HYDROGEOTHERMAL CONDITIONS OF THE ŽIARSKA KOTLINA DEPRESSION

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Abstract: The paper presents some important results of hydrogeothermal works from regional hydrogeothermal evaluation of the Žiarska kotlina depression, which were carried out by the Geological Survey of the Slovak Republic from 1998 till 2000.

Key words: geothermal water, hydrogeothermal structure, temperature, thermal flow density

Hydrogeothermal results

The Žiarska kotlina depression is a compound of the hydrogeothermal region of the Central Slovakia Neovolcanic Field – its NW part (Franko, Remšík and Fendek Eds. 1995). It represents an Inner Carpathians depression filled up mainly by products of andesite and rhyolite volcanic activity (Badenian-Sarmatian) and Pannonian to Quaternary deposits with the maximum Pre-Tertiary basement depth (Žiar n/H. – Lovča) even up to 3500 m below the sea level. The Pre-Tertiary basement is in the SE and NW part of the territory made of Hronicum with Triassic limestones and dolomites, while in the middle part of the territory it is made of shales and sandstones of the Melaphyre Formation of the Ipoltice Group. Deeper structures below Hronicum are made of Mesozoic rocks (Triassic-Cretaceous) belonging to the Veľký Bok Formation, or the Krížna nappe.

From the viewpoint of geothermics the Žiarska kotlina depression is characterised as geothermically highly active region. Temperatures around a depth of 1000 m reach about 55-60° C, thermal flow temperature ranges from 80 to 100 mW/m^2 with a characteristic value of 95 mW/m^2. The highest temperatures are located into central parts of the depression, in a

partial depression between Lovča and Žiar n/H, where the temperature at a depth of 3400 to 3500 reaches 130° C.

Geothermal waters from close area are known from 11 springs and two boreholes (ST-1, 2) in Sklenné Teplice (yield 0,1-22,3l/s, water temperature 24-53°C, Ca-Mg-SO_4 type with a mineralization of 2,4-2,6g/l), from boreholes ST-4 and ST-5 in their vicinity (yields 16,13 l/s and 4,4 l/s, water temperatures 57 °C and 46,3 °C, the same chemistry as by waters in Sklenné Teplice), and in Vyhne – the Vyhnianka spring in the gallery and the H-1 borehole (yields 5,3 and 5,0 l/s, water temperatures 33 and 36 °C, Ca-HCO_3 type with a mineralization around 1 g/l).

Geothermal waters of the Žiarska kotlina depression are situated within Pre-Tertiary basement linked to the environment of Triassic dolomites and limestones of the Hronicum unit and Veľký Bok Formation, or the Krížna nappe, respectively. The distribution of hydrogeothermal structures is either closely linked to the distribution of Triassic dolomites and limestones of the above tectonic units, or to the distribution of basement morphostructures, namely a sunken slope of the Hodruša_Štiavnica horst and the Žiar depression (Remšík et al., 2000).

Triassic dolomites and limestones of the Hronicum unit represent the uppermost parts of hydrothermal structures (the Upper Sklenné Teplice and the Upper Žiar structures), in which geothermal waters with a water reservoir temperature ranging from 20 to 150 °C at depths from 200-300 m to 4100 m are assumed.

Triassic limestones and dolomites of the Veľký Bok Formation, or the Krížna nappe, respectively, make up the lower hydrogeothermal structures (the Lower Sklenné Teplice and the Lower Žiar structures), in which geothermal waters with a water reservoir temperature ranging from 30-160 °C at depths from 600 m (-200 m) even up to 5000 m approximately (-4700 m), are expected.

The chemistry of geothermal waters of the Žiarska kotlina depression represents Ca-Mg-SO_4, or. Ca-Mg-SO_4-HCO_3 types with a mineralization around 3-5 g/l and CO_2, or eventually. H_2S content.

In the Žiarska kotlina depression (excluding the Upper and the Lower Sklenné Teplice structures) geothermal waters with a reservoir temperature 100-120 °C (eventually higher) can be verified by boreholes 2700-3500 m deep drilled up to Triassic dolomites and limestones of the Hronicum unit. The geothermal waters of the Triassic limestones and

dolomites of the Veľký Bok Formation, or the Krížna nappe could be reached by boreholes deep from 3200 – 4300 m, expected water reservoir temperature should be 110-145 °C (even higher).

At exploration for geothermal waters, we should take into consideration a geological risk, which flows out from a complex geological setting of the territory (reduction of strata successions, absence of geothermal waters collectors, presence of subjacent intrusive bodies in the lower volcanic structure or in the Pre-Tertiary basement, and others) and mainly due to a lack of direct and indirect geological and hydrogeological data from the inner territory of the depression.

References

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