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Natural Curative Factors of the Sotvino Salt Lakes

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There are about 29 deposits of subthermal (20-35°C), thermal (35-42°C) and highly thermal (> 42°C) mineral waters in Transcarpathia, Ukraine. They differ in chemical composition (nitrate, methane-containing, carbonic-acidic, sodium chloride, siliceous, iodine- and bromide-rich), total salinity, and temperature. The most interesting of these are the Sotvino Salt Lakes. Due to the specific geographic location on the south-east of the Carpathian Mountains, this region has distinctive atmospheric and climatic features. The natural resources of the Sotvino Salt Lakes include subthermal saline water up to salt-saturated brine, curative silt mud, and presence of halophilic bacteria. The karstic salt lakes were formed where the Sotvino rock salt massive emerged to the surface. The largest is Kunigunda Lake, with a total area of about 800-1000 m² and a depth of up to 8 m. The total salt content of the brine changes with the depth of the lake and also depends on the season; maximal levels reach 247-270 g/l. The water contains bromides and sodium chloride, and belongs to the type of Ust'-Kachka waters. The main chemical components of the water are given in Table 1 and its properties are described by Kurlov's formula as follows:

$$\text{Br}_{0.540} \text{M}_{247} \text{Cl}_{99} \text{pH}_{6.4} \text{T}_{22}^{\circ\text{C}},$$

$$(\text{Na} + \text{K})_{99} \text{Ca}_1$$

where M ("Mineralization") represents the total salt concentration.

In addition to these chemical properties, the lakes have unique photobiological characteristics. The solar spectrum of ultraviolet light reaching the lake is rather restricted because of a continuous haze that develops over the surface of water. The silt mud of the lake is slightly

alkaline, finely dispersed, with a clay skeleton and a pronounced colloidal complex, highly-saline sodium-chloride composition of the liquid phase. The organic material content is low. The mud may be diluted with brine for medical use. Halophilic bacteria live in the Sotvino Salt Lakes and these may contribute to the curative properties of the salt-saturated brine. They contribute a specific photosensitization effect to the brine solution. After removing the mud or the brine, these bacteria remain on the skin. Subsequent exposure to UV radiation causes a specific photochemical effect, which improves the skin barrier function and reduces inflammation of the skin. These three major factors, the lake, the sun and the halophilic microorganisms, serve as the basis for the treatment of different illnesses at the lakes, particularly skin diseases. Thus, the Sotvino salt lakes have a great potential as health resorts with possibilities for balneotherapy, phototherapy, climatotherapy (temperature, humidity, sunlight), heliotherapy, and thalassotherapy, providing treatment of specific health problems and new medication-free approaches in the treatment of different diseases.

Table 1—Chemical composition of mineral water of Kunigunda Lake.

Cations	g/l
Na ⁺ + K ⁺	95.60
Mg ²⁺	0.12
Ca ²⁺	1.05
Anions	g/l
Cl ⁻	147.37
SO ₄ ²⁻	2.01
Br ⁻	0.54
HCO ₃ ⁻	0.31