GEOLOGICAL AND HYDROGEOLOGICAL CONSIDERATIONS ON THE PHREATIC AQUIFER OF THE TARNAVA MICA RIVER FLOOD PLAIN AND TERRACES

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ABSTRACT. – Geological and hydrogeological considerations on the phreatic aquifer of the Târnava Mică river flood plain and terraces. The project „*Enhancement of Water Resources Management in Mureş River Basin*" target is the development of an instruments set and of a methodology on a sustainable management of surface and groundwater resources from the Mureş river basin. Thus, there has been selected as a pilot area, the Târnava Mică river basin (as sub-basin of the Mureş river basin), for which it was developed a mathematical hydrological integrated model.The phreatic aquifer located in the flood plain and terraces alluvial deposits of the Târnava Mică river basin represents a source for the localities water supplies (fountains) and for the economic agents (wells) from the area. Because of this reason, the groundwater from this aquifer is an important element in the balance of water, and also for the integrated management of the water resources from the study area.The paper presents some geological features (lithology, facies variations) and hydrogeological (hydrostatic level variation, dynamics, etc.) of the phreatic aquifer, as elements of a better knowledge of the phreatic aquifer from the Tarnava Mica flood plain and terraces.

Keywords: lithology, facies variations, hydrostatic level variation.

1. INTRODUCTION

The Târnava Mică river basin (as sub-basin of the Mureş river) was selected as pilot area within the „*Enhancement of Water Resources Management in Mureş River Basin*" project, for developing a mathematical hydrological integrated model. Within the integrated management of water resources from the study area, the phreatic aquifer located in the flood plain and terraces deposits of the Târnava Mică river (groundwater body ROMU 04) is an important element of the water balance, because of its important source for the localities water supplies (fountains) and for the economic agents (wells) from the area.

2. GEOMORPHOLOGICAL AND GEOLOGICAL CONSIDERATIONS

From geomorphological point of view the Târnava Mică river basin belongs to the Târnăvenilor Hills, as a sub-unit of the Târnavelor Plateau, except the eastern area which is part of the Transylvanian Plateau, and also the eastern

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part which overlaps the Târnavele Subcarphatians and the western peaks of the Gurghiului Mountains [2].

From geological point of view, in the most part of the Târnava Mică river basin there are developing Sarmatian deposits (marls, clays, sands, and tuffs) and Pannonian (marls, clays, sands, subordonated sandtones and tuffs) belonging to the Neogene filling of the Transylvanian Depression. To this, there are added Pannonian sedimentary volcanic deposits (pyroclastic breccias, conglomerates, microconglomerates, tuffs) which occupy a small area in the eastern part of the basin and Quaternary alluvial deposits, developed along watercourse [1].

3. THE CHARACTERIZATION OF THE PHREATIC AQUIFER FROM THE TARNAVA MICA FLOOD PLAIN AND TERRACES

The flood plain and terrace alluvial deposits in which the phreatic aquifer is located, forms an area quite narrow of each side of the Târnava Mică, in the Sovata and Pradid localities area until its confluence with Târnava Mare (Blaj).

Information regarding the lithological and hydrogeological characteristics of this aquifer are provided by the wells of the 9 first order hydrogeological stations from the National Hydrogeological Network for phreatic aquifer layers (from upstream to downstream) Chibed, Sângeorgiu de Pădure, Bălăuşeri, Bahnea, Găneşti, Seuca, Adămuş, Jidvei and Blaj Vest.(figure1).

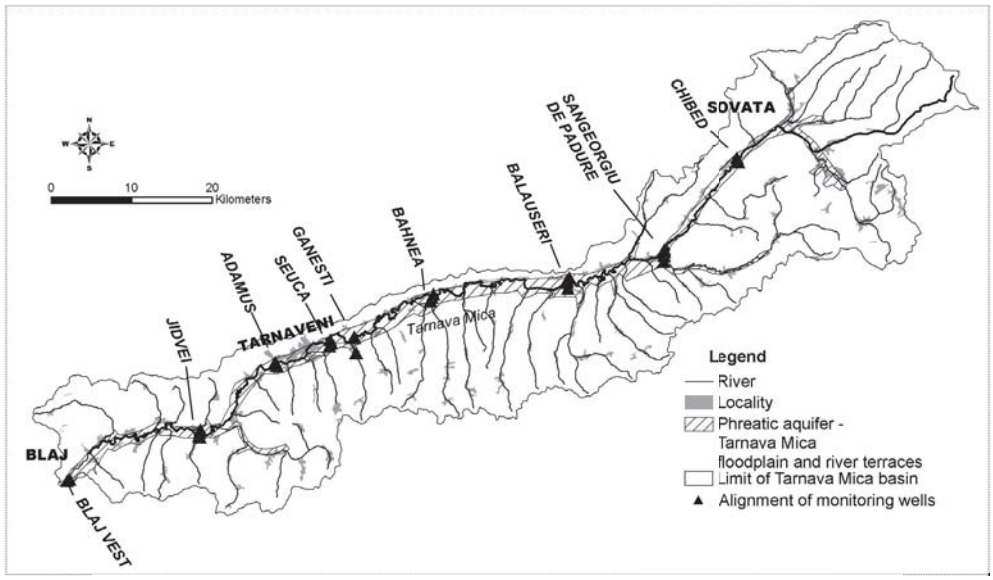

Fig. 1. ***The Târnava Mică river basin with the location of the phreatic aquifer and the first order hydrogeological stations***

The aquifer horizon has thicknesses of 2 – 10 m, having an impermeable bed of Sarmatian and Pannonian marls and clays. The biggest thicknesses, around 10 m, are located in the Bălăuşeri – Bahnea – Seuca area, in the central areas of the flood plains or in the Târnava Mică left bank flood plain. The thicknesses are decreasing from 1-4 m in the marginal areas.

From the developed hydrogeological sections (figure 2) the terrace deposits have a discontinous development on each side of the Târnava Mică, being intercepted only be the wells of the Sângeorgiu de Pădure, Bălăuşeri and Blaj Vest hydrogeological stations.

From lithological point of view, the flood plain alluvial deposits are quite homogeneous in the inferior part of the sequence, formed by sands and gravels and sands with gravels and boulders (Găneşti, Adămuş, Jidvei). Sometimes these contain sands, as thin intercalations (Bahnea), or as a lateral variation of facies (Jidvei). The biggest variation of facies is at Seuca, where the sands with gravels and boulders have a lateral passing to sands with gravels (right bank) or at sands (left bank) at which it is added a marls intercalation with lens-shaped aspect (right bank).

In the case of the flood plain alluvial deposits there is a decreasing of the deposits granulometry toward the upper part of the sequence through the appereance of the sands, and rarely of the sands with gravels. A characteristic of these deposits is represented by the presence on the upper side of some horizons with lens-shaped development made by clays, sandy clays, silty clays, sandy argillaceous silts, clays with calcareous concretions, which often have a lateral passing to sands, sandy silts (Adamus), clay slits, sandy argillaceous slits (Seuca).

From lithological point of view, the flood plain alluvial deposits are mainly made from sands with gravels and boulders, sands with gravels, sandy argillaceous silts, clays with calcareous concretions, sometimes sandy silts (Sângeorgiu de Pădure).

The researches conducted previously showed that, on certain sectors the alluvial deposits are clogged in a variable proportion by a fine clay material [3].

From the hydrogeological parameters point of view, the phreatic aquifer is characterized by average values, the hydraulic conductivity having values of 40 – 50 m/day, while the transmissivity doesn't surpass 400 – 500 m^2/day.

The aquifer gets its supplies from precipitations, and the general flow direction of the phreatic groundwater is from north-est to south-west. Regarding the river–aquifer relation, generally the flow direction is from the aquifer toward the river, but on certain sectors, according to the level on the river, it supplies the phreatic aquifer (Adămuş). The conducted researches have shown that the connection between the aquifer and river is weaker in the Sângeorgiu de Pădure area [3].

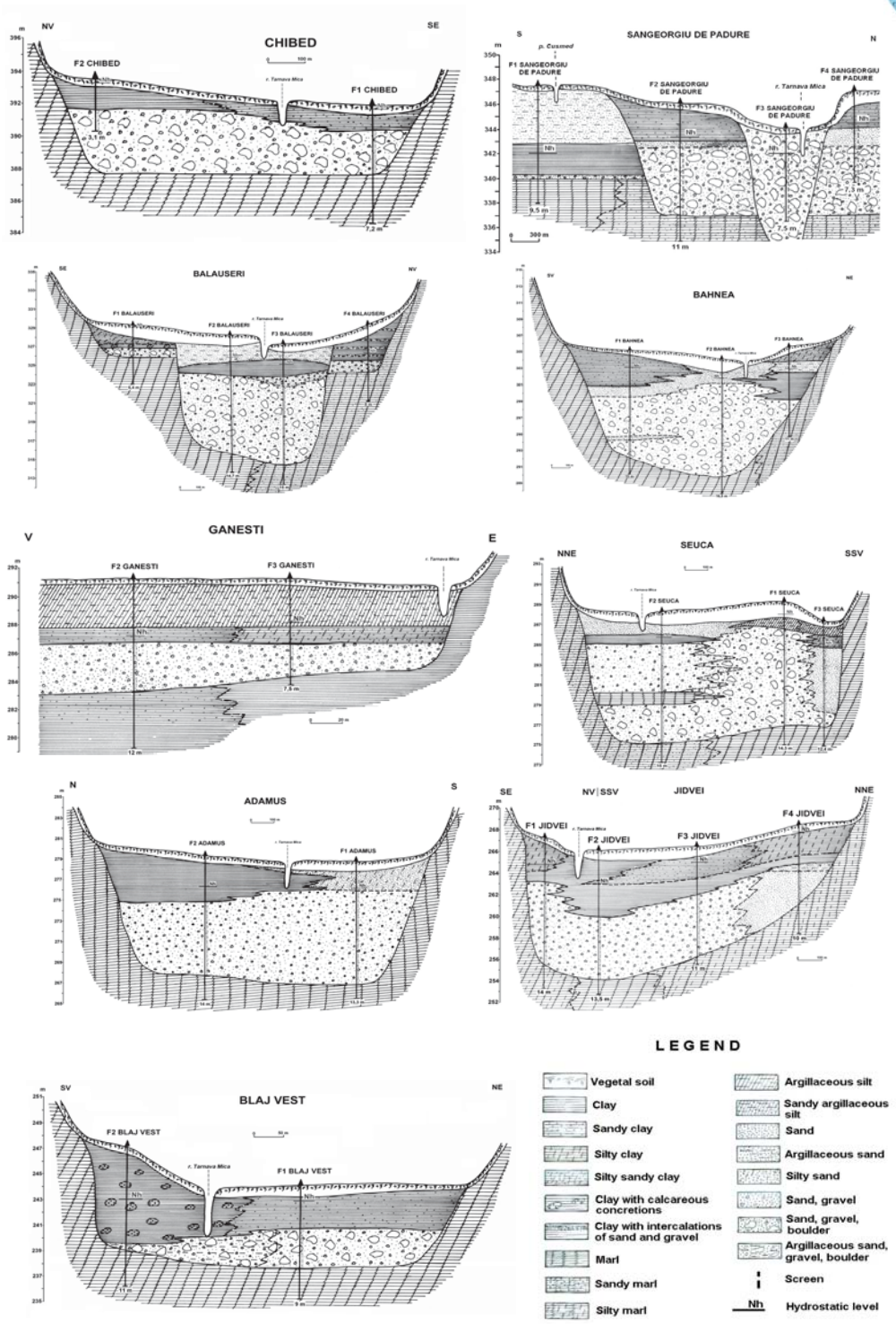

Fig. 2. ***Hydrogeological cross sections***

Generally the hydrostatic level of the phreatic aquifer is free, but in the areas of the cover where there are developing clays and silts deposits, the level is slightly increasing.

The systematic measurements program of the phreatic groundwaters levels in the wells of the hydrogeological stations from this area started in the year 1972. Currently there are level series of more than 30 years to 22 observation wells [3].

From the analysis of the levels recorded in the 28 wells of the hydrogeological network, results that the average multi-annual depths for all the observation period were, at most wells, in the interval 3,00 – 4,00 m.

The average multi-annual depths of the level which are lower than 1.00 m have been recorded at the wells Chibed F2 (0.59 m), Bălăuşeri F1 (0.74 m) and Gănești F4 (0.55 m) drilling.

The maximum depth of the average multi-annual hydrostatic level was recorded to the Blaj Vest F2 well (5.51 m).

In Figure 3 is presented the frequency of the depth of the average multi-annual levels in the Târnava Mică river basin, for the period 1972 – 2008.

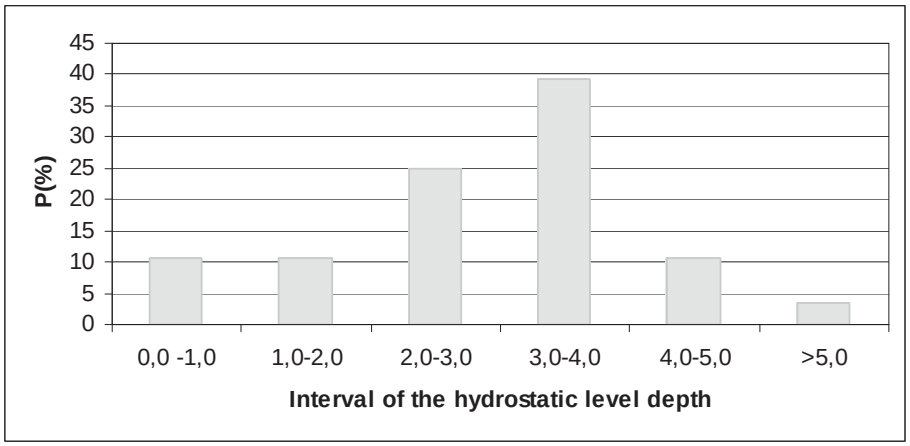

Fig. 3. ***The frequency of the groundwater levels average multi-annual depth in the Tarnava Mica river basin***

The variation graphics of the annual characteristic levels show a decrease tendency of the phreatic groundwaters, more obviously in the northern part of the area, the Chibed F1 well (Figure 4), and more shallow in the southern and central part of the area Jidvei F1 (Figure 5) and Bahnea F1 (Figure 6) wells.

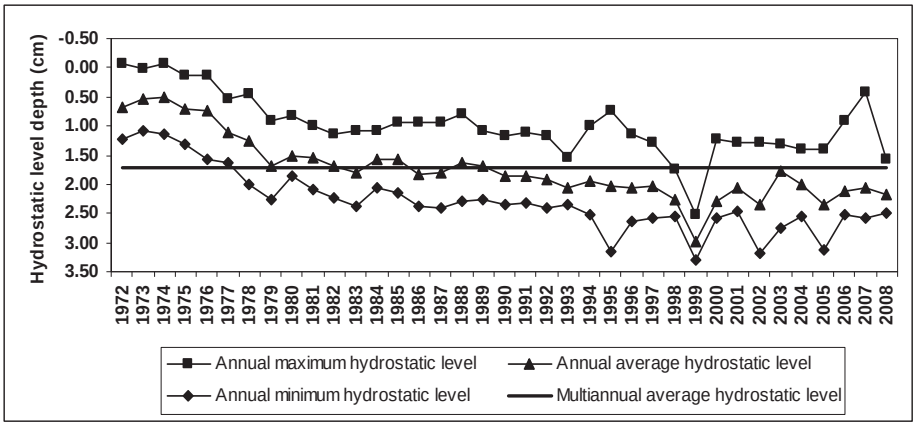

Fig. 4. ***The annual maximum, annual average, annual mimimum and multiannual average hydrostatic level at Chibed F1 well***

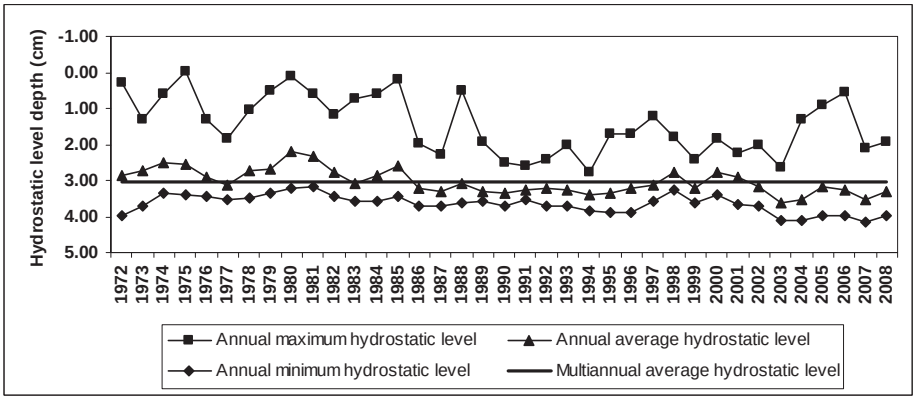

Fig. 5. ***The annual maximum, annual average, annual mimimum and multiannual average hydrostatic level at Jidvei F1 well***

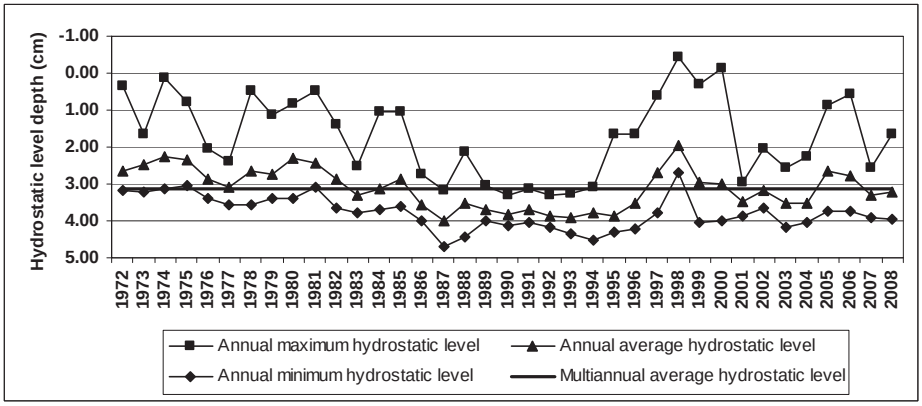

Fig. 6. ***The annual maximum, annual average, annual mimimum and multiannual average hydrostatic level at Bahnea F1 well***

4. CONCLUSIONS

The Târnava Mică river basin was selected as pilot area within the *„Enhancement of Water Resources Management in Mureş River Basin*"project, in order to develope an integrated mathematical hydrological model.

The phreatic aquifer located in the flood plain and terraces deposits of the Târnava Mică river, has an important role in the water balance, also being an important water supply source for the localities and the economic objectives in the area.

The hydrogeological sections accomplished through the wells of the first order hydrogeological stations belonging to the national hydrogeological Network for phreatic aquifer layers, have shown that, from lithological point of view, the alluvial deposits which quarter the phreatic aquifer from the Târnava Mică flood plain and terraces, are generally made from sands with gravels and boulders, sands with gravels, sands, clays and slits. It is noticed that the deposits granulometry decreases from the basis toward the upper part of the lithological sequence, and also the frequent presence at the upper part of some fine clayey silt deposits. This aspect leads to an ascending hydrostatic level in some areas.

The variation graphics of the annual characteristic levels show a decreasing tendency of the phreatic groundwaters, more obvious in the northen part of the area, the Chibed F1 well and more shallow in the southern and central part of the area, the Jidvei F1 and Bahnea F1 wells.

The knowledge of the lithological development and of the groundwaters regime, where at the basis of the conceptual model on groundwater flow in the phreatic aquifer and at its integration in the mathematical hidrological model developed for the study area.

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