# HYDROGEOLOGY OF THE PLIOCENE–QUATERNARY FORMATIONS OF THE DACIAN BASIN

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**Abstract:** Due to the Young Styric Tectogenesis Event, the Dacian Basin occupied large sunken parts of the Carpathian Foredeep, the Scythian Platform, the Buried North Dobrogea Promontory and of the Moesian Platform, during the Miocene-Pleistocene.

**Key words**: aquifer, specific capacity, Pliocene, Quaternary, Dacian Basin

According to the nature of the groundwater bodies and to the dominant flow, within the Pliocene-Quaternary pile pertaining to the Dacian Basin, we distinguished:

1. Practically non-aquiferous Sarmatian-Pontian rocks;
2. Moderately Lower Dacian aquiferous rocks
3. Locally-moderate Upper Dacian-Middle Romanian aquiferous rocks
4. Non-aquiferous, locally aquiferous Middle-Upper Pleistocene rocks
5. Moderate-to-high Upper Romanian-Lower Pleistocene aquiferous rocks

1. Before the Dacian time, the Central Paratethys was widely connected to the Pannonian and Euxinius basins. Generally, the off-shore marine environment was dominant in the inner sea of the Central Paratethys. As a result, the pre-Pliocene, mainly clayey marly rocks, contains discontinuous and high-mineralized aquifers (located mostly in the fine sand layers).

At the end of the Miocene, due to the paleoclimatic cooling, the level of the Dacian Basin experienced a progressive lowering. On the north-western, northern and north-eastern edges (Marinescu, 1987; Ghenea, 1968), during the Bosphorian substage (Upper Pontian), a thick regressive silty sandy formation (150-400 m thick) was deposited. The yields for some exploration wells (Ostrovu Mare, Patulele, Gighera, Malovat etc) are generally less than 0.3 l/sec.

2. At the beginning of the Dacian, after the interruption of the link between the Pannonian and the Dacian basins, a consistent pile of 50 to 300 m fine sandy rocks were accumulated (the Berbesti Formation, $N_2$dc) in a littoral-lacustrine setting, in the western third of the latter.

Corresponding to the northern flank of the South Carpathian Foredeep (faulted homocline), the recharge area of the main Berbesti Formation confined aquifer crops up at 390-350 m a.s.l. Here, the potentiometric lines are over 300 m. Towards the transit area, on the main west-east trending anticlines, the Holocene erosion of the main rivers (Jiu, Amaradia, Gilort) led to partial upward buried discharge (the potentiometric lines range between 200 and 170 m).

In the southern region of the transit flow field, on the main Strehaia-Calafat Uplift of the Moesian Platform, the Husnita, Drincea, Jiu and other streams eroded completely the thick pile of the Aquitard Overlying Jiu-Motru Formation (Upper Dacian-Middle Romanian). Near these hydrogeological windows, the potentiometric lines of the semiconfined Berbesti Formation diminish from 170 m (around Strehaia sector) to ca 50 m (in the Teasc-Bratovoesti sector).

The discharge area corresponds to the south of the Dacian Basin. Here, on large surfaces, the Berbesti formation is supplying by upward leakage the Danube Formation (Upper Romanian-Holocene in age).

Generally, the main hydraulic parameters (K ranging between $10^{-4}…10^{-3}$ m/sec, transmissivity between 10…100 $m^2$/day, specific capacity around 0.500 l/s/m) portray the Berbesti Formation as an intergranular moderately productive aquifer.

3. In the Upper Dacian-Middle Romanian, large, weakly drained floodplains with extended swamp regions, developed in the conditions of a warm temperate climate with precipitation values twice the present record.

With the unequal plunging rate of the Moesian Platform northwards, against the background of tectonic quiet, a coaly (12-17 seams)-clayey monotonous formation (100-600 m thick) accumulated (the Jiu-Motru Formation; Andreescu et al., 1985) during the Upper Dacian-Middle Romanian. Mainly, this formation is made up of river channel multistoried infill interstratified with fine-grained rocks and with episodic mini-lake sediments (marly clays, claystones etc).

The great of size, geometry and granofacies variability of the permeable beds (ribbons, bars, sheets etc) is expressed in the hydrogeological features. This mainly aquitard Jiu-Motru Formation contains a multilayered aquifer system. The specific capacity of these beds is extremely variable, frequently in the range of 0.050-0.500 l/s/m.

4. Toward the central part of the Dacian Basin, around of the west-east elongated Turceni-Tinosu-Dragasani-Tinosu-Fulga-Balta Alba strip, the Candesti Formation facies receded. Over sixty-

five hydrogeological wells with continuous mechanical drilling in the Dacian Basin (Enciu et al., 1995) led to the conclusion that during the Upper Dacian-Upper Pleistocene, ephemeral or highly meandering river plain alternating with episodic lacustrine-lagoon environments (practically non-aquiferous-to-locally aquiferous rocks) dominated the middle of the Dacian Basin.

5. In the north-eastern extremity of the Dacian Basin, at the foothill of the Subcarpathians, a thick pile (up to 400 m) of boulders, cobbles, gravels and sands was accumulated as a result of the Carpathian Bend uprise (the Wallachian phase). From the actual outcrop bend (nearby the Subcarpathians) to the axis of the Carpathian Foredeep (superposed on the median region of the Dacian Basin), this formation (the Candesti Formation) passes from proximal river stages, including alluvial fans, to the meandering river stage.

The lack of impervious layers at shallow levels on the northern edge determined infiltration of surface water to lower depths (70-140 m). The general underflow direction is north-south. The specific capacity is moderate: 5-50 $m^3$/day (Craciun et al., 1996). According to this study, the potentiometric lines are of 250-320 m between the Arges and the Dambovita, 170-240 m between the Ialomita and the Prahova and 150-130 m in the Teleajen-Buzau interfleuve. In the Buzau-Putna interstream, the Candesti Formation extends over the piedmont area (Craciun et al., 1996). The potentiometric surface contoured on the maps illustrates an active flow within the high plain sector and a slower one in the subsidence plain (situated between the Intramoesian and Peceneaga-Camena faults). On the lower plain, some artesian supply wells have the potentiometric levels at relative altitude of 1.0-10.0 m above the land surface.

Opposite to the central part of the Dacian Basin region with practically non-aquiferous, locally aquiferous rocks (at the first 600 m deep), the southern third is portrayed as highly and very highly productive(1-3 l/s/m and 3-7 l/s/m, respectively).

Here, during the Upper Romanian-Holocene, the Danube River and its main tributaries built up the Danube Formation. The lower member of the Danube Formation is represented by the alluvial fan deposited by the river and its right side tributaries (5-25 m sequence of psammo-psephitic beds) during the Upper Romanian-first part of the Lower Pleistocene.

Starting with the second part of the Lower Pleistocene, the Danube River built up a stairway-like seven terrace sequence. Each of these erosion-accumulation beds has one to four sedimentary rhythms of variable thickness (1.5-40.0 m) and significant hydraulic conductivity (K = 10-65 m/day).

Being fed by rainfall and by upward discharge of the confined Pliocene aquifers, this phreatic aquifer is the main groundwater source for water supply.

## References


Andreescu I., Ticleanu N., Pana I., Pauliuc S., Pelin M., Barus T., (1985), Stratigraphie des depots pliocenes a charbones. Zones est d'Oltenie (secteur Olt - Jiu). An. Univ. Buc., Geol., XXXIV, p. 87-96, Bucarest.

Craciun P., Mihaila N., Giurgea P., Enciu P., Grigorescu St., Grigorescu G., Mogos E., Munteanu M., Ciobanu G., Dinulescu C., Maftei R., Panait C., (1996), Hydrogeological Mapping in Large Aquifer Basins. An. Inst. Geol. Rom., 69/II, p. 512-522, Bucharest.

Enciu P., (1998), The Study of the Pliocene and Quaternary in the Jiu-Desnatui interfluve. Abstract of Ph.D. thesis, 29p, Univ. "Al.I.Cuza" Iasi.

Enciu P., Popescu Gh., Hadnagy A., Ciulavu M., Enciu M., (1998), Hydrostratigraphy of the Neogene deposits from the central Dacian Basin. An. Inst. Geol. Rom., 70, p.15-20, Bucuresti.

Ghenea C., (1968), Studiul depozitelor pliocene dintre valea Prutului si valea Barladului. Inst. Geol., Stud. tehn. si econom., s.J, 6, Bucuresti.

Marinescu F., (1978), Studiul Neogenului superior din sectorul Dunare-Motru. Editura Academiei Romane, Bucuresti.