UNIVERSITY ”ALEXANDRU IOAN CUZA” IAȘI

FACULTY OF GEOGRAPHY AND GEOLOGY

DOCTORAL SCHOOL OF CHEMISTRY AND LIFE SCIENCES AND EARTH

Thesis title:

OUTLINING GROUNDWATER PROTECTION ZONES FROM FARAOANI FRONTAGE, BACĂU COUNTY

THESIS SUMMARY

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Summary

Taking into account the very serious effects of pollution affecting the water sources for both surface and underground, it was intended to improve water quality by several means, one of them being to delimit the aquifers protection areas around the mesh structure to be used for drinking.

Methodology for sizing of sanitary protection zones currently used in Romanian legislation uses a series of mathematical formulas that require the usage of a large number of experimental data - tasks standpipes, filter coefficients, transmissivity, storage coefficient, flow exploited spatial variation-temporal physico-chemical and microbiological water relations and surface waters adjacent aquifers - determined by the parameters measured in the experimental pumping.

In the context presented, we chose to study water frontage to Faraoani hydro-system serving the village.

For each frame drilling frontage there were analyzed well logging and borehole pumping data from experimental.

Based on these data pump strokes there were developed main objectives of the thesis:

- Delineation of aquifers tapped on petroleum well logging lithology correlated with results from the drilling process;
- Determining the type of aquifer flow (pressure or free level);
- Determination of groundwater flow direction in the frontage;
- Classification of aquifers studied in the groundwater bodies of Romania;
- Calculation of hydrogeological parameters that describe the flow of water through each type of aquifer (transmissivity, coefficient of filtrate factor storage);
- Processing by mathematical statistical parameters determined in order to obtain average values;
- Use of average values in sizing of sanitary protection zones with strict diet and diet restriction.

In performing the research stages of aquifers in front of Faraoani the following tests were used:

- Direct observation method – by which positioning of piezometric level was compared to roof-permeable porous layer which is open through the filter;
- Graphical method - which was followed according to the bump flow variation in the gear pump.

For calculation of hydrogeological parameters both analytical methods for hydraulic calculation were used and numerical integration methods which were determined based on the volume of water drained freely for groundwater level.

In the case of the numerical integration method, the amount drained was determined by summing successive truncated cones defined by the unevenness and radius for each step of the pumping part.

An important role in the experimental data taken was given to the following programs:

- MONTE CARLO - the mathematical statistical evaluation of the parameters;
- SURFER, WELLZ and ArcGIS - spatial modeling parameters and sizing of sanitary protection zones with strict diet and diet restriction.

Outlining sanitary protection zones was conducted on the aquifer for the entire frontage, aiming at a more accurate sizing, which can provide optimal protection against pollution.

To achieve this research, particularly thank Prof. Dr. Eng. Mihai Șaramet for scientific coordination and efforts to improve processing and mathematical formulas for determining the hydrogeological parameters and processing of data from research methods that were used.

Thanks also to our teachers in the Department of Geology who have been with me and supported me in all efforts for the realization of this work, particularly gentlemen: Dr. Eng Viorel Ionesi and Dr. Eng. Daniel Țabără.

Sincere thanks to my husband, Dr. Eng. Alexander Stoicescu, who gave me a great help in producing graphics and processing and for all their efforts in making this work professionally.

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We thank institutions of which was kind enough to provide me information on specialty papers and works on the frontage of Faraoani Bacau - Siret Water Basin Administration of Bacau, the Water Management System Bacau - particularly Mrs. Eng. Vasilica Ignat and to Dr. in Geography Petre Olariu.

Thanks also particularly Mrs. Dr. Eng. Rodica Macaleț, Prof. Univ. Dr. Mihai Brânzilă and prof. Dr. Eng.Ioan Giurma for helping the scientific reviewers of the thesis.

The first chapter was done framing physical and geographical, geomorphological, geological and hydro to the frontage of Faraoani.

From the administrative point of view, Faraoani frontage is located in the eastern part of Romania and belongs to Faraoani commune in Bacău County, located at a distance of approx. 20km from Bacau (Fig. 1).

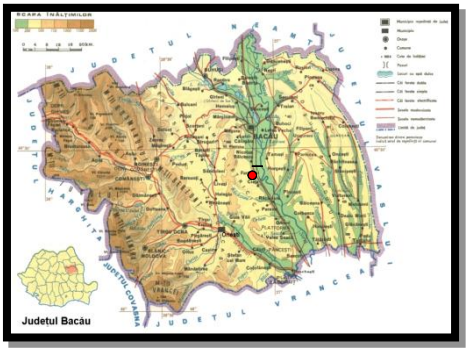

Fig. 1. Administrative location of Faraoani village, Bacau county
(after Atlas counties R.S.R., 1978)

The Faraoani front is a part of physico-geographical unit major relief Moldavian Plateau - Siret subunit.

The landforms of the study area consist of fluvial-lacustrine deposits and alluvial-proluvial, formed during the Quaternary. These deposits are horizontal, slightly inclined and covered most in loess.

Perimeter membership studied in the Siret River floodplain provides a number of significant advantages in terms of accumulation of permeable rock deposits and their supply from both surface water courses and by feeding on the heads of the precipitation layer.

In terms of ownership geological area analyzed is located in Scythian platform, about 3 km east of the fault represents its limit to the Carpathian hills band (Fig. 2).

According to other authors (Grasu et al., 1999 and 2002) the analyzed area is depozona Foredeep as depozones foreland basins.

Deposits outcropping in the study area belong to the Sarmatian (Basarabian and Chersonian) and Meoţianului.

In terms of lithology, Sarmatian is represented by clays, silts and sands with thin intercalations of sandstones, oolitic limestone (oosparite) biosparite. To the west, the contact between the platform and the Carpathian Ruthenia (Carpathian Foredeep) Sarmatian deposits are accumulated in deltaic facies, consisting of gravels and sands (Ionesi, 1994).

The existence of the mentioned faults denotes that during the Quaternary a fluvial system was formed, which led to the formation of terrace deposits that have inverse Convergence in relation with Sarmatian subasmentul.

The presence of fluvial relief caused by the existence of Siret river and aquifer structures well developed site fueled steady led to the shaping of the aquifer perimeter of particular importance in the water supply of Faraoani village.

After Macaleț (2006), aquifers in Faraoani belong to Sarmatian.

This aquifer is porous and permeable type, debit and pressure has free and cross-border level, surface part both in Romania and Moldova.

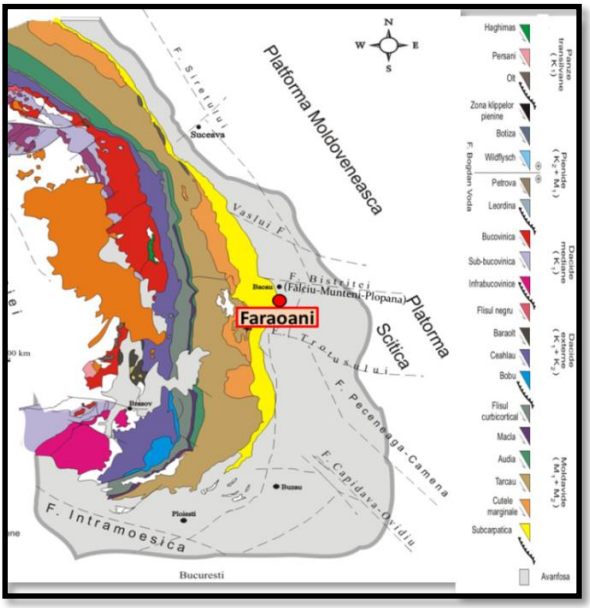

Fig. 2. Structural map of the Eastern Carpathians and adjacent areas (after Badescu, 2005)

Starting from general data Faraoani customization area was performed, focusing particularly on the influence of geology and hydrogeology of the aquifer formation frontage.

Presenting history hydrogeological research in the area of the starting point for studying the current situation of open aquifers by drilling.

The study of groundwater in the region of Faraoani was carried out by means of boreholes made in water of the front sensor.

Faraoani frontage consists of the following wells: 101H, 102H, 103H, 104H, 105H, 106h, 106Hbis, 107H, 108H, 109h and 110H (Fig. 3).

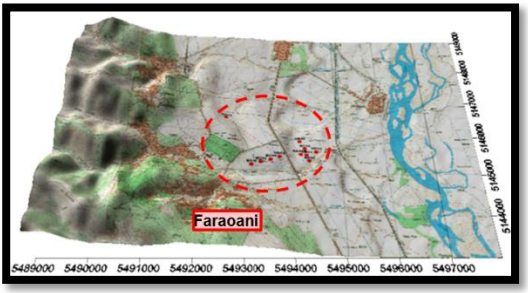

Fig. 3. 3D terrain map Faraoani frontage
(after 1:25000 topographic maps, sheet L-35-54-Dd, processed Surfer program)

An important step was the establishment of which was made open aquifers and their thickness by using well logging interpretations probe.

Based on flow and corresponding bumps cutting conditions of aquifers were fixed: Pressure ((drilling 101H, 102H, 104H and 106h) or free level (drilling 105H, 106Hbis, 107H, 108H and 109h).

From the analysis of physicochemical characteristics were determined exceedances of ammonium ions (NH4 +) and manganese (Mn) for some of the aquifers tapped.

Structures which intercepted water table aquifers in Faraoani frontage, part of the body of groundwater ROSI03 - Siret Valley and its tributaries and aquifers deep in front of the body belong to Faraoani groundwater depth ROPR05.

The flow of groundwater is Faraoani frontage on NW-SE direction, which leads to the conclusion that the power structures of the western aquifer is made of frontage, which belongs to the Carpathian molasse.

In chapter 2 execution of drilling conditions were analyzed within the frontage and correlations were made between the well logging data and the lithology probe. Based on these correlations were established structures aquifer thickness intercepted.

Chapter 3 important contributions on the theoretical foundations of hydrogeological parameters determine the steady flow of water from the aquifers for both cases: aquifers and aquifer pressure free level.

In this regard a series of demonstrations on formulas have been made with hydrogeological parameters for each pumping stage.

The data obtained for the calculation of hydrogeological parameters describing the flow of water in aquifers Faraoani were used in Chapter 4 to yield a mean value, the Monte Carlo statistical mathematical modeling.

The average values obtained were processed in Chapter 5, using the graphical methods WELLZ and ArcGIS for shaping sanitary protection zones with strict regime and diet restriction corresponding isolines of zero (0).

Sizing sanitary protection zones with strict regime and restriction regime for all wells within Faraoani frontage is represented in the form of envelopes, tangent polygonal surfaces, as shown in Figure 4.

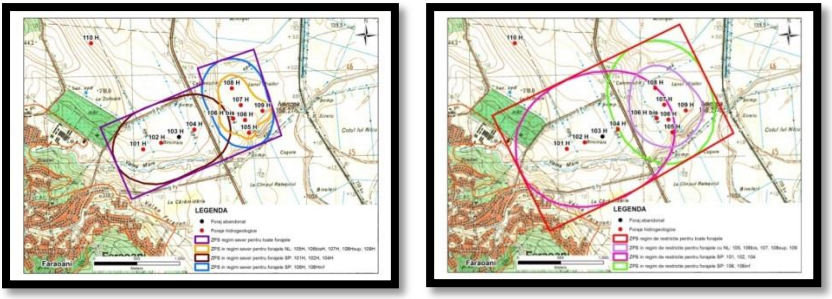

Fig. 4. Topo maps with sizing of sanitary protection zones with strict diet and diet restriction drillings frontage Faraoani

Areas established for the two zones of protection are:

- Sanitary protection area with strict regime - 1.89 km^2;
- Sanitary protection zone restriction regime - 3.64 km^2.

The legislation governing the sanitary protection zones for groundwater sources or surface is the Government Decision no. 930/02.10.2005.

Based on this decision ways to be studied water sources and measures to ensure their protection are set out.

The materialization of the field of sanitary protection zones is done based on the Government Decision no. 930/02.10.2005, legislation that legislates mandatory measures to be observed within these areas.

Protection of groundwater sources and their judicious use is therefore permanent responsibilities and their implementation leads to ensure quality and quantity of daily water needs for the population.

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