Water resources and wetlands, *Editors: Petre Gâştescu, William Lewis Jr., Petre Breţcan*
Conference Proceedings, 14-16 September 2012, Tulcea - Romania
ISBN: 978-606-605-038-8

UNDERGROUND WATERS IN THE GILORT HYDROGRAPHIC BASIN

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Abstract

The management and the use of the water resources of the Gilort hydrographic basin (surface waters and underground waters) have been analysed according to the data recorded between the years 1982 – 2009. The work has been structured into three parts according to the surroundings and the social and economical importance of the exploitation of the water resources:

- The exploitation of the Gilort river's hydro energetic potential and it's affluents represents an economical priority, especially in the mountain area of the basin
- The use of the fresh water and the industrial water has been intensified a lot during the last 5 years, especially in the rural and area where the water supply has been set up almost completely. In 95% of the cases, the water quantities used by the population and in the economy come from the surface underground waters and the deep underground waters. The 98 existing drills in the Gilort river hydrographic basin have a potential volume of 624 l/s, a lot more than the area needs. Nowadays there is a new priority, which is to set up a sewage installation and a sewage treatment station.
- The impact of the mining industry upon the water resources occurs often in the coal mines area and the oil and gas wells area.

Keywords: water resources, supply network, drill, Gilort

The lithosphere waters, that have endogenous or exogenous origin and who circulate or stagnate inside the cracks or the pores of the rocks are underground waters and are different from the surface waters through dynamics, physical, chemical and biological characteristics (Pişota, 1970). Hydrogeology is the science that studies the origin, the dynamic, the terrain disposition, the quality, the conditions of the deposit and the physico-chemical characteristics of the underground waters. (Zăvoianu, 2002). By the genesis and the deposit conditions the underground waters are deep waters and surface waters. The study regarding the underground waters from a hydrographic basin has two aspects, each of them with an important role: the physic-geographical aspect and the direct influence of the surface underground waters on the flowing regime and the economical aspect through the fresh and mineral water potential. It is necessary to know in details, the geological conditions, the relief conditions, the climate, the vegetation, the soil and the anthropogenic influences on the underground waters deposits. As a consequence of the infiltration of the meteoric waters in the soil, the water courses may have different aspects, but they are always influenced by the gravity. On their descending trajectory they may cross several layers of rocks until they meet one that is water proof and that is where the underground water accumulation begins (Zăvoianu, 2002). The knowledge of the areas where the underground waters accumulate, the analysis of their circulation trajectory (vertical, lateral, mixed), the elaboration of the hydro geological maps are very important for the development of the water systems for the towns or the economical agents.

1. GROUNDWATERS

Ground waters are very frequent and easy to intercept, but their piezomteric level and volume are influenced by the climate. In the Gilort hydrographic basin we encounter ground waters with important flow in the Parang piedmont (glaciar valleys and trails of debris where most of the springs have their origin), in the cones of dejection from the piedmont depressions and in the silt deposits located in the major riverbeds and river terasses. In the area of the glaciar valleys, the only fresh water interception is at the Galbenu river springs, in the Tidvele glaciar valley located on the North-East from the Rânca resort. There are two separate interceptions (12 l/s) that provide water for the resort through 6 basins that have a maximum water storage capacity of 450 m^3 (photo 1).

Photo 1. Water basins for Rânca resort **Photo 2. Novaci water basin**

South-West from the Cerbul Peak, at the limit between the Gilort and the Galbenu river basins, the town of Novaci has interceptes three springs with a 20 l/s flow (photo 2).

Baia de Fier village uses two water interceptions in the Galbenu river hydrographic basin with a 4,26 l/s flow. The quality of the water from the mountain springs, the determination of the flow and the gravitational transportation justify the investment into the river interceptions. (table 1).

Table – Spring water supply

Position	Village	The name of the spring	Flow (l/s)	Observations
1	Novaci	Cerbu, Tolanu, Berceşti	20	
2	Baia de Fier	Zănoaga, Băiţa	4,26	
3	Rânca resort	Tidvele	12	Two interceptions

In the piedmont depressions like Baia de Fier, Novaci and Crasna, with large deposits of gravel and rocks, the ground waters have a great potential. The only ground water resources in this area are being exploited in the Crasna depression where 2 drills have been made (12,5 m. deep) witha 10 l/s flow that supply the water for Săcelu village and resort. The stability of the flow of the 2 drills is maintained by the underground course of the Blahniţa river during periods of drought and the dimensions of the depression. The water from the drills is being collected in four basins with a 70 m^3 capacity each and is distributed with the help of the gravity in Săcelu village.

The ground waters from the subcarpathian and the piedmont area appear in the meadows and the terasses and it depends on the rain at the limit between two hydrographic basins. There are two villages, Albeni şi Brăneşti, that by the place in which they are situated in the Gilort meadow and at the intersection of the Gilort river with the Jiu river, have the conditions that made possible the realisation of drills 20-30 m. deep. The fact that many villages are arranged on at the limit between hydrographic basins and on the slopes, where a water supply system has been build only partially, keeps the inhabitants dependent on the water from the wells. In the hydrographic basin have been identified 12898 wells, out of which 36% become dry almost every year (table 2).

Table 2 – The disposition of wells in the villages from the Gilort hydrographic basin

Position	Village	Number of wells	Number of wells that do not become dry	Observations
1	Albeni	647	310	
2	Aninoasa	730	250	
3	Baia de Fier	491	130	
4	Bărbăteşti	548	340	
5	Bengeşti Ciocadia	602	120	

6	Brăneşti	956	410	
7	Bumbeşti-Piţic	376	190	
8	Crasna	683	320	
9	Jupâneşti	522	205	
10	Prigoria	815	140	
11	Săcelu	578	73	
12	Săuleşti	465	208	
13	Scoarţa	793	114	
14	Turburea	1604	745	
15	Ţânţăreni	1808	960	
16	Vladimir	1280	163	

Since 1966 there have been done drills for a hydrogeological study, at depths between 14 and 40m, where observations of the level have been done every three days. These drills are located in the Gilort and Blahniţa meadows and on the terasses and in this way informations have been obtained about the connection between the groundwaters and the river, and upon the influence of the rain on the level of water in the drills (fig. 1). Tha variation of the water level in the drill F1 –Scoarţa in 2003 shows a direct connection between the rain and the piezometric level (a maximum level of the ground waters in the spring and in November and a minimum level durin September-October). Nowadays, on five of these drills there have been installed systems that register automatically the level and the temperature of the water in the drill.

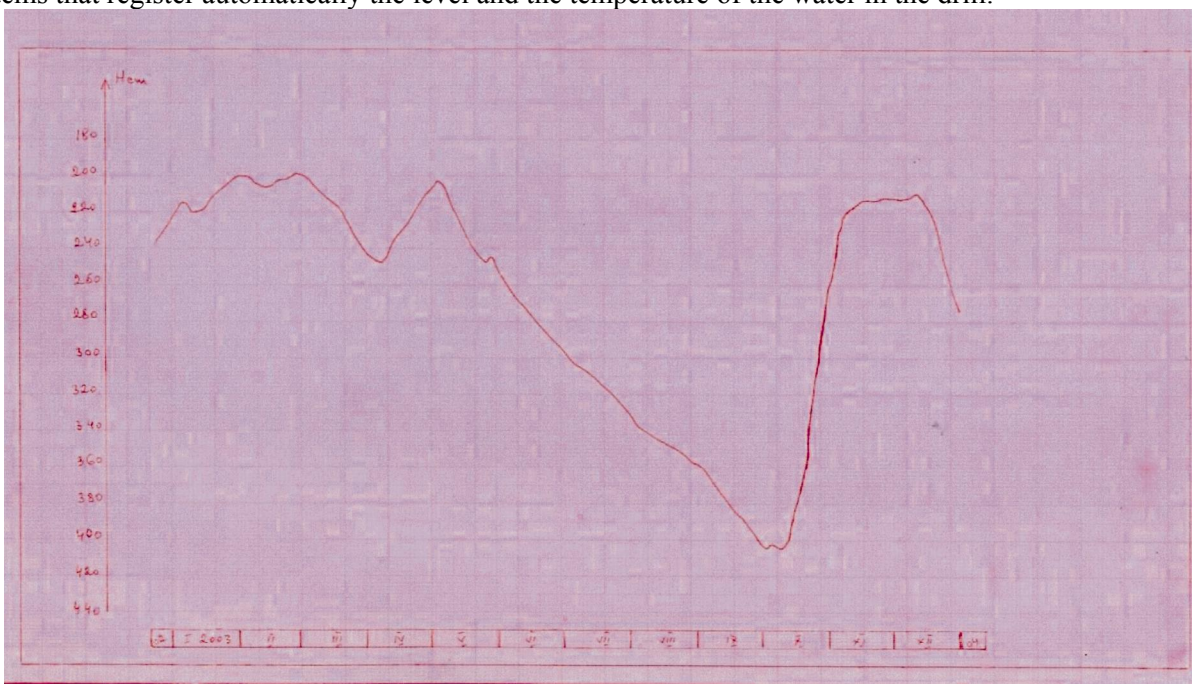

Fig. 1. The variation of the ground waters at F1 drill – Scoarţa in 2003

2. UNDERGROUND WATERS

Deep underground waters in the Gilort hydrographic basin represent the main source of water supply for the population and the economical agents located South of the internal subcarpathian hills. There are until now 98 drills with depths between 50 and 350 m., out of which 63 are active and 35 are being preserved. The estimated volume of the 98 drills is 624 l/s, out of which 60% is being used nowadays. The water deposits with the highest potential are from the Pliocene. The best conditions to exploit these underground waters are in the meadows, where the water has eroded the Cândeşti layers and the Pliocene is directly bellow the Quaternary silt deposits. In general, the aquifere deposits from the pliocene made from fine sand, sometimes from gravel, are under pressure. At the experimental pumpings, for the drills made in the studied area, there have been obtained volumes between 1,70 and 16 l/s. By the potential volumes and the extent of the aquifere

deposits, there have been noticed three main areas: Turburea, Socu (Bărbăteşti) and Tg-Cărbuneşti. Near Turburea village there are 27 drills (40-120 m. deep), most of them belonging to S.C. PETROM S.A. and supplying the water for the industrial area and the near villages. Between 1965-1970, for the water supply of the oil well Țicleni there have been made 16 drills at 350 m. in the Gilortului meadow at Socu. There is a water station here that supplies also the villages in the South, the constatnt volume being 64,4 l/s. For the supply of the Tg-Cărbuneşti town and of the near villages there are 18 drills (45-310 m.) that insure a 63 l/s volume. The situation of the water supply from the drills in the Gilort hydrographic basin is shown in table 3.

Table 3 - Water supply from the drills in the Gilort hydrographic basin

Position	Town	Number of drills	Depths of the drills (m)	Volume of the drills (l/s)	Observations
1	Tg. Cărbuneşti	8	175-300	63,2	
2	Albeni	2	20	8,00	
3	Aninoasa	2	200	7,10	
4	Bărbăteşti	16	350	64,4	Petrom drills in Socu area
5	Bengeşti-Ciocadia	2	130-250	3,65	
6	Brăneşti	2	30	1,40	
7	Bumbeşti Piţic	3	80	2,85	
8	Prigoria	4	128-190	12,5	
9	Săcelu	2	12,5	10,0	
10	Săuleşti	2	50, 210	3,68	
11	Scoarţa	13	16-250	22,4	
12	Turburea	27	40-120	2,35	Most of them belong to S.C. Petrom S.A.
13	Tânţăreni	2	70	11,6	
14	Vladimir	6	14-120	12,0	

The tectonic dynamic of the Getic Depression from the Pliocene and the Quaternary is demonstrated by the the large number of silt structures revealed in the drill sample (fig.2). In the case of the 300 m. drill at Tg-Cărbuneşti 54 layers have been crossed: 21 layers of clay, 19 of sand, 7 of gravel, 6 of marl and 1 layer of rocks. The thickness and the number of sand layers insure a good stability of the underground waters located in the Gilortului area, South of Tg-Cărbuneşti.

3. MINERAL SPRINGS

The complex geological structure, the tectonic of Romania, the presence of several deep faults, of a massive chain, of large deposits of salt, oil, coal, methane gas in the silt deposits have favoured, in the conditions of an active underground water circulation, the apparition of numerous different mineral springs that have therapeutic properties, famous outside the country (Pişota 1970).

Out of the conditions mentioned above, regarding the genesis of the mineral springs, in the area of the Gilort hydrographic basin we find: deep faults, oil and gas deposits and mineral salts in the silt deposits. The rocks from the Săcelu-Ciocadia anticline (Eocene conglomerates, microconglomerates, chalk, sandstones) are affected by numerous faults and cracks through which the mineral waters reach the surface. Blahnița river, by creating a narrow and deep valley between the subcarpathian hills, has revealed the mineral springs that have been used since the roman period (106-271). After that the springs have not been used until the year1880, when the first villas of the future Săcelu resort appeared (photo 3).

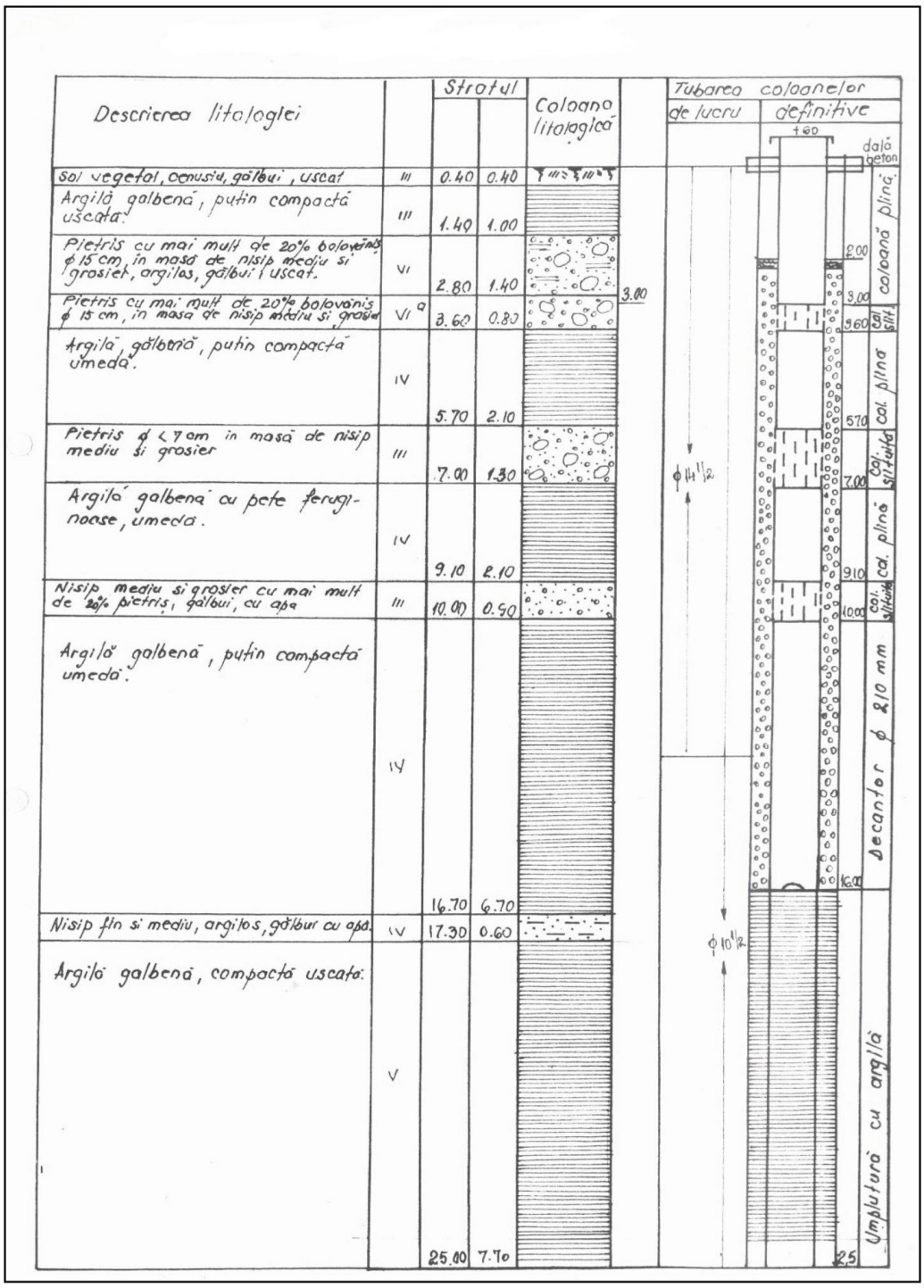

Fig. 2. Scoarţa- F3 drill (sample)

The first drills, during 1952-1953, were made in the area in order to find out if there are deposits in the area. Between 1963-1964 The Institute for Balneology and Physiotherapy, has done 5 drills in the center of the resort, and in 1971, near basin number 3 there has been made a drill, 1990 m deep, in order to investigate the hydrogeology of the area, that insures a volume of 2,7 l/s of mineral water (total mineralization of 44500 mg/l). In the south side of the Săcelu resort, a salt water drill, 570 m deep was put into use. All the drills that have been dug into conglomerates and sandstone have reveales the existence of mineral water. The water with a high mineralization,the therapeutic mud and the pleasant climate of the area contributed to the appearance and the development of the Săcelu resort (photo 4).

Other mineral springs, but with low volumes and unexploited can be found also in the minor riverbed of the Ciocadia river, where they appear through the existing cracks and the Eocene conglomerates.

Photo 3. Săcelu treatment base

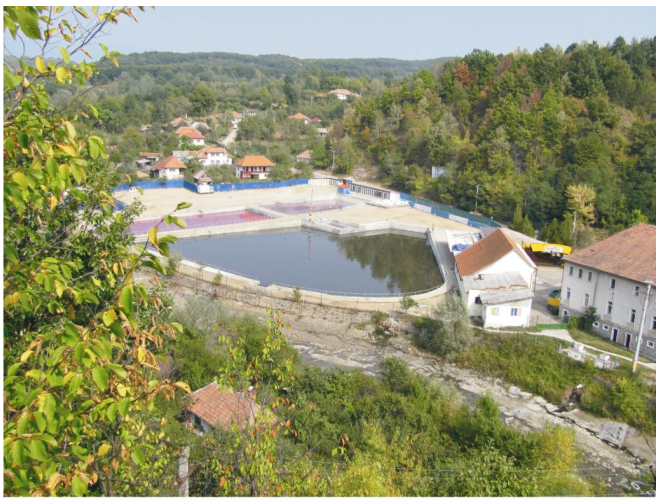

Photo 4. Săcelu resort-open air basin

CONCLUSIONS

Gilort hydrographic basin has important deposits of fresh water in the hydrographic system and in the ground waters. Nowadays, 95% of them are being used as fresh water and industrial water and come from the drills. From the ground waters take their supply Rânca resort, the town of Novaci and the village of Baia de Fier. The population and the economic activity from the subcarpathian and the piedmont area use water from the 98 drills (total volume of 624 l/s), 50-350 m. deep. Three main deep drilling areas hjave developed: Turburea withdrills (40-120m), Târgu Cărbune□ti with 18 drills (45-310m) and Socu with 16 drills (350m). The mineral springs, existing along the internal subcarpathian hills (Ciocadia-Săcelu), and with important therapeutic effects have been exploited during the Romans and nowadays in the Săcelu resort. Deep underground waters are located mainly in the layers from the Pliocene, composed of sand and gravel and are of a very good quality.

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