacu Sărat, Techirghiol, Sovata and Mangalia). In Romania, the use of mud for therapeutic purposes began in the second half of the 19<sup>th</sup> century in Techirghiol (sapropelic mud) and Vatra Dornei (peat mud). In the 20<sup>th</sup> century, therapeutic muds were used in the balneoclimatic spas on the Black Sea coast (Munteanu and Cintează, 2011). Before using therapeutic muds, it is important to take into account their physical properties (hydropexy, thermopexy, plasticity, granulation) but also their chemical properties (water content, mineral and organic substances). (Mineral waters and therapeutic muds in the People's Republic of Romania/Socialist Republic of Romania, 1965, 1970, 1973; Studies and research of balneology and physiotherapy, 1963, 1965, 1969, 1972).

The mud can be used in spas in the form of wraps, baths, poultices or on the shores of lakes in the form of anointings (Aniței et al., 1986), with effects on the locomotor, cardiovascular, nervous, respiratory and genital systems. As the liquid phase of the mud is in fact a hypertonic solution of mineral, bituminous, organic substances with rich contents in amino acids, enzymes and carbohydrates, it was possible to extract a solution (Narti, 1957) that has effects of neuroendocrine balancing, general desensitization and immunization (Teleki et al., 1984). Based on this liquid, anti-rheumatic ointments, body massage creams, toothpaste, facial mask have been patented.

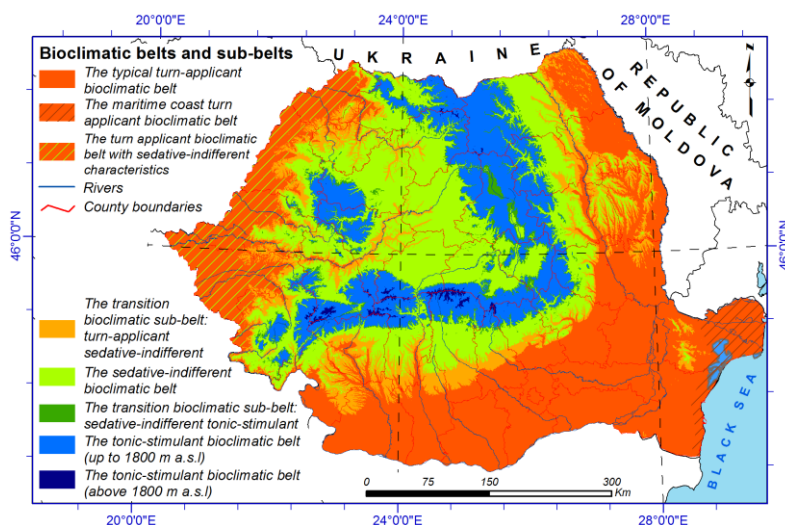
#### **4.3. The microclimate of salinas and caves and the procedures of treatment and therapy associated to their use**

Speleotherapy is a method of complementary medicine that uses natural factors of saline or cave underground environment. Saline therapy was used sporadically in the '50s and '60s in the past century, especially in Europe, with effects on allergic and respiratory diseases. In Romania, specialists from the National Institute of Recovery, Physical Medicine and Balneoclimatology performed clinical studies on the use of salinas (Slănic Prahova, Praid, Tg. Ocna, Cacica, Dej and Turda) for the treatment of a specific pathology. The microclimate of Romanian salinas has a constant temperature (10-12°C), relative humidity (60-75 %), atmospheric pressure (according to the air pressure outside), a low speed of air currents below 0.1 m/s inside the rooms and 0.3-0.4 m/s at the vents, with slight hypothermic and dehydrating stress, determined by the cooling and decreasing of the amount of water vapor. Aeroionization is predominantly negative (Simionca et al., 2005). The air is pure, with minimal concentrations of microorganisms (Simionca, 2013). The environmental studies and the medical ones conducted in the beginning of the 21<sup>st</sup> century point out the effect of this microclimate on the increase of immunity, non-specific resistance, reducing the chronic inflammatory process in respiratory diseases (Simionca, 2013).

#### **4.4 Special bioclimatic features of bioclimatic floors. Treatment and therapy procedures associated to their use**

In 1961 Dr. Maria Modvad and Physicist Ștefan Pașcu made a classification of Romania's bioclimates. Specialists from the National Institute of Recovery, Physical Medicine and Balneoclimatology had important contributions to the regionalization on a quantitative-scientific and methodological basis of Romania's bioclimates (Berlescu, 1982; Teodoreanu et al., 1984;

Teleki et al., 1984; Teodoreanu 2011 etc.). Romania's relief is divided into three distinct stages with a close percentage: 34 % mountains, 36 % hills and 30 % plains. The geographical location and the presence of the Carpathians determine the existence in Romania of a temperate transition climate with moderate shades to the west of the Carpathians, excessive to the east, but also with an obvious stratification within them.



**Figure 12** Bioclimatic belts and sub-belts in Romania.

Climatic data and indices, respectively bioclimatic ones, allowed the classification of our country's climate and bioclimate. The mountain climate has a bioclimatic counterpart: the tonic - stimulating bioclimate (Fig. 12). The climate is very contrasting from summer to winter from a thermal, moist, unfavorable, dynamic, pluviometric and phenomenological point of view. It is very cold on the highest mountain

peaks, the fog is high, there are precipitations, thicker and persistent snow layers, reduced atmospheric and oxygen pressure, more active circulation, high skin stress, high pulmonary stress, pure unpolluted air whereas negative air ionization has high values. High mountain peaks are suitable to adapted young healthy people or to the healthy trained elderly. On the floor of the average and low mountains (1800 / 2000 m – 700 / 800 m and even less in the depressions and inland valleys), the climate is various. On the positive forms of relief: peaks, plateaus, saddles, high intra-montaneous colours, the climate is cold and relatively humid, with significant precipitation, with alternating periods of high nebulosity/ long sunshine, strong ventilation and snow blizzard. The *western* slopes exposed to ocean circulation are wetter and have richer liquid/solid precipitation, thicker layers of snow, they are cooler in summer and warmer in winter. The *eastern* slopes are drier, warmer in summer, less cloudy and better warmed by the sun, but in winter they are more exposed to the continental traffic in the east. The *northern* slopes are less sunny, colder, wetter whereas the *southern* ones are drier and better warmed by the sun.

The thermal comfort can rise in certain spatial-temporal circumstances up to 1800 m on the southern slopes, and up to a maximum of 1400 m on the northern ones. The air baths in the cold season are very cold and moderately-humid or moderately-dry, strongly or moderately dynamic. In the warm season they are less stressful: cool, moderately humid and dynamic. Negative air ionization has high values. The climate and bioclimate of the negative forms of relief (depressions, narrow valleys, wide valleys or in the average and low mountains) have the brightness duration of the sun diminished by the surrounding obstacles. It is sheltered in relation to the general circulation of the atmosphere and marked by frequent atmospheric calmness and thermal inversions. The thermal excess is obvious: on summer days the maximum temperature rises to 25-30°C, whereas in winter nights the minimum temperature drops to -20 and -30°C. The humidity is in excess, high nebulation / fog in the cold season, frequent fog in winter. In summer the thermal comfort increases, the air baths are cool or indifferent, static low skin stress, slightly dehydrating

lung stress. Winters are stressful and hypertonic, autumns and springs have a high frequency of relaxing, non demanding time. Air ionization is dependent on the geological substrate, on the vegetation and on the presence of water. The bioclimate of the average and low mountains help the neuro-vegetative, endocrine functions that coordinate acclimatization, it has a tonic character: it is stimulating at the top, but it has shades of sedation and relaxation at the bottom. The mountain cure is indicated in anemia, convalescence, rickets, insomnia and hyperexcitability. For people with reduced acclimatization capacity in early hyperthyroidism (Berlescu, 1998).

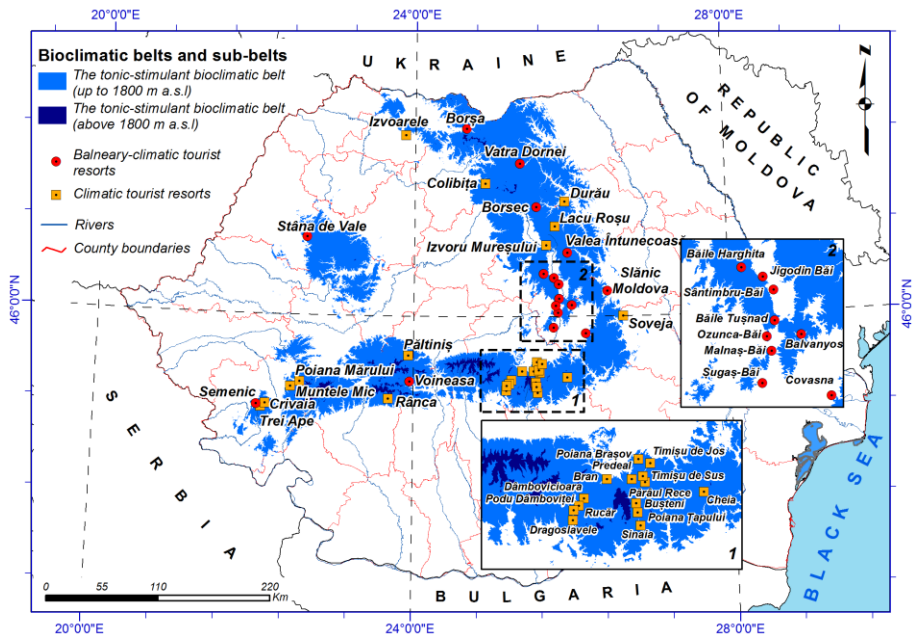
The climate on the higher hills and plateaus corresponds to the indifferent (sparing) or sedative-relaxing bioclimate. It is located at altitudes between 700 / 800 and 200 / 300 m. It is specific in the hilly depression of Transylvania, Subcarpathians, in high portions of the Moldavian Plateau and the Dobrudgean Plateau (over 300 m), Mehedinți Plateau, the Western Hills, wide portions in Banatului Mountains, Poiana Ruscă, at the feet of Apuseni Mountains (Teodoreanu and Gaceu, 2013) (Fig. 12). The temperature has moderate variations, the winters are mild and the summers are cool. The thermal comfort is the highest. Humidity, nebulosity, the amount of precipitation, the dynamics of the air, the atmospheric pressure have moderate values. The skin and lung stress has minimal values whereas the number of relaxing, undemanding, balanced months is maximum. In the sedative, sparing bioclimate, the body does not make great efforts for acclimatization. The bioclimate is recommended for the persons with thermoregulatory deficiencies, the elderly, children, people in convalescence, the worn out and without therapeutic contraindications.

The climate of the plains and low plateaus corresponds bioclimatically to the exciting demanding bioclimate. There are three regions with special characteristics I) the Romanian plain, the areas under 300 m in the Moldavian Plateau, Dobrudgean Plateau, II) West Plain and III) seaside. The elements characteristic of the complex of the therapeutic climatic factors are represented by: high temperatures in summer and low ones in winter - large thermal amplitudes, low thermal comfort both in summer and winter, high dryness, low nebulosity, great length of sunshine (2100 – 2200 hours/year), quite active dynamics, deficient precipitation and high atmospheric pressure. The air baths in the warm semester are predominantly warm and very warm, dry and moderately dried, poorly dynamic and less static. Comfort increases in the evening and in the morning. The cutaneous, lung and total stress have high values. Positive air ionization predominates. The presence of forests and waters improves the deficiencies of the bioclimate. All these bioclimatic particular features lead to an intense demand for the body (the intense request of the central and vegetative nervous system, of the endocrine glands). It increases the capacity of immunobiological defense processes of the body and it improves the mechanism of the calcium. People on the higher relief floors adapt harder to this bioclimate. There is an increased risk of overheating, erythema, heat shock or hyperthermia. Exposure to air and sun baths should be made with restrictions for the ones with cardiovascular, neurological and lung diseases. In Moldavian Plateau and in the Dobrudgean one, at less than 300 m + Romanian Plain, it is possible to treat in the spas with salted lakes: degenerative, inflammatory and abarticular rheumatic disorders posttraumatic, peripheral neurological, gynecological, dermatologic, rickets, children's growth disorders (Berlescu, 1982). In the Western Plain, the bioclimate has a relaxing shade. The cardiovascular, digestive, hepato-biliary, renal and urinary, metabolic and nutritional disorders can also be treated in combination with the use of mineral waters (Berlescu, 1982; Teodoreanu and Gaceu, 2013). On the coast, the bioclimate is exciting and demanding with specific nuances. The biological effects are similar to the plain bioclimate but the thermolysis process is replaced by the process of training and thermal hardening due to the possibilities of contrasting thermotherapy, thanks to the presence of sea water and breeze. The strengths of this bioclimate are given by: the duration of the Sun's brightness of 2300 – 2400 hours / year, the air temperature that is lower than the plain in summer- due to the sea breeze even higher in winter, high humidity (80 %), little rainfall

(300 - 400 mm), permanent wind with average speeds of 4 - 5 m per second, atmospheric pressure with the highest values. Air baths on the beach in the summer season are frequently cool and indifferent, moderately and intensely dynamic, moderately dry and humid. Bioclimatic stress is high. According to Berlescu 1998, this shade of bioclimate is recommended to treat diseases of the musculoskeletal system, peripheral nervous system, dermatitis, rickets, extrapulmonary tuberculosis, gynecopathy, allergic asthma, Ear-Nose-Throat, endocrine, metabolic and nutritional diseases. It is contraindicated for developing infection foci, malignant tumors, acute ulcer, tuberculosis, hyperthyroidism and heart decompensation.

#### 4.5. Spas. Anthropic elements of scientific valorization in the highest potential of natural environmental factors for cure and treatment

The Romanians were the ones who laid the foundations of the first thermal spas in Europe (Italy, France, Germany, Belgium, Romania) and ensured the transport of healing mineral waters in clay amphorae. In Romania, too, there were spa constructions that used mineral waters in Calan, Herculane and Geoagiu. In the 19<sup>th</sup> and 20<sup>th</sup> centuries, there were references to the use of thermal springs in the Oradea perimeter and the existence of hospital establishments in the vicinity or inside this city.



**Figure 13** Balneoclimatic and climatic tourist spas located in the stimulating tonic bioclimatic belt.

In the 20<sup>th</sup> century, the tourist spas with a climatic and balneoclimatic profile developed numerically and proliferated in the territory. There appeared numerous guides and scientific papers where their potential, profile and endowments were described in detail (Munteanu et al., 1978 and 1986; Teleki and Munteanu, 2012 etc.). At present, Romania has a network of tourist spas that completely cover the territory, from the highest Carpathian peaks (Fig. 13), then going to the floor of the hills and plateaus (Fig. 14), to the lower plain and on the Black Sea coast (Fig. 15). Romanian tourist spas (climatic and balneoclimatic) could attract more tourists provided that a series of simple or practical measures is encouraged (Subchapter 4.9). First of all, the tourist infrastructure of the treatment, the accommodation and the adjacent bases must be modernized.



The balneoclimatic potential of these resorts is very high, but unfortunately insufficiently exploited.

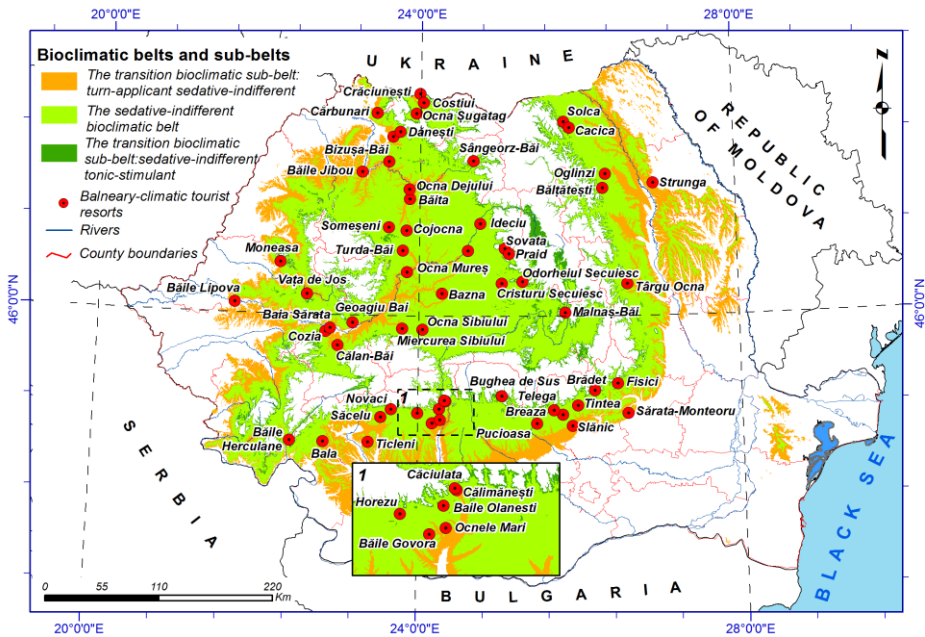


Figure 14 Balneoclimatic tourist spas located in the sedative indifferent bioclimatic floor.

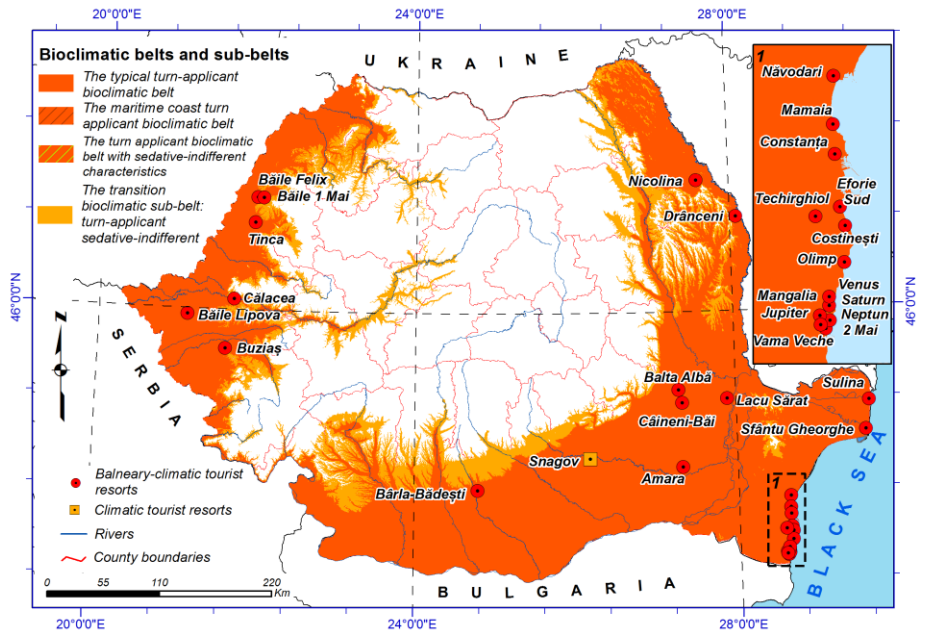


Figure 15 Balneoclimatic tourist spas located in the exciting bioclimatic floor.

At this moment, the future represents a challenge for the Romanian balneoclimatic tourism field.

#### 4.6. Scientific and research activity, a factor that contributes to the development of balneoclimatology

Carol Davila transformed in 1869 the Medical School of Bucharest (established in 1853) into the Faculty of Medicine. Thus, he opened the possibility of developing scientific research and

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publishing results in the spa field. A first example is the work of Alexandru Saabner Tuduri 'Mineral waters and climatic spas in Romania' published in 1900. To the end of the 19<sup>th</sup> century and the beginning of the 20<sup>th</sup> century, the use of other natural therapeutic physical factors (water and climate) is the objective of these researches, whereas their results were published in the country and in Europe.

*Evolution of research in the field of geology, hydrogeology and hydrochemistry of water deposits with a curative and therapeutic role*

The oldest scientific writings on the thermal waters in Herculane area belonged to Caryophili (1739a and 1739b). The first thermal analyses regarding the thermal waters in our country were performed by Crank in 1773. Stadler (1776) brought additions to Crank's study. Another paper that analyzed the chemistry of thermal waters with therapeutic effects in Transylvania was published under the coordination of Barbenias in 1792. In 1837 Episcopescu studied the metallic waters of Great Romania. We will then present the first analysis of the radioactivity of mineral waters in Romania, succeeded by Hurmuzescu in 1909. In 1970 Airinei and Pricăjan correlate the geological structure of the Eastern Carpathians with the existence of the Moferic aura and with the mineral springs in this area with a focus on Covasna County. Airinei et al. proposed in 1976 a conceptual scheme regarding the study of geothermalism and the process of groundwater heating in Romania. In 1977 Airinei et al. made detailed reference to the significance of the Neogene volcanism in Romania in relation to the thermal water sources of the specified territory. Consumer mineral waters in Romania were researched by Pricăjan and Airinei in 1979.

The geothermal potential of the Romanian underground with impact on the genesis of geothermal water resources was analyzed by Airinei in 1981. Brandabur et al. had notable scientific concerns and achievements while analysing the spread of hydrogeological conditions of geothermal structures in Romania in 1984. Another valuable work was done by Cosma et al. (1985) having as a subject the radioactivity of natural gas emanating from mineral and geothermal water sources in the Eastern Carpathians.

Until 2000, the hydrogeological bibliography of Romania included 1530 titles that addressed the water resources in the Romanian underground in terms of quantity, quality, mineralogical, chemical, radioactive, thermal etc. Almost half of them refers directly or indirectly to different parameters of mineral water resources. Therefore, the contribution of hydrogeologists and hydrochemists to the knowledge of Romania's mineral and thermal water resources is a meritorious one and made possible the quite precise and detailed evaluation in terms of the resolution of the spatial-temporal coverage of the territory with quality information. All the ordinary groundwater reserve in the Romanian underground were analyzed of hydrogeologists and hydrochemists. Where mineral or thermal waters were identified, the studies were even more detailed. However, the groundwater is in a continuous dynamic (for example, the area Băile Felix-1 Mai where the thermal water level decreased after 1989 by about 9 m due to overexploitation). Therefore, in order to use them for treatment, consumption or other purposes (heating), it is necessary to make punctual or detailed re-evaluations.

*The evolution of research in the field of Balneology and Balneoclimatology*

Balneology and Balneoclimatology study the application in medical practice of natural factors such as mineral waters, muds, therapeutic gases, aerosols, specific and special features of microclimates or topoclimates etc.

Balneology on the territory of today's Romania has been certified since Antiquity. Dacian priests used thermal mineral waters to treat certain diseases. The medicine they practiced was rudimentary. After the Romans had conquered Dacia, new therapeutic treatment techniques based on natural factors were introduced. The first balneologist of Dacia Felix was Marcus Valerius

Longinus, a Romanian military doctor from the 7<sup>th</sup> legion. The mineral springs were fully exploited by the Romans who built public baths such as the ones in Germisara (today's Geoagiu Băi) that were used by the Roman camp in Cigmău. In Cerna valley, near Ad Median camp, the Romans discovered several springs of sulphurous thermal waters. They founded the spa 'Ad aquas Hercule Sacras ad Mediam', declared the holy baths of Hercules. Another important spa for the Romans was the one in 'Călan Aquae' near Sarmisegetusa- Apulum where they used the thermal waters as 'healing waters'. The bioclimate and other environmental factors played at that time, in the described context, an almost insignificant role from a therapeutic point of view. The Dacians - Romans also exploited the mineral and thermal mineral waters from Olt Valley in Călimănești - Bivolari area. They also used for therapeutic purposes the salt waters from Ocna Sibiului, Turda and Sovata. After the official departure of the Romans from Dacia, the wars and the invasion of the migrating peoples began and the local population used less and less these natural sources for treatment. The use of public baths became an increasing risk due to the spread of diseases such as plague, cholera, leprosy etc., which led to the abandonment of some spas.

There are documents certifying the use in the Middle Ages and the beginning of the modern era for curative and therapeutic purposes of mineral waters from Băile Felix (1221, 1405, 1777), Covasna (1593), Tușnad (1600), Băile Herculane, Bazna, Strunga (1734), Băile Homorod (1743), Borsec (1770). The papal legate Antonio Posevino spoke in 1578 about the diseases and natural treatments in Transylvania. The Italian traveler G.P. Campani mentioned in 1585 the healing waters of Oradea. Ferdinand de Marsigli from Amsterdam wrote in 1736 about the skunks from Transylvania. The Croatian Italian Ruggiero Giuseppe Boscovici spoke in 1762 about the salt mines from Turda, Ocna Sibiului, Cojocna, Ocna Dejului, Praid. Friedrich Wilhelm von Bauer, wrote in 1788 about the climate and mineral springs in Banat. In the 17<sup>th</sup> - 19<sup>th</sup> centuries, many doctors, chemists, physicists (Austrians, Hungarians, Germans, Romanians) made research in natural therapeutic factors, especially mineral and thermal springs (Tușnad 1600, Homorod 1743, Olănești, 1760, Șaru Dornei, 1788, Călimănești, 1827–1830, Covasna 1800, Slănic Moldova, 1819, 1864, Vâlcele 1875 etc.) which could thus be capitalized medically (Teodoreanu, 2015).

Bioclimatology (and biometeorology) appeared relatively late and were supported by the beginnings of climatological and medical research. The foundations of the climatological research were laid after the establishment of the network of meteorological stations, with a permanent observation program. The first meteorological observations in Romania were made at short time intervals starting from: 1770 in Iași, 1773 in Bucharest, 1789 in Sibiu, 1833 in Cluj, 1857 in Sulina, 1863 in Giurgiu, 1874 in Timișoara, and in 1878 in Galați and Braila. In July 1884, the Meteorological Service of Romania was established under the leadership of the physicist Ștefan Hepites.

At the beginning of the 19<sup>th</sup> century and throughout it, emphasis was placed on the establishment and development of several balneary/ balneoclimatic spas. At the beginning of the 19<sup>th</sup> century, some studies were made in collaboration with French and German doctors who presented their results in a spa guide published in 1829 in 'Curierul Românesc / The Romanian Courier'.

Among the important personalities who made their contribution in the field of balneology, we mention the German doctor Werthimer who in 1829 and 1853 made a description of all the mineral waters in Romania.

In 1896, specialists in the spa and climatological field met at the International Congress of Hydrology and Climatology at Clermont Ferrand and decided to set up a meteorological station in each spa, because '... climate is one of the most important factors in the spa treatment that have

not been taken into account so far'. In 1896, after the Congress in Clermont-Ferrant, Hepites promoted the research of the climate of spas.

At the beginning of the 20th century, in 1900, Tuduri radiographed the mineral waters and climatic spas in Romania in a successful synthesis about spas, climate and therapy .

The Society of Medical Hydrology and Climatology was established at the initiative of Dr. Vicol on 1<sup>st</sup> May 1922. In this society, many representative works were printed with reference to the knowledge of the therapeutic factors and properties in the balneoclimatic spas in Romania. Among the most remarkable works in this field, we mention those of Țeposu and Pușcariu in 1932 and of Teohari in 1934. In 1930, Dr. Marius Sturza founded the first department of balneology in Cluj-Napoca. Dr. Marius Sturza (1876–1954), a member of the Romanian Academy (1938), is practically the founder of the Romanian balneoclimatology and bioclimatology. Marius Sturza drafted the first work on mud and its therapeutic value, established the characteristics of Lake Sovata, namely heliotherapy, and its therapeutic action. In 1930 he published in Vienna an extensive work on salt waters in Romania and their healing properties. He is the author of numerous papers on the hydrotherapy of gastrointestinal diseases, climatotherapy in tuberculosis, climatotherapy to treat diseases of the digestive tract, baths and climate on the Black Sea coast, the preventive and curative importance of winter climate, combined balneotherapy and physiotherapy, and climatic conditions, technical and hygienic protection of spas and climatic resorts, mineral waters and muds, meteorotropic diseases etc. (Teodoreanu, 2015). In 1938, Herovanu carried out the first complex research program on atmospheric physics, bioclimatology and balneoclimatology in the Balkans. In 1946, Topor elaborated the first long and very long forecasts, useful for a future medical forecast. In 1971, Berlescu reanalyzed, through the prism of the results from the level of the respective year, the potential of the Romanian spas and its use throughout time. Pricăjan and Airinei presented in 1981 the hydromineral resources of Romania that could be capitalized in spas. Among the most valuable and comprehensive works on the balneoclimatic treatment in Romania, we mention the one of Teleki's team since 1984, which remains a landmark work for this field. It is completed from a bioclimatic perspective through the study 'Bioclimate of spa resorts in Romania' developed in the same year by Teodoreanu et al.

Studies on spa and balneoclimatic lines were continued after 1990. There were works that considered water a therapeutic agent (Mogoș, 1990), encyclopedic works on Romanian balneoclimatology (Berlescu, 1998) or human bioclimatology (Teodoreanu, 2002).

A comprehensive modern and current approach to natural therapeutic factors was made by Cintează in 2011. Then, on 2012, Munteanu developed doctor Sturza's studies of 1930 on mud and their therapeutic use. In the same year Iețcu et al. pointed out on a scientific and medical basis the possibility of capitalizing the salt mine of Cacica for curative and therapeutic purposes. In 2013 Simionca made a retrospective of speleotherapy in Romania analyzing the condition and possibilities of using salt mines for medical purposes. In the same year Munteanu brought new contributions to the knowledge of the therapeutic role of mineral waters. In 2014, Mihăilă brought new completions, clarifications and approaches about the relationship between the human body, weather and climate by insisting on clarifying the affiliation of some climatotherapeutic procedures in the field of balneoclimatology and, in 2017, Bistricean et al. performed a bioclimatic and GIS update of the Moldovan bioclimatic complex west of the Prut river.

Closely related to the fields of balneology and balneoclimatology is the field of tourism and balneoclimatic or health tourism.

*The evolution of research in the field of balneoclimatic tourism*



The Romans had great interest in the exploitation of healing baths which led to the construction of spas, some of which survived to this day (Herculane Ad Aquas Herculis Sacris and Germisana in Romania). With the discovery of heating based on hot air, the Romans built the famous 'Terme2' where they gathered from all corners of the empire for recreation, cultural and sports activities. These bathrooms had a simultaneous serving capacity of approximate 60000 people.

In the medieval period, after the fall of the Roman Empire, tourism had a very slow evolution, pleasure trips had almost disappeared, numerous wars and frequent epidemics hindered the development of tourism. In the Middle Ages, spa tourism stagnated due to the invasions of migrant peoples who were attracted by the resources of the Romanian land. Many of the spas were abandoned or destroyed. However, documents certifying the use of mineral waters from Băile Felix (1221, 1405, 1777), Tușnad (1600), Băile Herculane, Bazna, Strunga (1734), Homorod (1743), Borsec (1770), Covasna (1593) were preserved. The Jesuit Antonio Posevino informed around 1578 about the diseases and natural treatments in Transylvania. The Italian monk Campani wrote in 1585 about the thermal waters of Oradea; Ferdinand de Marsigli from Amsterdam showed in 1736 that at the level of the mentioned year there were skunks in Transylvania, not only in Italy. Boscovici (1762) gave information about the salt mines from Turda, Ocna Sibiului, Cojocna, Ocna Dejului and Praid. Von Baner (1788) referred to the climatic conditions and mineral springs in Banat.

In the 17<sup>th</sup> and 19<sup>th</sup> centuries, rulers and boyars retired to monasteries and royal mansions for recreation in summer. We find information in the works of Ghica and Alecsandri 'About the moments of relaxation and recreation in some spas'. In the interest of the rulers, some localities developed in the form of resorts or climatic spas.

In the contemporary period, tourism declined immediately after the Second World War. Small resorts disappeared after the nationalizations of 1948. Only after 1965 spa tourism began to experience a slight recovery, meaning that climate resorts were built at the feet of the mountain and began a slight development of the network of spa resorts of general and local interest.

The increase in accommodation capacity has led to the extensive development of internal tourism and to a doubling of the total number of internal tourists accommodated in tourist and treatment tourist units (from over 5.4 million in 1970 to almost 11.6 million in 1989) (Rădulescu and Stănculescu, 2012).

Immediately after the revolution, the material complex of resorts fell apart and were considerably deteriorated, there was a decrease in tourist traffic, whereas the network of resorts did not belong to the Ministry of Health and started to be administered of the Ministry of Tourism. This transit resulted in the privatization of many resorts in order to generate an advantageous economic profit while the treatment bases were ignored.

Among the most recent and representative works with a profile (balneoclimatic and balneoclimatic tourism), we mention the studies of balneotourism potential of Romania made by Teleki and Munteanu (2012), balneoclimatic tourism potential - Teodoreanu and Gaceu in (2013) or potential tourist on the climatotherapeutic component made by Mihăilă in 2014.

Many studies on the climate-tourism relationship have been published in a series of books or articles authored by professors or researchers, geographers, climatologists and doctors. Among them we mention the one of Apostol and Gaceu from 2011 which aimed at the climatic-tourist potential of the Romanian Black Sea coast during the summer. Then we mention two bioclimatic and tourist studies conducted by Mihăilă et al. in 2018 aimed at analyzing the potential of the climate for tourism activities in tourist resorts in the North East region of Romania or Moldova. A notable achievement in the field of climatology and tourism is the one of Sfică et al. in 2018

regarding the climatic favorability of the Romanian territory for spa type tourist activities in the summer season.

We believe that in the future balneoclimatic research will have to focus in the years to come both on the publication of research results in the field of balneo-therapeutic and tourism, but more on research in the climate / bioclimatic to highlight the relationship atmosphere between climate, man and tourism, a relationship that has often been minimized or even neglected.

In conclusion, the introspection in the field of research on the balneoclimatic potential of tourist resorts in Romania presented the achievements in this field, but also the directions to be followed by future concerns: analysis of balneoclimatic potential, updating, redefining and enhancing the tourist profile of resorts, the role that individual and local community perceptions can play in the development and management of tourism activities.

#### **4.7. Legislative regulations in the field of balneoclimatology that marked the progress of this branch of activity**

An important role on the evolution of balneology was played by the political factor. In 1886, the 'Law on the development of spas' was passed, and at the end of the World War I, two more laws were passed: in 1924 the Regulation of spas, then in 1925 the Regulation about the specialty of balneologist.

In the beginning of the 20<sup>th</sup> century, there were legislative measures on the regulation of mineral water exploitation but also the activity in the balneoclimatic resorts. In 1903, the Regulation for the organization of the domain service in Dobrogea was applied, by which the mineral waters and lakes became the property of the state. One year later, some spas (Govora, Călimănești-Căciulata, Lacu Sărat) were reorganized by applying the Regulation for the administration and operation of state baths in the mentioned resorts. In 1907, the regulation was also applied to Slănic Moldova spa (Silișteanu, 2014).

An important legislative document that imposed the development of balneology was the Law for the operation of state spas in 1909, it approved the emergence of joint stock companies for a period of 30-50 years with the role of allowing the application of baths and crenotherapy procedures and maintaining free in the needy (Teleki and Munteanu, 2012).

The essential role in the development of the balneology specialty in Romania was played by the establishment in 1922 of the Society of Medical Hydrology and Climatology and then in 1923 of the Institute of Balneology by Dr. Anibal Teohari. Through these institutions, the publication of publications was supported, such as 'Journal of Medical Hydrology and Climatology, Physiology and Dietetics', 'The Courier of the Baths, climatic resorts and tourism' in which numerous articles and research in the spa field were published.

In the interwar period, the spa patrimony expanded due to the reunification of the country. In 1922 the balneo-climatic spas became subordinated to the Ministry of Health whereas the Balneo-climatic Inspectorate was established. Through the Mining Law of 1924, the mineral springs belonged to the Ministry of Industry and their exploitation was leased for 50 years (Silișteanu, 2014).

The Institute of Balneology was founded in Bucharest in 1923. In 1924, the Regulation of spas and climatic resorts was passed by royal decree, allowing the appearance in 1925 of the Regulation on the balneologist specialty. Another important moment was the voting of the Săveanu sanitary law in 1926 that regulated the spa activity. In 1931, the Department of Hydrology was established within the Faculty of Medicine in Bucharest. By the Law for the organization of the territory from 1936, the balneoclimatic resorts started to belong to the National Tourism Office that was under

the protection of the Ministry of Interior, therefore the attributions of the Ministry of Health in the activity of the resorts decreased. In 1943, there were 2 legislative events: the first class spas as tourist resorts by the decision of the Ministry of National Propaganda, and then the new Sanitary Law transferred the spas from the Ministry of Interior again to the Ministry of Health, where a spa was established (Teleki, 2009).

The 70's of the last century are representative for the development of the spa sector. The first spa complexes were developed, which included in the same building the accommodation spaces with standard equipment, modern medical equipment and specialized staff to provide with complete spa treatment: Băile Herculane, Băile Felix, Tușnad, Călimanești-Căciulata, Vatra Dornei, Covasna, Mangalia, Eforie Nord, Moneasa, Sângeorz Băi and Geoagiu Băi. In 1986, under the leadership of Prof. Dr. Nicolae Teleki, balneology was reorganized through the development of the clinical departments of the institute whereas recovery hospitals were established where numerous specialists in the field were trained. After 1989, in the absence of a sanitary policy, of some investments, the spas were deteriorated, especially as their patrimony passed to the Commercial Tourism Societies (Silișteanu, 2014).

#### **4.8. Factors that contributed to the development of balneoclimatology in the 20<sup>th</sup> century**

Among these factors we can briefly mention:

- i) the increase in the number of published studies - most regarding the effect of therapeutic mineral waters, natural environmental factors on human health,
- ii) the recognition of balneology as a medical specialty in Europe and Romania,
- iii) the increase in the number of national and international scientific events showing the relationship between natural factors, climate and results obtained while treating patients,
- iv) the evaluation of the effects of mineral waters in treating various diseases through internal, external or aerosol administration and
- v) the increase in the number of published studies on climate therapy and the links between environmental components, quality of life and human morbidity.

#### **4.9. Development of balneoclimatology in perspective**

The development of Romanian balneoclimatology in the perspective of the next years is a necessity. It can be done in several directions and must integrate several categories of actions, some of which we will review:

- i) the elimination/ reduction of the effects of air pollution (chemical, thermal, electromagnetic, biological, sonic, radioactive) sources of air and water and soil contamination, good management of wastewater and waste from resorts,
- ii) the strict protection of the nature of the places: groundwater springs, hydrographic arteries, lakes, forests, reservations, valuable natural sites, plants and fauna specimens with landscape, ecological or scientific value,
- iii) topoclimatic, hydrographic, forestry and landscape arrangement of the territory through afforestation, arrangement of parks, arrangement of springs, lakes and ponds, river courses,
- iv) the discreet and harmonious insertion in the landscape of modern infrastructural elements (access roads, water pipes, gas, telephone cables, internet, constructions, sports bases, swimming

pools, summer gardens, terraces, view points) which through color and architecture could be adapted to the nature of the places and their cultural-urban specificity,

v) the maximum use of renewable energy sources,

vi) the careful use of climatic and spa resources to keep their pace of renewal/ regeneration unaltered,

vii) the making of various leisure opportunities other than the ones intended for treatment, or for tourists who came for recreation, fun, adventure (routes for horseback riding, cycling, theme routes, one-day tourist mini-circuits, cultural and artistic events etc. ), for business, work meetings, professional (training), for scientific purposes (congresses, conferences, field research, geological, geomorphological, climatic, hydrological, forestry, botany etc.),

viii) keeping a reasonable proportion of traditional menus in the gastronomy of restaurants,

ix) keeping in the arrangement of rooms/ hotels/ pensions etc. of cultural and material elements related to the specific and symbolism of the place (images, local crafts, elements of local architecture, personalities of the place and fragments of their creations),

x) thorough training of the staff engaged in tourism activities on the tasks provided in the job description and to respect tourists and their money,

xi) the multiplication and professionalization of the services made available to tourists: banking, commercial, sanitary, cultural, utilitarian etc.

xii) the promotion in the online environment on specialized tourist sites, on televisions and radio (videos, commercials) of the tourist offer of the place by emphasizing the balneoclimatic one,

xiii) interesting and intense promotion by various materials of tourist locations: brochures, leaflets, flyers, various handicrafts etc.), or other types of promotional materials (maps, illuminated advertisements or short characterizations) of tourist locations in the key points in airports, in railway stations, on motorways, on European and national roads and also tourist information at resorts up to the level of a mere tourist attraction,

xiv) making attractive tourist packages in terms of price and flexible in terms of duration, specificity, opportunities, etc. to constantly bring to that location large flows of loyal tourists all the time.

The attention of the decision makers must be urgently focused on limiting / stopping the degradation of the balneoclimatic resources through natural processes, anthropogenic pollution with the deterioration of the environment of the balneoclimatic spas and of the localities with natural treatment factors. Natural hazards such as landslides and land erosion, floods caused the degradation or destruction of mineral water sources in Sărata Monteoru, Bălățești and Ocele Mari. Polluting economic agents destroyed the quality of the air (Govora), the lakes (Techirgiol, Amara, Lacu Sărat) and deforested lands around the resorts in Sovata, Slănic Moldova etc. It is necessary to prohibit in the area of the spas the location of objectives that evacuate noxious substances in the atmosphere, of excavations and mining works, the development of activities with a high degree of noise pollution. Balneoclimatic tourism itself can be, in the absence of adequate management, a polluting agent of its own sources. Through such measures we can relaunch of balneoclimatology and the alignment of Romanian balneoclimatic resorts to the European ones.



## 4. Conclusion

Spa medicine in Romania, integrated with physical medicine and medical recovery, through the existing natural therapeutic factors, offers natural remedies both in the prophylaxis of some diseases, but also in the treatment of many chronic diseases.

This spa eco-system characterized by diverse, offering and complementary bioclimates, by the rich quantity, the high level of quality, the variety of natural mineral-medicinal springs, sulfation, we can say that it represents a privileged space. Such useful and beneficial therapeutic elements must be used to their full potential through the integrative capitalization of all sanogenic natural factors.

There is evidence about the benefits of various non-pharmacological strategies in preventing pathologies and clinical benefits when used therapeutically, it is increasingly published and have become more solid. However, further research is needed to prove the molecular and cellular basis of the immune mechanisms that support these benefits.

The modern evaluation of health, well-being, quality of life, requires for Romania the continuation and development of the research activity in order to establish the mechanisms of action and the curative effects of the existing natural therapeutic factors in the spas. The research activity must be closely intertwined with the medical activity, the tourist one and the educational one.

## References

- Airinei Șt. 1981. *Potentialul geotermic al subsolului României* Ed. Științifică și Encicl. București
- Airinei Șt., Pricăjan A. 1970. Corelații între structura geologică adâncă și aureola mofetică din județul Covasna, cu privire la zonele de apariție a apelor minerale carbogazoase. *Bul. Soc. Științ. Geol., R. S. România, București*, vol. XII, p. 173 – 185
- Airinei Șt., Pricăjan A., Bandrabur T. 1976. Conceptual pattern concerning the study of geothermalism and thermalization process of underground waters in România. *Rev. roum. geol., geoph., geogr., serie Geoph., Acad. R. S. România, București*, vol. 20, nr. 2, p. 283-298
- Airinei Șt., Pricăjan A., Bandrabur T. 1977. Semnificația vulcanismului neogen din România în legătură cu sursele de ape termale. *Stud. cerc. geol., geofiz., geogr., seria Geol., Acad. R. S. România, București*, vol. 15, p. 93 – 101
- Aniței L. și colab. 1986. *Cura Balneoclimatică - indicații și contraindicații*. Ministerul Sănătății – Institutul de Medicină Fizică, Balneoclimatologie și Recuperare Medicală, Ed. Medicală, București
- Apostol L., Gaceu O. 2011. The climatic-touristic potential of the romanian black sea coast during summer, established according to the method of Besancenot, Mounier and de lavenne, *Carpathian journal of earth and environmental sciences* 6(1):199-206
- Bandrabur T., Craciun P., Ghenea C. 1984. Considerații privind răspândirea și condițiile hidrogeologice ale structurilor geotermale din România. *Studii și Cercetari. Fundamentarea meteorologică și hidrologică a resurselor neconvenționale*. IMH, București, p. 343-353
- Barbenias J.B. 1792. *Chemische Untersuchungen einiger merkwürdiger Gesund-und, Sauerbrunnen des Szekler Stuhes Haromszek in Siebenburgen*, 56 p., Sibiu
- Berlescu El. 1971. *Stațiunile balneare de-a lungul timpului și azi*, Ed. Medicală, București
- Berlescu El. 1998. *Enciclopedia de balneoclimatologie a României, Ediția a II-a*, Ed. All București, 258p

- Bistricean P. I., Mihăilă D., Lazurca G. L. 2017. Bioclimatic regionalization of Moldova west of the Prut river, DOI 10.1515/pesd-2017-0004, PESD, VOL. 11, no. 1, 2017, 45 – 54 pp
- Caryophili P. 1739a. De Thermis Herculanis, nuper in Dacia detectis. Dissertatio epistolaris 4. Mantuae
- Caryophili P. 1739b. De usu et praestantia thermarum Herculanae quae nuper in Dacia Trajanae detectae. Dissertatio epistolaris: altera quae an. MDCCXXVII. Kal. Aug. confecta nunc primum prodit
- Cinteză D. 2011. Cercetarea științifică a factorilor naturali terapeutici, Ed. Balneară, București
- Cosma C. et al. 1985. Radioactivitatea gazelor naturale emanate din surse de ape minerale și geotermale din Carpații Orientali, Ed. Acad. R.S.R., București
- Crank H.N.I. 1773. Analyses thermarum Herculanae Daciae Trajanae
- Episcopescu, V. 1837. Apele metalice ale României-Mari. Buzău
- Feru A. 2012. Ghidul apelor minerale naturale, SNAM SA, București
- Gross F.A. 1844. A nagyvaradi sz. Laszlo furdorol es Biharmegye asvanyos vizeiro, Magy.Orv.Term.Tud. Munk., 4, p. 85
- Hurmuzescu D. 1909. Radioactivitatea apelor minerale din România, Analele Acad. Rom., Mem. Sect. Șt., ser. 2, 31, p. 233, București
- Iețcu I., și colab., 2012. Cristale de Bucovina—pledoarie pentru climato-balneospeleoterapie la Salina Cacica. Ed. Mușatinii, Suceava
- Marco Antonio Della Fratta Montalbano 1678. Practica minerale, Dvca di Parma, Di Piacenza
- Miclăuș R., Rogozea L., Nica A. S., Ramon N., Caloianu S., Mateescu C. 2017. Reglementările legislației balneare la limita dintre secole (al XIX-lea și înainte de primul război mondial), Istoria Medicinii, JMB nr 2
- Mihăilă D. 2014. Atmosfera terestră. Elemente de favorabilitate sau nefavorabilitate pentru organismul uman și activitățile turistice, Ed. Sedcom-Libris, Iași, 234p
- Mihăilă D., Bistricean P. I. 2018). The suitability of Moldova climate for balneary - climatic tourism and outdoor activities - a study based on the Tourism Climate Index, DOI 10.2478/pesd-2018-0021, PESD, VOL. 12, no. 1, 2018, 263 – 282 pp
- Mihăilă D., Bistricean P.I., Briciu A. E. 2019. Assessment of the climate potential for tourism. Case study: the North-East Development Region of Romania, Theoretical and Applied Climatology, Volume 137, Issue 1–2, pp 601–622
- Mogoș V. 1990. Apa, agent terapeutic, Ed. Sport-Turism, București, 206p
- Munteanu C. 2013. Ape minerale terapeutice, Editura Balneară, București, 64p
- Munteanu C. 2012. Nămolul terapeutic, Ed. Balneară, 108p
- Munteanu L., Stoicescu C., Grigore L. 1978. Ghidul stațiunilor balneoclimaterice din România, Ed. Sport-Turism, București
- Munteanu L., Stoicescu C-tin, Grigore L. 1986. Ghidul stațiunilor balneoclimaterice din România, Ediția a II-a, Editura Sport-Turism, București
- Munteanu, C., Cinteză D. 2011. Cercetarea științifică a factorilor naturali terapeutici, Ed. Balneara, ISBN 978-606-92826-8-7
- Povară R. 2001. Biometeorologia și bioclimatologia, Editions du Goeland, București
- Pricăjan A. 1972. Apele minerale și termale din România, Ed. Tehnică, București
- Pricăjan A. 1985. Substanțele minerale terapeutice din România, Ed. Științifică și Enciclopedică, București
- Pricăjan A., Airinei Șt. 1979. Apele minerale de consum din România, Ed. Științifică și Enciclopedică, București
- Pricăjan A., Airinei Șt. 1981). Bogăția hidrominerală balneară din România, Ed. Științifică și Enciclopedică, București

- Radulescu A., Teodoreanu El. 2014. Notiuni de balneofizioterapie si balneolimatologie-o selectie de restituirii, Ed. Medicala, București
- Rădulescu D.C., Stănculescu M.S. 2012. Oferta turistică din România: 1948-2010, Calitatea vieții, XXIII, nr. 4, p. 299–326
- Sfîcă L., Stratulat I.S., Hrițac R. Ichim P. 2018 Favorabilitatea climatică a teritoriului României pentru activități turistice de tip balnear în sezonul estival, Balneoclimatologia în România și Republica Moldova, Ed. Academiei Române, 407p
- Silișteanu S. 2014. File de istoria medicinei. Stațiunile balneo-climatice ale Romaniei (din antichitate pana la sfarsitul secolului XIX), Ed. Pim, Iași
- Simionca Iu. (Ghe.) 2013. Speleotherapy in Romania, status and possibilities of using of some salt mines in medical purposes, "balneoclimatic" and "mining" tourism, Balneo Research Journal, Vol. 4, No.2
- Simionca Iu. (Ghe.), Enache L., Guțu E., Teodoreanu E., Aniței L. 2005. Microclimatul cu aerosol salin și regimul ionizării aerului (saline, litoralul Mării Negre) factori de sanogeneză a căilor respiratorii. Al 28-lea Congres Național de Medicină Fizică și de Recuperare. SRMFR, Poiana Brașov, 02-05 noiembrie 2005, P73, p.95
- Simionca Iu. (Ghe.) 2013. Speleotherapy developpement in Romania on the world context and persepectives for use of some salt mines and karst caves dor speleotherapeutic and balneoclimatic tourism pupose, Balneo Research Journal, 4, 133-9
- Șoabner-Turduri Al. 1900. Apele minerale și stațiunile climaterice din România, București p .70,1 87-188 și 278
- Stadler, I.M. 1776. Versuch uber die uralten roman Herkulesbader
- Stoicescu C-tin., Munteanu L. 1976. Factorii naturali de cură din principalele stațiuni balneoclimaterice din România, Ed. Sport-Turism, București
- Teleki M., Munteanu L., Stoicescu C., Teodoreanu El., Grigore El. 1984. Cura balneoclimaterică în România, Ed. Sport-Turism, București
- Teleki N., Munteanu L. 2012. România Balneo-turistică, Ed. Royal Company București
- Teleki N. 2009. Enciclopedia medicală românească de la origini până în prezent” Ed. Universitara Carol Davila, 1971-2022
- Teleki N., Muntean L. 2012. SPA turism în România balneo-turistică, Ed. Royal Company
- Teleki N., Muntean L. 2012. SPA turism în Romania balneo-turistică, Ed. Royal Company, București.
- Teodoreanu E. 2002. Bioclimatologie umană, Ed. Academiei Române, 215p
- Teodoreanu E., Dacoș-Swoboda M., Voiculescu M., Enache L. 1984. Bioclima stațiunilor balneoclimaterice din România, Ed. Sport-Turism, București
- Teodoreanu E. 2015. Bioclimatologia umană în România. Schiță istorică Studii și comunicări / DIS: Vol. 8/2015/ Academia Română. Comitetul Român de Istoria și Filosofia Științei și Tehnici, Cluj- Napoca
- Teodoreanu E. și colab. 1984. Bioclima stațiunilor balneoclimaterice din România, Ed. Sport-Turism, București
- Teodoreanu E., Gaceu O. 2013. Turismul balneo-climatic în România, Ed. Univ. din Oradea, 228p.
- Teposu E., Pușcariu V. 1932. România balneară și turistică, Cartea Romaneasca, București, 501 p
- Theohari A. 1934. Tratat de terapeutică, București
- Wertheimer M. 1853. Descrierea tuturor apelor minerale
- \*\*\**Apele minerale și nămolurile terapeutice din R.P.R./R.S.R., Ministerul Sănătății, Institutul de Balneologie și Fizioterapie, Ed. Medicală, București (Vol II–1965; Vol III–1970; Vol. IV-1973)*
- \*\*\**Studii și cercetări de balneologie și fizioterapie, Ministerul Sănătății, Institutul de Balneologie și Fizioterapie, Ed. Medicală, București (Vol V–1963; Vol VII–1965; Vol. X – 1969; Vol. XI - 1972)*