

Geochemical Characterization of Geothermal Waters in Albania, Preliminary Results

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Abstract : Albanian geological terrains represent an important node of the Alpine - Mediterranean mountain belt and are divided into several predominantly NNW - SSE striking geotectonic units, which, based on the presence or lack of Cretaceous transgression and magmatic rocks, belong to Internal or External Albanides. The internal (Korabi, Mirdita and Gashi) units are characterized by the Lower Cretaceous discordance and the presence of abundant magmatic rocks whereas in the external (Alps, Krasta-Cukali, Kruja, Ionian, Sazani and Peri Adriatic Depression) units an almost continuous sedimentation from Triassic to Paleogene is evidenced. The internal and external units show relevant differences in both geothermal and heat flow density values. The gradient values vary from 15-21.3 to 36 mK/m, while the heat flow density ranges from 42 to 60 mW/m², in the external (Preadriatic Depression) and internal (ophiolitic belt) units, respectively. The geothermal fluids, which are found in natural springs and deep oil wells of Albania, are located in four thermo-mineral provinces: a) Peshkopi (Korabi) province; b) Kruja province; c) Preadriatic basin province, and d) South Ionian province. Thirteen geothermal waters were sampled from 11 natural springs and 2 deep wells, of which 6 springs and 2 wells from Kruja, 1 spring from Peshkopia, 2 springs from Preadriatic basin and 2 springs South Ionian province. Temperature, pH and Electrical Conductivity were measured in situ, while in laboratory were analyzed by ICP method major anions and cations and several trace elements (B, Li, Sr, Rb, I, Br, etc.). The measured values of temperature, pH and electrical conductivity range within 17-63°C, 6.26-7.92 and 724- 26856µS/cm intervals, respectively. The chemical type of the Albania thermal waters is variable. In the Kruja province prevail the Cl-SO₄-NaCa and Cl-Na-Ca water types; while SO₄-Ca, HCO₃-Ca and Cl-HCO₃-Na-Ca, and Cl-Na are found in the provinces of Peshkopi, Ionian and Preadriatic basin, respectively. In the Cl-SO₄-HCO₃ triangular diagram most of the geothermal waters are close to the chloride corner that belong to "mature waters", typical of geothermal deep and hot fluids. Only samples from the Ionian province are located within the region of high bicarbonate concentration and they can be classified as peripheral waters that may have mixed with cold groundwater. In the Na-Ca-Mg and Na-K-Mg triangular diagram the majority of waters fall in the corner of sodium, suggesting that their cation ratios are controlled by mineral-solution equilibrium. There is a linear relationship between Cl and B which indicates the mixing of geothermal water with cold water, where the low-chlorine thermal waters from Ionian basin and Preadriatic depression provinces are distinguished by high-chlorine thermal waters from Kruja province. The Cl/Br molar ration of the thermal waters from Kruja province ranges from 1000 to 2660 and separates them from the thermal waters of Ionian basin and Preadriatic depression provinces having Cl/Br molar ratio lower than 650. The apparent increase of Cl/Br molar ratio that correlates with the increasing of the chloride, is probably related with dissolution of the Halite.

Keywords : geothermal fluids, geotectonic units, natural springs, deep wells, mature waters, peripheral waters

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