The Precambrian metamorphic basement of the Southern Carpathians, intruded by granite bodies, is overlain by Mesozoic sedimentary formations, consisting of diverse Upper Jurassic-Lower Cretaceous limestone facies, covered by Upper Cretaceous detrital and volcano-sedimentary deposits (Fig. 1). The main tectonic feature of the region is the Gâdean Nappe, represented by large outliers (Godeanu and Mehedinți). Ophiolite suites largely outcrop within the para-autochthonous nappe of Severin. The Danubian Autochthonous comprises various limestones facies and features a duplex structure, resulting from multiple overthrusts, which also affected the granite basement. Transverso-antitransverse regional movements, initiated after the Upper Cretaceous tectogenesis and very active during the Miocene, led to the formation of the Cerna Graben, a complex structure, which locally presents aspects of half-graben, paired graben or pull-apart basins. Along the eastern fault (the lateral fault), the Mehedinți Mountains were isostatically uplifted with more than 1000 m; the resulting, positive and negative, “flaw” structures drive the karst cold water flow on the Cerna Valley eastern slope.

**Figure 1.** Location of the cold and thermo-mineral karst systems from the Cerna Valley Basin. (A) Main elements on the geological map of the Gâdean Nappe. (B) Key to the main elements of the Gâdean Nappe. (C) Key to the main elements of the Gâdean Nappe. (D) Key to the main elements of the Gâdean Nappe. (E) Key to the main elements of the Gâdean Nappe. (F) Key to the main elements of the Gâdean Nappe. (G) Key to the main elements of the Gâdean Nappe. (H) Key to the main elements of the Gâdean Nappe. (I) Key to the main elements of the Gâdean Nappe. (J) Key to the main elements of the Gâdean Nappe. (K) Key to the main elements of the Gâdean Nappe. (L) Key to the main elements of the Gâdean Nappe. (M) Key to the main elements of the Gâdean Nappe. (N) Key to the main elements of the Gâdean Nappe. (O) Key to the main elements of the Gâdean Nappe. (P) Key to the main elements of the Gâdean Nappe. (Q) Key to the main elements of the Gâdean Nappe. (R) Key to the main elements of the Gâdean Nappe. (S) Key to the main elements of the Gâdean Nappe. (T) Key to the main elements of the Gâdean Nappe. (U) Key to the main elements of the Gâdean Nappe. (V) Key to the main elements of the Gâdean Nappe. (W) Key to the main elements of the Gâdean Nappe. (X) Key to the main elements of the Gâdean Nappe. (Y) Key to the main elements of the Gâdean Nappe. (Z) Key to the main elements of the Gâdean Nappe.

The chemical composition of the thermo-mineral water varies across the region. The sources located in the north (Crucuș Ghizilești Well, Ștefan Hot Springs, Scorțoiu Well, the springs grotto) and II) are less mineralized than the sources located in the center of the Biblișteanu Spa (Apolo, Hebe) and in the south (Fig. 5). Thus, the total dissolved solids (TDS) rise from the north (ca. 300 mg/l) to the south (up to about 8000 mg/l), along with the dissolved H₂S content (0-60 mg/l). Except for the Crucuș Ghizilești Well, the water can be assigned to the chloro-sodium hydrochemical facies (Fig. 6). The Total/Quant assessment of the thermal water sources from the Biblișteanu Spa points to the presence of many metals and metalloids, including rare earth elements (REE) and actinides in detectable levels (Fig. 7).

**Figure 2.** Karst hydrogeological and morphological map of the Vâlcele and Juli de Verde upper reaches. Four binary karst systems (non-karst/Jurassic-Cretaceous limestones) discharge important water resources, at flow rates of up to 0.4-10.5 l/s. Cerna Spring (Fig. 2), Piporari Springs (Fig. 3), Seven Cold Springs and Domogăd Spring. The groundwater (calcium-bicarbonate), with a mineralization of less than 300 mg/l, flows with average theoretical velocities of 8-96 m/h. The recession curves show a low development degree of the drowned karst (low K coefficient), a quick discharge (high q coefficient) and an important contribution of the surficial runoff to the systems recharge (high i coefficient). On the western, crustal, strike-slip fault, along a distance of 25 km, there are 19 thermo-mineral springs, with an average total flow rate of 89 l/s, joined in 6 groups, depending on their physical and chemical properties. On the same area, 10 wells were drilled, the deepest reaching a depth of 1200 m. Within the Cerna Graben aquifer, the ascending thermo-mineral water is mixed with descending, karst cold water (Fig. 4).

**Figure 3.** Geotectonic and hydrogeological map of the Piporari Springs-Apold Fluviatile sector of the Cerna Valley. **A**. Main hydrogeological systems. **B**. Lithological map deconstructed. **C**. Main hydrogeological systems. **D**. Main hydrogeological systems. **E**. Main hydrogeological systems. **F**. Main hydrogeological systems. **G**. Main hydrogeological systems. **H**. Main hydrogeological systems. **I**. Main hydrogeological systems. **J**. Main hydrogeological systems. **K**. Main hydrogeological systems. **L**. Main hydrogeological systems. **M**. Main hydrogeological systems. **N**. Main hydrogeological systems. **O**. Main hydrogeological systems. **P**. Main hydrogeological systems. **Q**. Main hydrogeological systems. **R**. Main hydrogeological systems. **S**. Main hydrogeological systems. **T**. Main hydrogeological systems. **U**. Main hydrogeological systems. **V**. Main hydrogeological systems. **W**. Main hydrogeological systems. **X**. Main hydrogeological systems. **Y**. Main hydrogeological systems. **Z**. Main hydrogeological systems.

**Figure 4.** A conceptual model of the functioning of the thermo-mineral spring complex from the Biblișteanu Spa.

**Figure 5.** Sketch map showing the location of the thermo-mineral springs from the Biblișteanu Spa.

**Figure 6.** A Piper diagram displaying the hydrochemical facies of the limestones of the Moldavian massif, Bistrița-Băiceni Formation.

**Figure 7.** A partial image of the chemical composition of the thermal water sources from the Biblișteanu Spa (Piporari) method, where we notice a mixture with a high temperature (35°C-60°C) water.