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DRINKING WATER SUPPLY AT GROPNIŢA VILLAGE, IASI COUNTY

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KEY WORDS: phreatic water, quality, supply, source of waters

INTRODUCTION

From *National Strategy regarding the development of public services of village management during 2001-2004 until 2030 of Romania Government* we can separate several statistic characteristics regarding the centralized system of distribution for drinking water in Romania:

1. by this system benefits 2910 settlements: 263 municipalities and cities and 267 villages (that is 17% from total)
2. from a total of 22,4 million persons, in Romania there profit 14.7 mil. persons (65%) of drinking water and from this amount 11.3 mil in the cities and 3.4 mil in the villages.

Taking into consideration this, we want to study the supply possibilities for a village from Iasi county with drinking water. Gropniţa village is situated in the central north parts of the Iasi' county and from a management point of view is composed of Mălăeşti, Forăşti, Gropniţa, Bulbucani, Săveni and Sângeni villages.

Nowadays, villagers of Gropniţa do not have a centralized system water supply, but the actual use of water is given by men built up wells, that does not have environment protection. For this reason it is necessary to know the quality of these phreatic waters and how they correspond to the World's Health Organization standards.

From a geological point of view (fig.1), the studied area belongs to the central – eastern part of Moldavian Platform, that represent in fact a socle from Precambrian that is made up from metamorphic rocks and a sedimentary cover (with Ordovician, Silurian, Cretacic, Eocen and Neogen deposits).

The studied perimeter is characterized by the appearance of Sarmatin and Quaternary deposits. The Basarabian deposits have a large development and the most

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forms of relief are carve in it. The Quaternary is represented by Pleistocen (from the terrace area) and Holocen (from the plain area) deposits. The Holocene deposits have a thickness that varies between 6 and 8 m and are composed from two lithological complexes: a superior composed by fine grained deposits (clay and silt) and inferior that is compound from sand and pebbles.

From a geomorphologic point of view, the studied area belongs to the Jijia's Plain. It is dominated by the sculptural relief with large valleys aspect and hilly interfluves or little low plateaux. The flat forms and the large valleys with the slopes affected by the landslides or by the splash and gully erosions, give relief of the region a monotony - blurry aspect.

The general aspect of the relief and lower altitudes comparative with the around units are a consequence of the petrography (dominant clay and clay-sand).

Because of the Jijia's valley subsequential character, the right slope is a cuesta. On the surface of the plain we observe the high insular forms of erosion, especially at the north- west of Larga. To the intersection of the slopes with the plain appears a glacis zone more developed on the right part.

From a hydrogeographical point of view, the studies zone is framed by Miletin's river on north and east and Jijioara's river on south. The debits vary by the regime precipitations. On the both rivers the accumulations deposited that reduced the floods and can be used in the pisciculture. The most important accumulations are in Hălceni (on the Miletin river) and Bulbucani (on the Jijioara river).

The relief between the two rivers is fragmented by torrentiall valleys. Sometimes it has a swampy character on the middle and inferior course.

The studied area belongs to the tempered continental climate and it is characterized by the presence of the annual mean temperature of 9-10 ºC. The precipitations have mean values between 474 and 550 mm / year and the number of days with snowbed is until 70.

From the hydrogeological characterization we deduce that the phreatic waters are hosted in two hydro-structures: the first is hosted in the alluvial deposits inside the principals everglade of the rivers and it is composed by sands with a fine grain size and rarely coarse grain in base; the second is hosted on the bottom of loess deposits from the plateau areas, in the sands between the clays and the marls. The first hydro-structure is supplied from the versants and hydrostatic level is under pressure with an ascensional character. The second is supplied from the permeable strata of the Inferior and Middle Sarmatian that appear on the large areas along the important valleys.

MATERIALS AND METHODS

With the occasion of the research on the field we identified two old systems of capture with the distributions.

The first capture and the most important, regarding the debits, represents a longitudinally drain situated on the superior and middle course of Boziana Valley. Initially it had a length of 4.5 km and it was started from the NV of Săveni village. Nowadays it functions just in the south of the remembered village, with a drainage basin by 50 m^3. From this drainage basin starts a waterpipe that accomplishes the alimentation a part of the buildings from Forăşti and Mălăeşti villages. In the past, it delivered water for the farm from Forăşti village. Upstream, into the visit room it was measured a debit of the drain of 4.0 l/s.

Approximately at 200 m north of Bulbucani village, on the valley that crosses the settlement, at the stable of the ex CAP, there is a capture of smaller dimensions. It is made of a few drains that it is fall into drainage well. From this, the water is pumped into the basin that supplies Bulbucani and Gropnița streets and a lot of buildings. The exploitations are not permanently, but intermittencely and it assures 40 – 5- m^3/day. Both captures do not have environment protection.

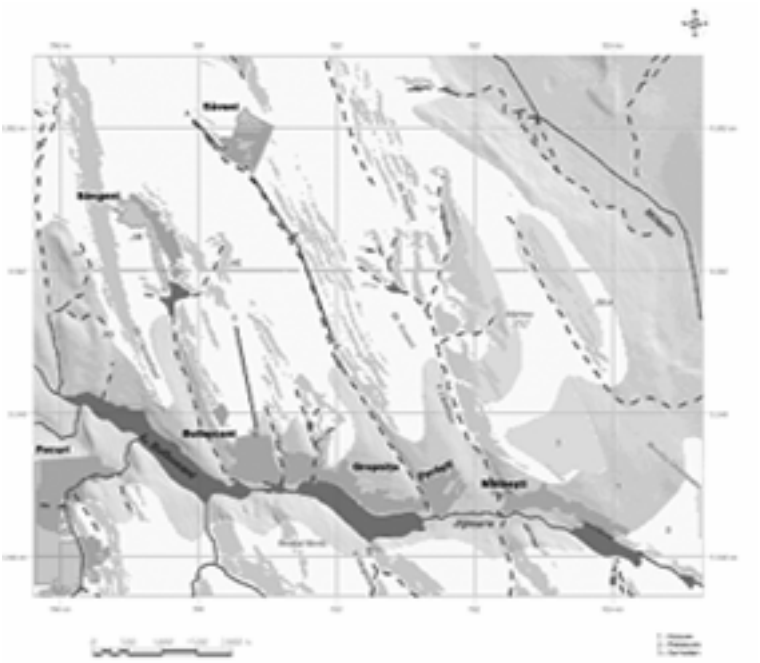


Fig. 1 The Geology of the studied area

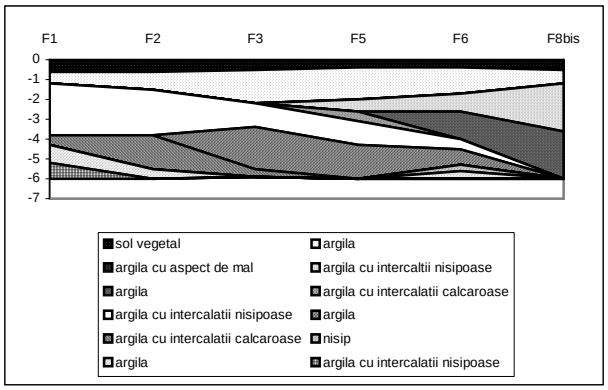
In this studied area there were made investigations through drilling.

Upstream of Săveni village it was made the drills F1 –F8 bis, and downstream of Săveni village, the drills F10 - F21 bis, and upstream of Bulbucani village the drills

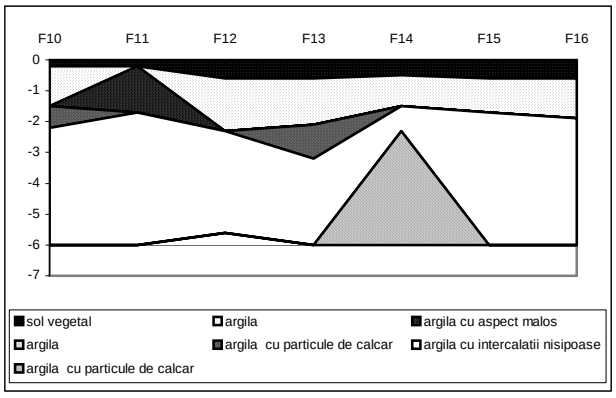
F22- F28. All the drills were made at 6 m depth and they intercepted the formations from the bottom of loess deposits and from the alluvial deposits. So, there were made three sections (fig.1):

- the section AA', upstream of Săveni village, with a length of 900 m;
- the section BB'B'', downstream of Săveni village, with a length of 3100 m;
- the section CC', upstream Bulbucani, with an approximately length of 3100 m;

For determination of water quality there were assayed samples from the drains and the alluvia of Miletin river. These samples were analyzed by the Lab of the Prut Waters Direction.

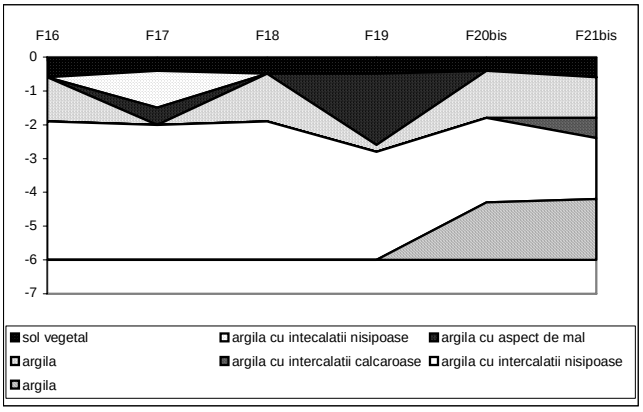


a

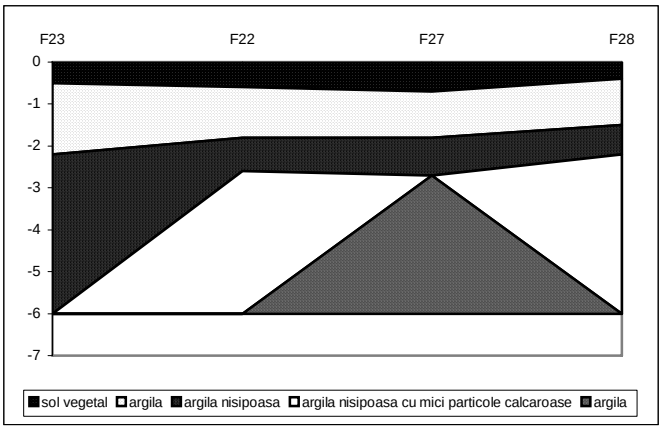


b

Fig. 2 The longitudinal hydrogeological sections:a - the section AA; b - the section BB'



c



d

Fig. 2 The longitudinal hydrogeological sections: c - the section B'B''; d - the section CC'

RESULTS AND DISCUSSIONS

On the base of the drill data there were accomplished the lithological sheets for each drill and there were made longitudinal hydrogeological sections (fig.2). From a lithological point of view we observe on the top the presence of the brownish clays with the grey zones that characterize the formations from the bottom of the loess deposits, and the black clays, sometimes with the mud aspect, that denote the presence of the alluvia deposits. Under this clays, appear yellow brownish clays more or less with sands, that horsts the water. The thickness of the clays varies between 0.8 and 4 m, but some

drills do not intercept this stratum. On the base there are brownish clays with the grey zones, sometimes with the calcareous concretions.

Usually, the piezometric level is under the low pressure with the weak ascensional character.

For the determination of the hydrogeological potential was made taking into consideration the dimension of the supply surface, the lithological structure, the flow slope and some debit values of the. Thus, we can to estimate the debits: 4-5 l/s for the Boziana valley (upstream and downstream of Săveni village) and 1-1.5 l/s for the upstream of Bulbucani village. These debits are influenced by the hydro-meteorological factors and they present the variations in time.

From the ions balances (fig. 3) we observe that the difference between the sum of cations and the sum of the anions is framed in the errors limits. So, the electro-neutrality principle is respect.

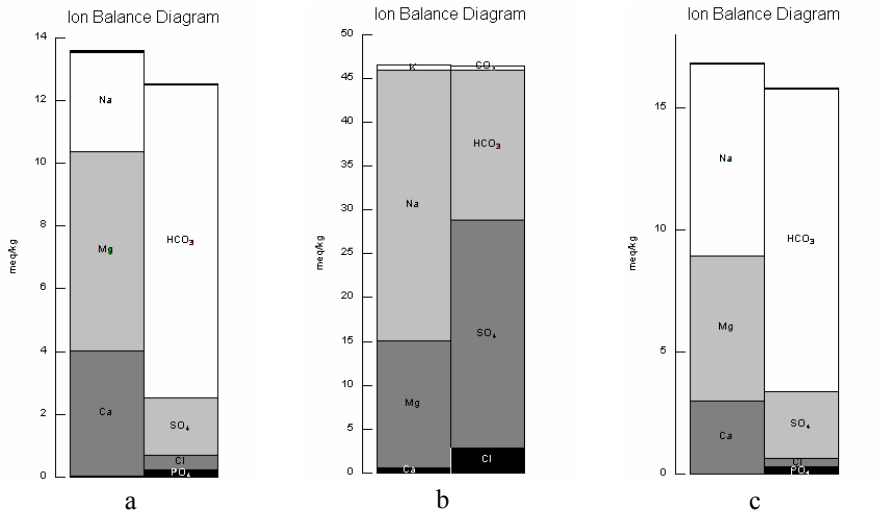


Fig. 3 Ion Balance Diagrams : a- Bulbucani; b: Miletin's valley; c -:Săveni

The samples of the water that were assayed, for the bottom of loess deposits from the high plateau (sample a and c), after the Piper and Durov diagrams, are the Mg^{2+} – HCO_3^- type (sample a) and Na^+ - HCO_3^- type (sample c) (fig. 4 and 5). But, the sample assayed from the alluvial deposits of the Miletin valley is Na^+ - SO_4^{2-} type, fact that shows the presence of the gypsum into the clay from the studied area. From the chemical composition, we determinated the dissolves salts (fig. 6 a, b, c) and their percentage

participation using the chemical principle of the differential degree of the ions into the solution and the Scholler' series of the ion change. For the water of the second hydro-structure we observe the same salts composition (in principal $NaHCO_3$, $CaHCO_3$, $MgHCO_3$ and subordinate $CaSO_4$ and NaCl). We have to specify that the participation of the Mg salts is more reduced in the Săveni source (34 %) than Bulbucani source (49 %). A inverse situation is for the Na salts (47 %, than 17 %).

The present of sodium is due to the actual conditions of the climate and the clays of the Sarmatian strata, in the process of the ions changes with the water, retain the calcium and oust the sodium *(Schram, 1971)*. In the water of the alluvium deposits dominate the sulfates (≈ 50 %), and subordinate $NaHCO_3$, NaCl and KCl. The arid conditions from the studied area favour the soil salinization and the appearence of the efflorescence that have a big percentage of sulfates (especially Na_2SO_4).

For water quality we use the standard STAS 1342 / 91 modified by the law 458 / 2002 and we remark (fig. 7) the concentration over limits for the CCOMn indices and the magnesium and sulfate ions for the Miletin source. The first hydro-structure is good from a quality point of view.

Using the chemical composition of the waters, we calculated the saturation indices for the $CaCO_3$ minerals calcite and aragonite. The saturation indices (table 1) show whether the minerals are supersaturated ($SI > 0$), saturated ($SI = 0$), or undersaturated ($SI < 0$). So, the waters are supersaturated. In this situation will be precipitated $CaCO_3$, but is influenced by the effect of ions uncommon.

Table no 1 The saturation indices in $CaCO_3$

The saturation indices in $CaCO_3$ (SI)			
	Bulbucani - Gropnița	Miletin's valley	Săveni – Gropnița
calcite	0.9478	0.7839	0.601
aragonite	0.7835	0.6196	0.437

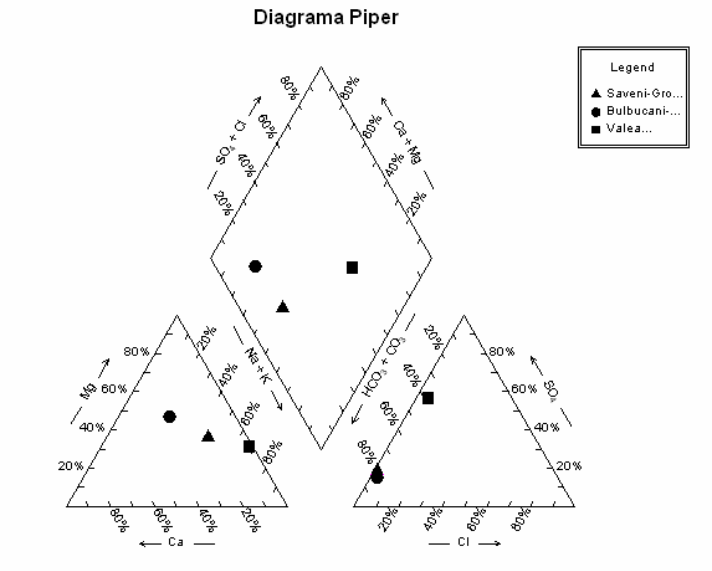


Fig. 4 Piper Diagram

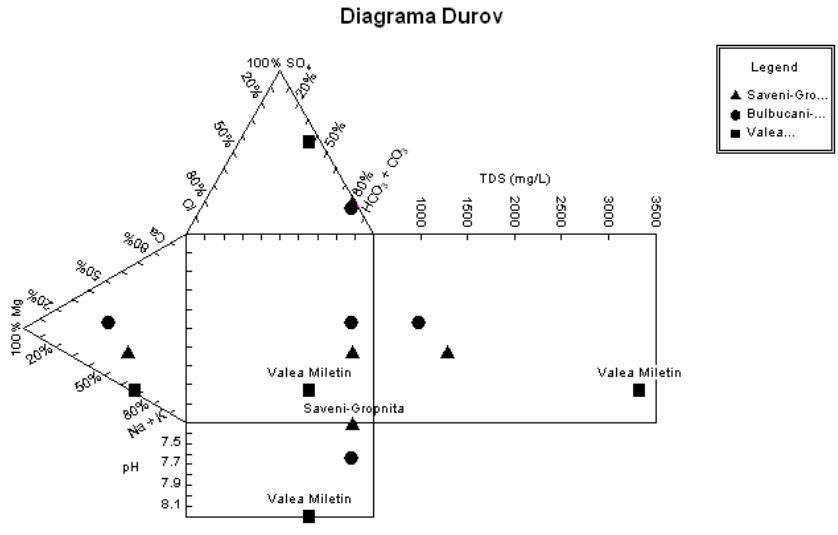
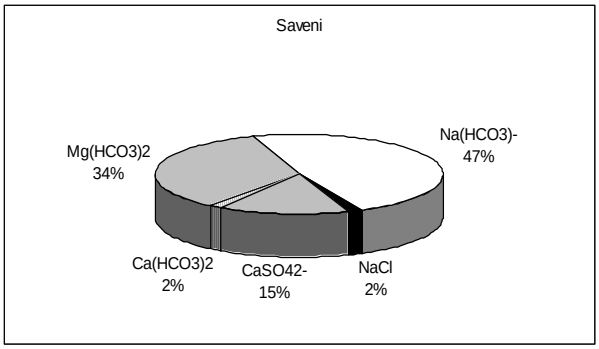


Fig. 5 Durov Diagram



6a

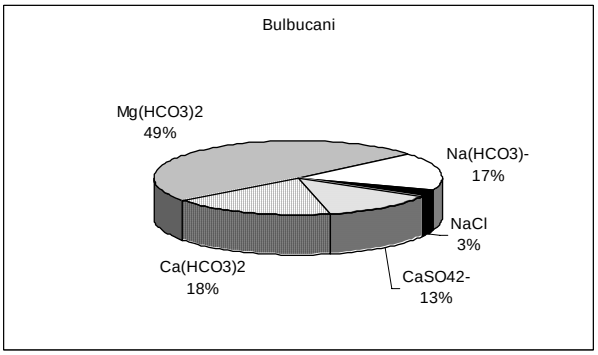


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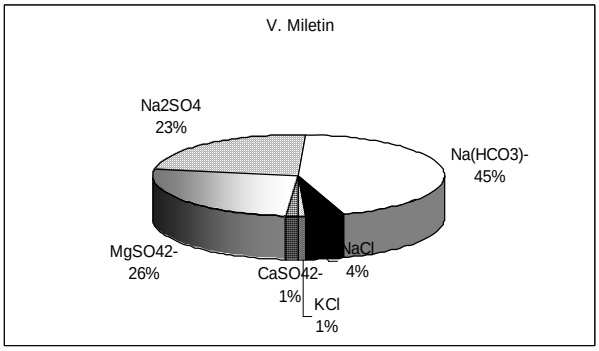
Fig. 6 (a,b) The dissolved salts (a – Saveni, b- Bulbucani)



6c

Fig. 6 (c) The dissolved salts (c – Miletin's valley)

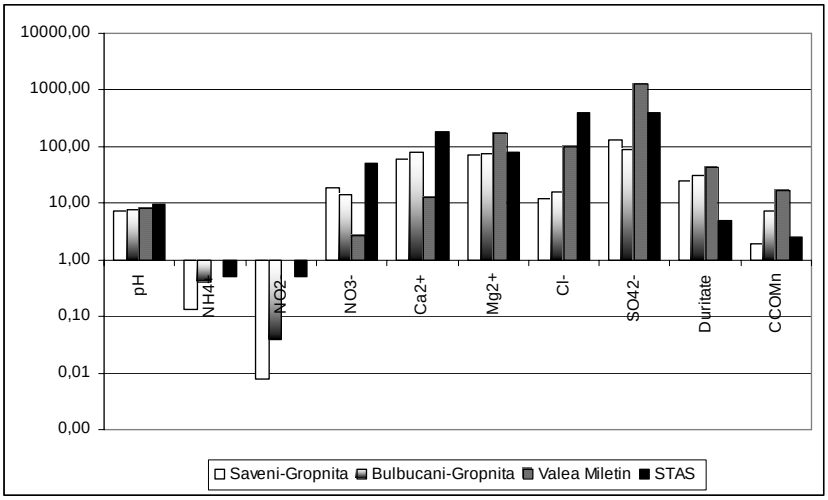


Fig. 7 Water quality indices (after the STAS 1342 / 91)

CONCLUSIONS

The morphological and lithological conditions from the studied area impose a unique solution supply possibilities with drinking water: the drains. These drains are in the two hydro-structures: the aquifer from the bottom of the loessoid deposits from the high plateaux and the aquifer from the alluvium deposits along the rivers. The second aquifer is not acceptable from a quality point of view. For the efficiency of the exploitation is necessary to make rehabilitate works. So, there are imposed the follows measures:

- by prospection works there will be indetify correctly the depth and the length of the drains;
- it is necessary to know the quality of these phreatic waters and how they correspond to the World's Health Organization standards.
- Săveni capture will be extend to the north of the village for to permit the supply of water in Săveni and Sângeni

REFERENCES

DRAGOMIR S. (1993) – *Zonarea hidrogeologica si hidrochimica a surselor acvifere subterane din judetul Iasi*, An. St. Univ. Al. I. Cuza Iasi, T XXXIX s. II, Iasi.

IANCULESCU SPERANȚA, IANCULESCU O. (2002) – *Legislație privind protecția mediului,* Ed. Matrix Rom, București.

PANTAZICA MARIA (1974) – *Hidrografia Campiei Moldovei*, Ed. Junimea, Iasi.

POPA GH. (1993) – *Etude hydrogeochimique sur quelques sources des eaux souterraines de la region de Moldavie.* An. St. Univ. Al. I. Cuza Iasi, T XXXIX s. II, Iasi.
SCHRAM MARIA (1971) - *Contributii la studiul hidrochimic al lacurilor din Campia Moldovei*, extras din Lucrari stiintifice, seria geografie, Ed. Univ. Al. I. Cuza, Iasi.
UNGUREANU A. (1993) - *Geografia podisurilor si campiilor Romaniei*, Ed. Univ. Al. I. Cuza, Iasi.
WILLIAMS I. (2001) – *Environmental Chemistry*, John Wiley & Sons, Ltd, New York, SUA.
*** STAS 1342 / 1991