

**HYDROGEOLOGICAL OBSERVATION WELL FROM HARLAU, IASI
COUNTY – CONTRIBUTIONS TO THE KNOWLEDGE OF SARMATIAN
AQUIFER FROM THE NORTH PART OF MOLDOVA**

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Abstract

Hydrogeological observation well FA HARLAU pertains to the National Hydrogeological Network for Depth Groundwater and was drilled up to 170 meters depth, in year 2002.

The main research objective of this well was, from hydrogeological point of view, the study of Sarmatian deposits which develop in Hârlău area, Iași county.

It was intercepted alternation of clays and marls, with sands and argillaceous sands intercalations. It was intercepted the aquifer horizon situated between 148 and 156 meters depth.

FA HARLAU complete quantitative and qualitative hydrogeological information concerning the Sarmatian aquifer from the north part of Moldova, confirming the fact that this aquifer has a low quantitative potential and the water quality is inappropriate.

Key words: hydrogeological observation well, Sarmatian aquifer, groundwater quality.

Introduction

Hydrogeological observation well FA HARLAU was drilled in 2002 and it pertains to the National Hydrogeological Network for Depth Groundwater. The main research objective of this well was, from hydrogeological point of view, the study of Sarmatian deposits which develop in Hârlău area, Iasi county.

Well FA HARLAU is situated in the north-eastern part of Hârlău locality, in the Bahlui river meadow, at 140 meters altitude. (Fig.1)

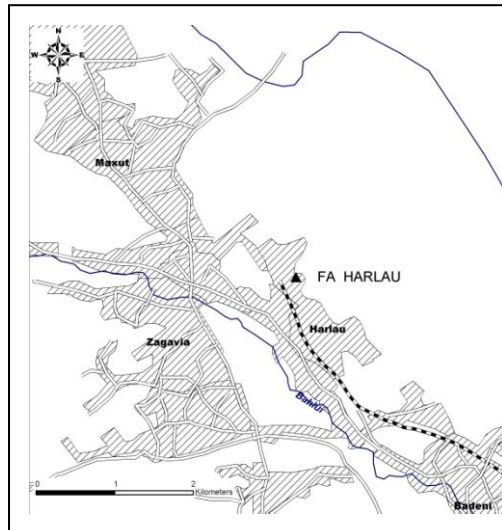


Fig.1 Location of the FA HARLAU Well

Geomorphological considerations

The study area is located in the southern part of Moldova Plain, known under the name of Lower Jijia and Bahlui Plain. This plain is characterized by a rippled relief, with large valleys, developed terraces and planes, with sculptural very fragmented interfluves.

The southern half of Moldova Plain is constituted by many small geomorphological units, one of them being the Hârlău-Hodora Depression.

Hârlău-Hodora Depression has an oblong configuration on the NW-SE direction (12 km length), with approximately 4 km width. The main characteristic is the superposition of this depression across the Bahlui valley, which extends a lot downstream, just after it leaves the Dealu Mare high unit.

Geological considerations

From structural point of view the Hârlău area belongs to Moldova Platform. This platform is constituted by a Precambrian peneplain basement and a sedimentary cover

formed by Ordovician, Silurian, Cretaceous, Miocene and Quaternary deposits, with some important stratigraphical gaps.

Sarmatian deposits sink from north to south, older terms (Buglovian) cropping out in north part, in Prut area, and new terms (Chersonian) cropping out at south of Iasi.

In Hârlău area the deposits belonging to Volhynian, Basarabian and Quaternary area crop out. (Fig.2)

Generally, the Volhynian is represented by clays and marls with sands and sandstones intercalations and the Basarabian is represented by the marly clayey facies of *Cryptomactra* Beds belonging to Lower Basarabian. In the western part of Hârlău area, this interval is constituted by sandy clay and sand, with rare clayey intercalations and sandstones.

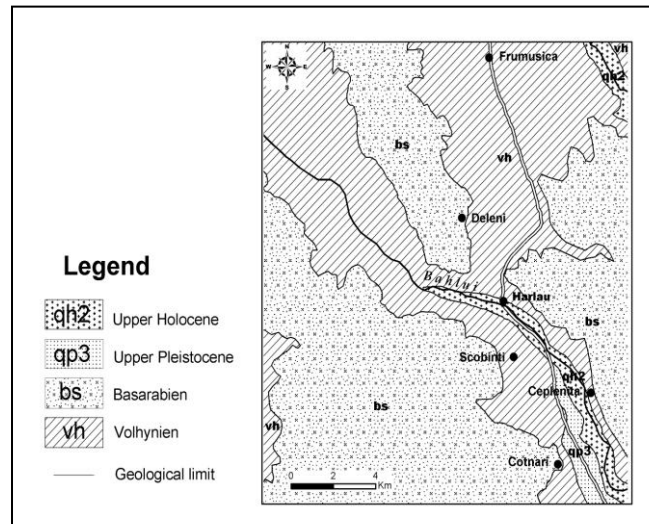


Fig.2 Geological map of the Hârlău area, Iași county

The Quaternary, represented by Holocene, is developed in the floodplain of Bahlui river and is constituted by clays, rarely sands and gravels.

In a geological study of the Dealu Mare-Hârlău region, published in 1997, Stefan separates the Upper Volhynian in two lithological units: Onega Clays (without fossils) in base and Lespezi-Tudora Sands and Sandstones (rich fossiliferous) in the upper part.

In Lower Basarabian the same author separates eight lithological units: Băiceni Clays and Sands, Hărmănești Sandstones, Bahlui-Sirețel Sands, Hârlău Sandstones, Sticlăria-Sângeap Sands, Crivești Sandstones, Humosu Sands and Dealu Mare Microrudites.

FA Harlau well – lithological, stratigraphical, hydrogeological and hydrochemical considerations

Observation well FA HARLAU was drilled in 2002 by SC LAFORSERVICE SRL Comănești and it pertains to National Hydrogeological Network for Depth Groundwater

Having 170 meters depth, this well had as objective the hydrogeological research of Sarmatian deposits developed in Hârlău area, Iași county.

The well intercepted fine sedimentary deposits constituted of marls, clay and sandy clay with sand and clayey sand intercalations.(Fig.3)

The micropaleontological analysis of 92-94 meters depth interval emphasized a microfaunistical association represented by foraminifera and ostracods characteristic for upper part of Volhynian.

On the geophysical diagraph base it was identified one aquifer layer, situated between 143,5 and 157 meters depth and which was catch on 148-156 meters depth (8 meters thickness).

The aquifer granulometric analysis shows that the aquifer is constituted of silty argillaceous sand (61% sand, 16% clay, 13% silt).

The piezometric level is artesian (3,5 meters above soil) and the yield was 0,3 l/sec.

In order to establish the aquifer hydrogeological parameters there were executed experimental pumping tests on single step, with $Q=0,1$ l/sec until the hydrodynamic level stabilization (24 hours) and the correspondent reversion (9 hours).

The determined hydrogeological parameters values are:

- Piezometric level $N_p = + 3,5$ m;
- Drawdown $s = 55,5$ m;
- Hydrodynamic level $N_{hd} = 59,5$ m;
- Exploitation yield $Q_{exp} = 0,1$ l/s;
- Hydraulic conductivity $K = 0,014$ m/day;
- Transmissivity $T = 0,113$ m²/day.

From qualitative point of view, the physical-chemical analyses of one water sample extracted from the well shows that the water is not potable because there are exceedings over maximum admitted concentration in case of some indicators (NH_4 , Cl, Fe, organic substances), according to Law concerning the quality of drinking water 458/2002 (Table 1).

Short considerations regarding the Sarmatian aquifer from the north part of Moldova

In order to increase the knowledge of the Sarmatian aquifer located in the north part of Moldova, during the time, there were executed, in the frame of National Hydrogeological Network for Depth Groundwater more hydrogeological observation wells, with depth between 95 and 260 meters (Fig.4, 5).

Table.1. FA HARLAU Well – hydrochemical characteristics

INDICATORS	MU	RESULTS	CMA(458/2002)
pH	unit.pH	8,11	6,5 – 9,5
Conductivity	µS/cm	5400	2500
Total hardness	ger. degrees	5	min. 5
Calcium	mg/l	12,8	-
Magnesium	mg/l	13,9	-
Iron	mg/l	0,36	0,2
Aluminum	mg/l	0,001	0,2
Chlorine	mg/l	992,8	250
Organic substances (KMnO ₄)	mg/l	36,1	20
Ammonium	mg/l	6,9	0,5
Nitrates	mg/l	0,8	50
Nitrites	mg/l	0,014	0,5

Going from presented data in tables 1 and 2 it observes that aquifer located in the Sarmatian deposits from North Moldova is confined, which locally can be artesian (Hârlău). The yields obtained at pumping tests have values comprised between 0,45 and 6,25 l/sec (majority being of 1 – 3 l/sec), for drawdowns of 1,86 – 65 m, which implies that specific yields have very low values: 0,002 – 0,4 l/sec/m.

Low values are also presented by the hydraulic conductivity (0,014 – 4,25 m/day) and transmissivity (0,113 – 11,495 m²/day).

Hydrochemically, it can outline an investigated area through Săveni, Botoşani and Dancu wells, in which the chlorides contents have very high values, between 856 and 16.000 mg/l. In the rest of investigated area (Dorohoi, Ruginoasa, Tg.Frumos) these contents go from 8 to 28 mg/l.

The Hârlău area represents a transition area between the northern part with low contents of Ca (12,8 – 72 mg/l) and Mg (13,9 – 36 mg/l) and the southern one with higher contents of Ca (96 – 348 mg/l) and Mg (58 – 89 mg/l).

Qualitatively, excepting FA Tg.Frumos, the water is undrinkable, having a high degree of mineralisation, in some areas being salted or presenting exceedings at certain chemical indicators, the most frequent at ammonium.

Generally, all these characteristics define the Sarmatian aquifer like an aquifer with low potential and with undrinkable water (Fig.5).

Table 2. Hydrogeological and hydrochemical characteristics of hydrogeological observation wells from the north part of Moldova

Well	Depth (m)	Filters	Np (m)	s (m)	Q (l/sec)	q (l/sec/m)	K medium (m/day)	T medium (m ² /day)	Chemism (mg/l) Quality
FA DOROHOI	95	34 – 41 47 – 52 74 - 81	39,6	1,86 – 5,43	0,5 – 1,5	0,28	1,14	21,66	Na=1,95;530 SO ₄ =308;631 Fe=urme;0,8 NO ₂ =urme;1,8 Freshwater Undrinking
FA SAVENI	207	148-154 169-182	3,1	8,69 18,2- 40,5	0,5 1-2	0,057 0,049- 0,055	0,029	5,51	NH ₄ =8,6 Na=1185 K=21,4 Fe=1,28 Cl=856 Salted water
FIA RUGINOASA	260	50 – 54 56 -102	19,6	5,4 – 15,4	2,15- 6,25	0,39-0,4	4,25	42,5	NH ₄ =0,25;4,0; 2,0 Freshwater Undrinking
FA TG.FRUMOS	200	35-46 60-70 160-168	10,5	8,5-25,6	1-3	0,117 – 0,118	0,489	11,495	Drinking water
FA DANCU	250	118-122 147-151 178-182	15	21,5 - 65	0,45 - 1,3	0,002	0,17	2	Na=9950 Cl=16000 Salted water
FA BOTOSANI	225	Non-productive Sarmatian deposits; between 142 – 143,2 meters gas manifestation							Chemical analyze on water separated from the drilling fluid: Na=1950 Cl=2100 SO ₄ =667 Saltwater

These wells intercepted various deposits which from litological point of view, belong to Lower Sarmatian .

The main hydrogeological and hydrochemical characteristics of these wells are synthesized in Table 2.

Conclusions

Hydrogeological observation well FA HARLAU was drilled in 2002 and pertains to the National Hydrogeological Network for Depth Groundwater. The main research objectives of this well was, from hydrogeological point of view, the study of Sarmatian deposits which develop in Hârlău area, Iași county.

Having 170 meters depth, the well intercepted fine sedimentary deposits, marls, clay and sandy clay with sand and clayey sand intercalations.

On the geophysical diagraph base it was identified one single aquifer layer, situated between 143,5 and 157 meters depth and which was caught on 148-156 meters depth (8 meters thickness).

The piezometric level is artesian (3,5 meters above soil) and the yield is 0,3 l/sec.

Hydrogeological parameters had small values ($K=0,014$ m/day, $T=0,113$ m²/day), the exploitation flow also have small values ($Q_{exp}=0,1$ l/sec), and the water quality is improper (admitted maximum concentration exceeding in case of NH₄, Cl, Fe, organic substances).

Hydrogeological observation well FA HARLAU confirms all information gathered by other hydrogeological wells: the porous-permeable horizons from the Sarmatian deposits situated in the northern part of Moldova detain one aquifer with low quantitative potential and inappropriate from qualitative point of view. Water has a rise mineralisation degree, in some zones being even salted.

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Figures

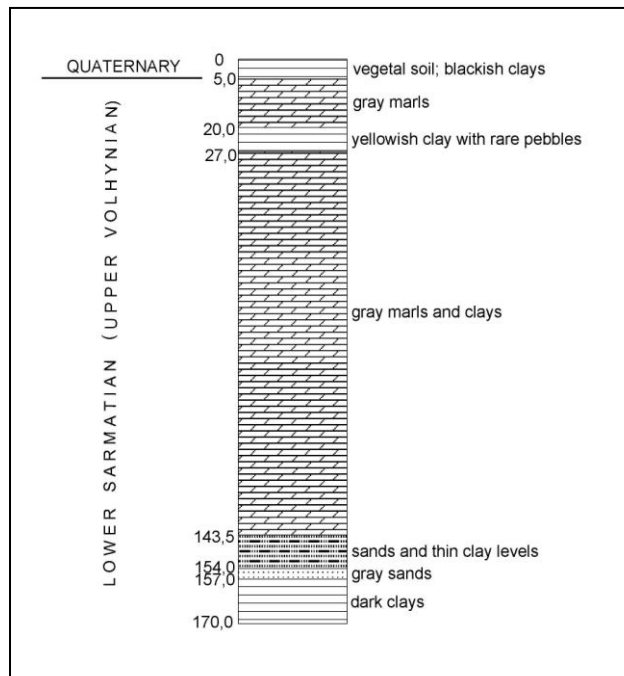


Fig.3 Lithological column of the FA HARLAU Well

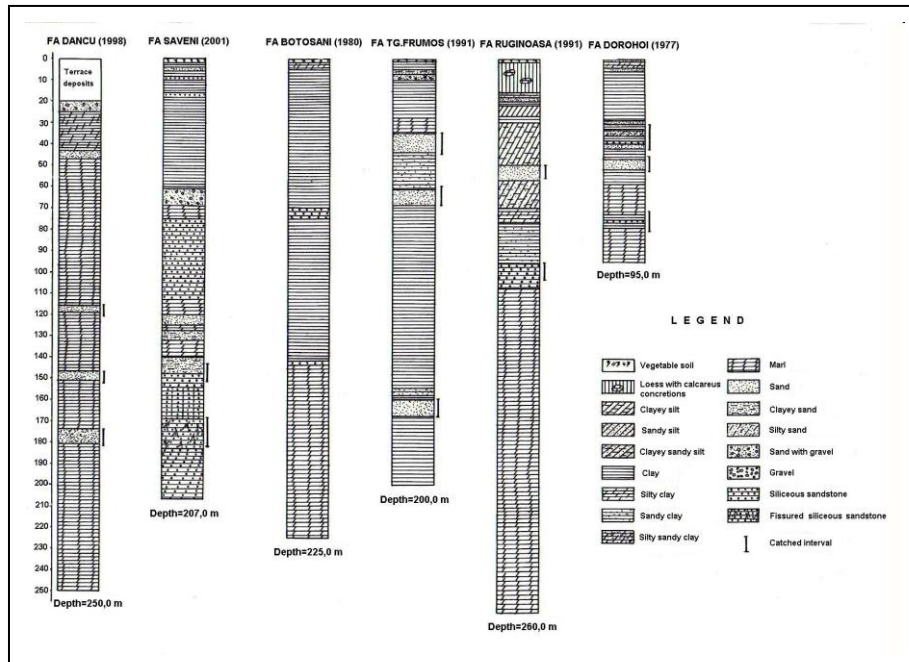


Fig.4. Lithological and hydrogeological characteristics of some observation wells executed in the north part of Moldova

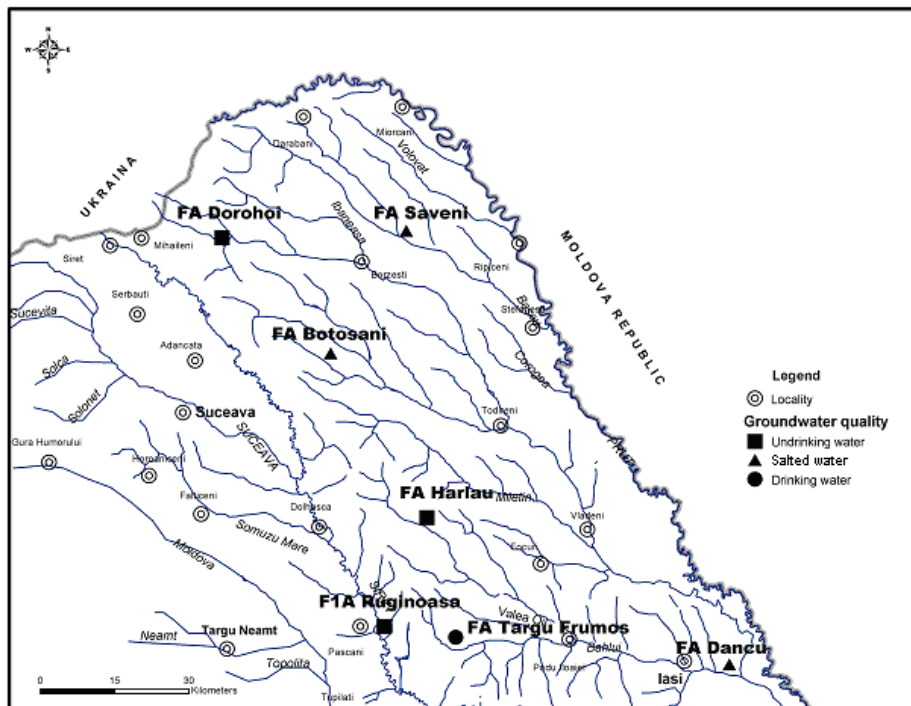


Fig.5. Location of the observation wells from the north part of Moldova and the groundwater quality