An Artesian aquifer in Rakovica near Sarajevo area

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Abstract: The aquifer is composed of Middle Triassic limestone formations, developed at the base of impermeable Upper Cretaceous Flysch deposit substratum 140 m deep, as confirmed by subsurface drilling. A testhole (ŠG-1) was drilled to 190 m. On depth of 136.50 m where a confined aquifer under artesian pressure (1 bar) and a flow of 4.0 l/s was encontered. Groundwater is of excellent quality, as deduced on the basis of physical, chemical and microbiological determinations.

Key words: Hydrogeological investigations, Artesian aquifer, Limestone Triassic formations, Upper Cretaceous Flysch deposits.

Introduction

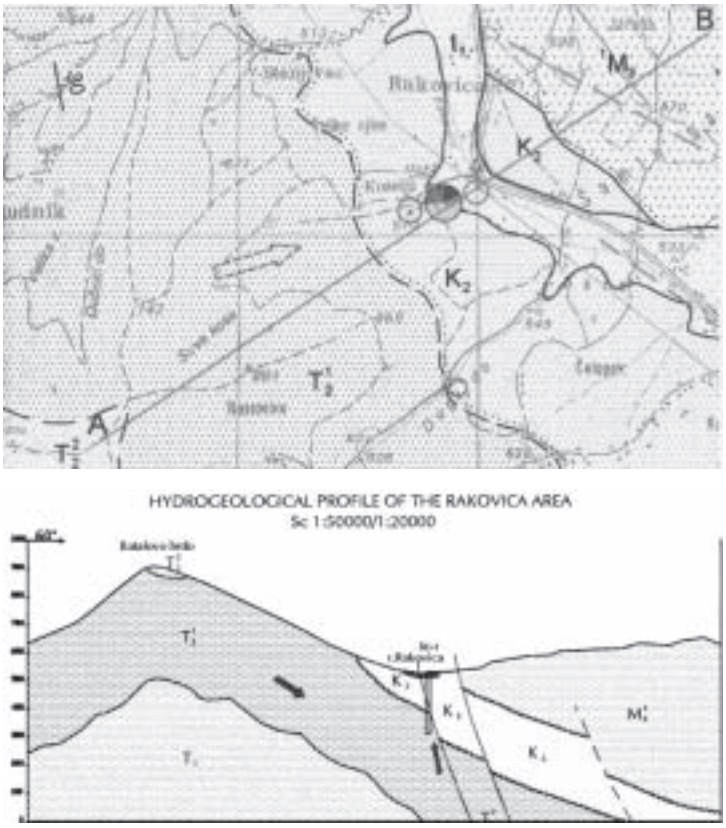
While the existence of artesian aquifers in limestone formations of Triassic age could be expected below the overlying Neogene basin in the Ilidža area, there was no proof whether such aquifers could exist below the overlying Upper Cretaceous Flysch deposits in the Rakovica area.

Objective and Scope of Work

The principal objective of the hydrogeological investigation was to determine whether an artesian aquifer exists in the Triassic limestones below the overlying impermeable Upper Cretaceous sediments.
The scope of work consisted of defining an appropriate geological-structural research framework and optimum hydrogeological and technical conditions for the groundwater withdrawal and water quality characterization. The investigation area is shown on Fig. 1.

Figure 1. Layout of investigation area, Sc 1: 500.000

RESULTS AND DISCUSSION



Legend:
M_3^1- clays, marls, claystones and sandstones (practically water impermeable rock);
K_2 - claystones, sandstones, marly-limestones (water impermeable to slightly permeable rock);
T_2^2 - limestones, sandstones, claystons, hornstons and tuff (water impermeable to slightly permeable rock);
T_2^1- limestones and dolomites (water permeable rock)

Figure 2. Hydrogeological map and profile of investigation area

Hydrogeological Characteristics

Rock formations and hydrogeology of the area were determined by the geological structure and the structural tectonic setting. Rock formations are attributed by different level of water permeability and different hydrogeological functions. According to water permeability, rock formations in exploring area can be sorted in three categories: a) Practically water impermeable rock formations (Upper Miocene sediments), b) Water impermeable to barely permeable rock formations (Upper Cretaceous flysch) and c) Water permeable rock formations (Middle Triassic limestones and dolomites) - see Fig. 2.

Testhole Drilling

The testhole was drilled to a depth of 190 m, with a final diameter of 86 mm and coring over the whole length (Fig. 3).

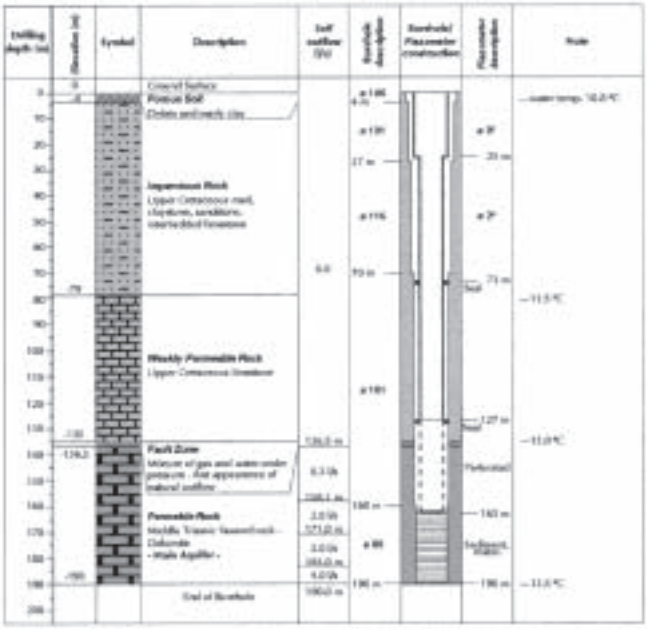


Figure 3. Geotechnical profile of the testhole ŠG-1

Hydro-chemical Testing

During the testhole drilling water temperature, electrical conductivity, water mineralization and dissolved gases were measured continuously. The water temperature rose from 7 °C at the surface to 12.8 °C at 136 m depth. This increase is indicative of a thermal gradient, G, which would have a value of 0,045 °C m^{-1}, consistent with the value of the geothermal gradient of the hydrothermal systems the "Busovača Fault" and the Sarajevo-Zenica basin. The groundwater in the artesian aquifer had a constant temperature of 12.8 °C. Strong gas exhalations were observed at the depth of 136.5 m. Field chemical analyses revealed that the gas was not CO_2 dissolved in the groundwater, but the nascent CO_2 emitted from rock fractures and caverns. Physical and chemical analyses of the groundwater from the artesian aquifer showed that the water is of a hydrocarbonate-calcium-magnesium type, with total dissolved solids of 450 mg/l, is of a pleasant taste, and has no colour and turbidity. These water quality parameters are in complete compliance with drinking water regulations. Microbiological analyses of groundwater samples further support this conclusion.

CONCLUSIONS

This paper describes hydrogeological investigations that led to the discovery of a major confined aquifer below the impermeable Upper Cretaceous rock formations near Sarajevo. The study area was located in the village of Rakovica in the Ilidža Township, approximately 2.5 km northwest from the Mostar the Mostar crossroads in Blažuj at the location of Šamin Gaj.

The testhole passed the slightly impermeable formations of the Upper Cretaceous at a depth of 136.5 and entered into a confined aquifer composed of middle Triassic limestones, dolomites and dolomite limestones. An artesian flow occurred at the top of the test hole with a pressure of 1.0 bar and a flow rate of 4 l/s. Hydro-chemical investigations showed that the groundwater was of good quality and in compliance with drinking water regulations.

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