

Fountains of Health



JAKUB SOKOŁOWSKI

Polish Geological Institute
National Research Institute, Warsaw

jakub.sokolowski@pgi.gov.pl

Jakub Sokołowski studies underground water deposits, focusing on their curative properties. He also studies springs used by the mineral water industry.

Distilled water, stripped of its mineral salts, has an insipid taste. What is it that makes natural mineral water taste good, or gives it curative properties?

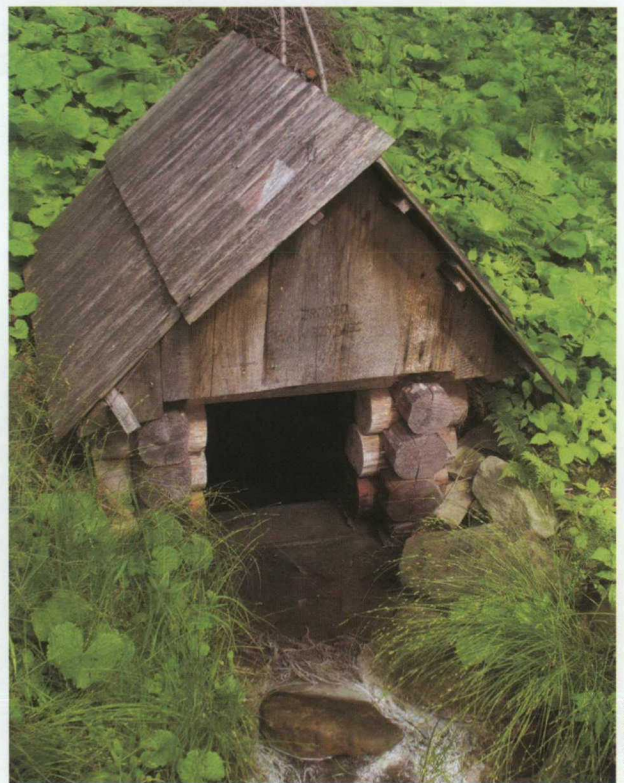
Mineral waters get their subtle flavor from dissolved salts and gases, as well as colloidal suspensions; our perception of their taste depends on the sensitivity of our sensory organs, the type and quantity of the components, and on the water temperature. Water appears to have a more powerful flavor at a slightly higher temperature; cold water containing sodium carbonate has a barely perceptible flavor, but when it is heated to approx. 30°C, it takes on a distinctive alkaline taste. A salty taste is caused by the presence of sodium chloride, bitterness results from the presence of magnesium and sodium sulfates, while alums are responsible for a sour taste. A sweet taste of water is most commonly caused by the presence of an organic substance. Tastes are frequently complex: for example, a bitter-sweet taste results from the water containing potassium chloride. Water can also taste unpleasant due to the presence of substances such as hydrogen sulfide, or pleasant as a result of a small amount of dissolved carbon dioxide. The appealing taste of water containing carbon dioxide makes it valuable for bottling. Other distinctive tastes include a metallic tang caused by iron compounds, or alkaline, resulting from the presence of sodium carbonate.

Deep within

Natural underground springs are not chemically pure; they contain ions, dissolved gases and colloids. Since water is an excellent solvent, it is easily mineralized by circulating through rocks, which in turn gives it flavor. Chemical composition of water largely depends on the lithology of the rocks it flows through, the depth of the aquifer, the temperature and pressure in the deposit,

and its persistence in the environment. Water from underground springs usually contains approx. 80 elements, including high levels of macroelements, including chlorides, bicarbonates, sulfides, sodium, calcium and magnesium. Other components occur at significantly lower levels. Water is generally discussed in terms of its mineral composition, with different levels of total dissolved solids distinguished at less than 0.1g TDS/litre, 0.1-0.5g TDS/l, 0.5-1.0g TDS/l, and over 1.0g TDS/l. The boundary mineralization value of 1.0g TDS/l, above which water is regarded as mineral, was marked at the International Congress of Balneology held in the Germany spa town of Bad Nauheim in 1911; the classification is still being used in numerous countries, including Poland.

The degree of mineralization is also significant: here the brackets are 1-3g/l, 3-10g/l, 10-35g/l (brackish water), and over 35g/l (brine). However, the divisions are arbitrary, since in reality water does not fall precisely into any category.



Wawrzyniec spring in the Babiogórski National Park. The water contains hydrogen sulfide at levels over 4mg per litre

Jakub Sokołowski



The extraction of curative waters in Poland reached close to 8 million cubic meters per year in 2010; however, a large proportion of the resources have yet to be tapped into – such as this unharnessed mineral water source in Piestrzec in the Świętokrzyskie region

Taking the waters

The curative effects of spring water on the human body have been known as far back as Ancient Greece, when people bathed at natural springs said to be blessed by the gods. In Poland, the tradition of curative spas date back as far as the 12th century, with the first mention of today's Cieplice Śląskie-Zdrój made in 1132, and descriptions of Łądek-Zdrój from 1242. As the study of natural and medical sciences developed, observations and research made it possible to define the components and characteristics of mineral waters with the most beneficial effects on the human body. In 1522, Maciej of Miechów wrote the first treatise on the benefits of spa treatments. In 1578, a book was published on the subject of mineral waters, entitled *Cieplice*, written by Wojciech Oczko, a court medic to Poland's kings, including Stefan Batory. In Medieval Europe, drinking water was a popular cure across Italy and France, while in central European countries such as Poland, Bohemia, and Germany, the preferred treatment was bathing.

Today, mineral springs are popular in balneology due to their therapeutic properties confirmed through clinical studies. Curative water must not contain any

bacterial contamination, and its chemical composition and physical parameters must not change significantly during use. Water regarded as curative has its medicinal properties confirmed by a certificate issued by a research facility authorized by the Minister of Health. Curative waters are usually mineral, and more rarely waters with a lower mineral content but containing chemical compounds with pharmacological properties. Such compounds include iron at levels of at least 10mg/l as Fe²⁺ ions, sulfur (mainly as hydrogen sulfide) at levels of at least 1mg/l, and free carbon dioxide at levels of at least 250mg/l (forming a weak carbonic acid solution). They also include radon water, characterized by radioactivity at a level of at least 74 Bq.

The main aim of spa therapies, or "taking the waters" as they are traditionally known, is treating chronic disorders including occupational diseases, physiotherapy following injury or surgery, and illness prevention. Poland has 38 curative water spas, with 24 located in southern Poland in the Carpathian and Sudetes Mountains. There are also five spas along the Baltic coast, with the remaining nine located throughout the rest of the country. Spa treatments mainly revolve around curative

Mineral waters in Poland

waters, as well as mud treatments, physiotherapy and so on. Curative water treatments are also held away from the main spa resorts, for example in Krzeszowice, Grudziądz, Rzeszów, and Uniejów. In certain resorts, curative waters are also used to make over-the-counter products used to continue the treatment at home. They include muds from Ciechocinek, iodide and bromide salts prepared at Iwonicz-Zdrój and Rabka-Zdrój, and gels and sprays from Szczawa used to treat disorders of the upper respiratory tract.

According to Poland's laws governing mining and geology, curative waters are regarded as a mineral resource; as such, their exploitation follows mining regulations. For each mineral water spring, a mining area is created, with a spa mining institute overlooking the exploitation of natural springs and drilled sources. These regions are covered by regulations striving to prevent the degradation of aquifers.

Message in a bottle

The appealing taste of mineral water has also driven the rapid development of a bottling industry. The earliest mentions of mineral water trade in Europe date back to 1416 from Cheb in Bohemia. In Poland, spa resorts were the cradle of the mineral water industry. The first mineral water bottling plant was opened in Krynica-Zdrój in 1806, with subsequent ones opening in Szczawno-Zdrój (1836), Szczawnica (1860), Ostromecko (1894), Ciechocinek (1902), and Polanica-Zdrój (1905). During the interwar period, Poland had nine bottling plants; in the early 1930s, approximately 400,000 litres of mineral water were bottled, reaching 3.5 million litres by 1938.

In 1950, the consumption of mineral water in Poland was just 0.096 litres per person; it increased in the following decades, reaching 6.1 litres per person by 1980. Another major jump in consumption occurred in the 1990s. The current levels fall at around 70 litres per person per year, placing Poland 14th in Europe. There are now approximately 200 bottling plants in Poland.

The bottling industry differentiates water types into natural mineral water, natural spring water, and table water. For bottled water, including water with mineralization levels of over 1g TDS/l, organoleptic properties - including taste - are not normalized, although they are generally defined. Water is studied in order to define the origins of certain characteristics; if they are not acceptable, they are removed prior to bottling. Organoleptic properties resulting from anthropogenic factors disqualify water from being suitable for bottling, since pure spring water has no harmful organoleptic properties. However, it is only possible to eliminate colors and smells, both of which are easily removed using widely-available procedures (such as aeration and filtration). However, the taste of water cannot be corrected, since

its intensity depends on the concentration of dissolved mineral components. The most powerful taste sensations are stimulated by water containing sodium and chloride ions (salty), sulfide, sodium and magnesium ions (bitter), sodium ions (alkaline) and bicarbonate ions (sour). The wide range of elements dissolved in spring water makes it a valuable consumer product. When asked the question "Is drinking bottled water worth it?", approximately 20% of Polish respondents who answered "yes" indicated taste as the main reason to do so (research conducted by the TNS OBOP market research group).

Bottled curative waters with therapeutic properties are bottled at just four of Poland's spa resorts: the water products Mieszko and Dąbrowka are bottled in Szczawna-Zdrój, Wielka Pieniawa is bottled in Polanica-Zdrój, Jan, Zuber, and Słotwinka are produced in Krynica-Zdrój, while the waters Franciszek, Henryk and Józef are bottled in Wysowa-Zdrój. If taken in large quantities, curative waters should be drunk following doctor's orders. Forecasts anticipate a continuing increase in the use of bottled water in Poland, at a level of approx. 5% per year. In recent years, the numbers of small, local bottling plants have been decreasing, while large plants bottling water for major labels have been gaining ground. Let's hope that we will be able to enjoy the delicious taste and medicinal properties of mineral water for a long time to come. ■

Further reading:

- Paczyński B., Sadurski A. eds., 2007. *Hydrogeologia regionalna Polski. Tom II. Wody mineralne, lecznicze i termalne oraz kopalniane* [Regional Hydrogeology of Poland, Vol. II. Mineral, curative, thermal, and mining waters]. PIG, Warsaw
- Paczyński B., Plochowski Z., 1996. *Wody mineralne i lecznicze Polski* [Poland's Mineral and Curative Waters]. PIG, Warsaw.
- Franczukowski Z., Kucharski M. eds., 2011. *Historia rozlewni wód w Polsce* [History of Water Bottling in Poland]. Press-Forum, Warsaw - Polanica-Zdrój.



A distinctive white coating of sulfuric bacterial colonies often accompanies the outflow of water with a high sulfide content, such as the visually impressive Jacek spring in Lipnica Wielka, shown here

Jakub Sobolewski