

## CHEMICAL CHARACTERIZATION OF GEOTHERMAL WATERS FROM WEST FIELD OF ROMANIA. IV. GEOTHERMAL WATERS FROM NORTH OF FIELD

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### ABSTRACT

Chemical characterization of geothermal waters of Pannonian System from northern region of West Field of Romania is presented here. Both its constituent like ( $\text{Cl}^-$ ,  $\text{NO}_2^-$ ,  $\text{NO}_3^-$ ,  $\text{HCO}_3^-$ ,  $\text{CO}_3^{2-}$ ,  $\text{SO}_4^{2-}$ ,  $\text{PO}_4^{3-}$ ,  $\text{Ca}^{+2}$ ,  $\text{Mg}^{+2}$ ,  $\text{Na}^+$ ,  $\text{K}^+$  etc.) and microelements were found in these waters using various methods. On the basis of these facts those can be classified in category bicarbonate-chlorate-sodium waters. The work is a comparative study from Oradea region.

### INTRODUCTION

The western part of the country called the Pannonian Depression is the hottest zone in Romania. It is characterised by a Mesozoic crystalline basement dissected into horsts and grabens. The research [1] geothermal area displays complex hydrogeological characteristics.

Due to these, there is necessary to study the geothermal aquifer, which is found in permeable formations of the Upper Pannonian, taking in account the general hydrologic characteristics of the entire area. This geothermal reservoir is formed by two formations from different structural periods. The lower geological framework, which is the basement for this geothermal reservoir, consists in formations of Presenonian. It continues to the western part of the country, the mineral formations from Padurea Craiului Mountains, Rezului, Bacului and Magura Simleului.

### RESULTS AND DISCUSSIONS

This paper presents the physical-chemistry characteristics of geothermal waters located in the northern part of the Western Plain of Romania. The distribution of geothermal activity is shown

Figure 1. The distribution of geothermal wells in the research area.



in figure 1. The following geothermal wells were taken for studies: Bors 529, 4155, 4156 and 4158, Tamaseu 1021, Mihai Bravu 603 and 605, Ciocai 4045, Sacuieni 4058, 4076, 4797, 4696, 1704, 4692, 4694, 752 and 4691, Chereșeu 4057, Adoni 300, Ciuhoi 4076, Sarcau 4078, Chislaz, Chiraleu

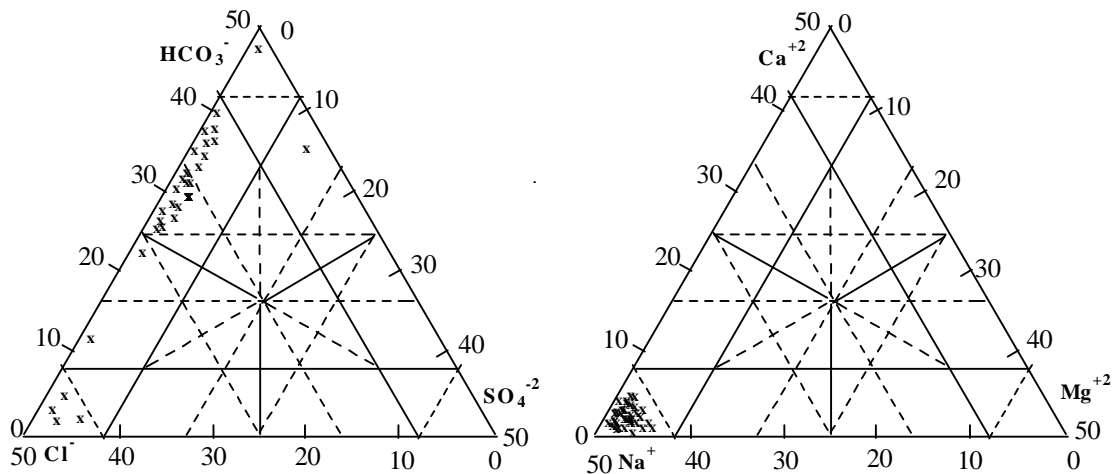
4094, Sanicolau de Munte 4028, Cenalos 4079, Marghita 4089, Valea lui Mihai 4090, Satu Mare 4741 and 4743, Carei 4063, Satmarel 4716, Acas 4060, Moftin 4760 and Tasnad 4777 [2].

The major components from these geothermal

waters were analyzed. The results are presented in Table 1. Compared to the waters, which have the origin in Cretacic and Triassic aquifers, the geothermal waters from the Western Plain of Romania contain methaboric acid. Gases like: methane, carbon dioxide and sometimes argon, krypton and helium can be detected in these waters as well. The high concentration of organic compounds in these waters proves the contact of water with some petroliferous layers. The major characteristic is the abundance of bicarbonate, sodium and chloride. The main compounds of geothermal waters from the gram percent, in Table 2.

The concentration of cations (from Table 2) does not vary much, but sodium is in a very high concentration in all these waters. Regarding the composition of anions the data from Table 2 show a very different composition from water to water. Some geothermal waters present a very high concentration of chloride and some of them a high amount of bicarbonate anions. Figure 2 shows the diagram with the distribution of the major anions ( $\text{HCO}_3$ ,  $\text{Cl}$ ,  $\text{SO}_4$ ) and the diagram with the distribution of the main cations ( $\text{Na}$ ,  $\text{Ca}$ ,  $\text{Mg}$ ) for the 34 geothermal wells located in the research area.

Figure 2. The triangular diagram with the distribution of ions in geothermal waters.



The Bors basin, which is located at the margins of Triassic collector, has a particular behavior. The type of this water is sodium chloride. The mineralisation is more than 10 g/l. The characteristic formula for geothermal waters from all over the Bors basin is  $\text{Cl}^-\text{Na}^+$ . Well 529 is a production well from Bors and it was observed for a longer period. After the production was stopped, it was reinjected cold water with a composition as a river water. Later, after well 529 was started again, the mineralisation dropped until about 7 g/l, but after a month the mineralisation increased to values more than 10 g/l. Geothermal waters from Bors have a sodium chloride mineralisation, that makes them close to the last evolution period of these geothermal waters after Chebotarev. These waters also contain carbon dioxide and methane [3]. The very high temperature of geothermal waters from Bors basin (about  $127^\circ\text{C}$ ) and the relatively high pressure of carbon dioxide will accelerate the precipitation of calcium carbonate from the water since the gas pressure

has been decreasing. If they compare this property of geothermal waters from Bors with geothermal water from Triassic from Oradea, the last one will not form calcium carbonate deposits even if it has a higher content of calcium. They assume that the higher stability of Triassic geothermal waters from Oradea is due to the high content of sulphate in these waters. Geothermal waters from Oradea being the type calcium-sulphate, at the measured temperature the calculated solubility of calcium sulfate may keep this in solution.

Taking in account the ratio of chloride and bicarbonate ions from table 2 it is possible to make a classification of these geothermal waters. Wells 1021, 605, 603, 4076, 4014 and 4094 which are located in Tamaseu-Mihai Bravu area, south to Sacuieni, Sanicolau de Munte, Chiraleu and Chislaz can be included in one group. Other distinct group corresponds to Sacuieni basin, where the chloride: bicarbonate ratio is about 0.5; Marghita basin has this ratio approximately 1;

Sarcou basin with the ratio more than one, Carei-Tamaseu-Moftin basin and finally Satu-Mare basin which includes Satu-Mare – Satmarel-Acas.

The type of geothermal water from well 1021 Tamaseu is  $C^sCl^1Na^w$ , having a high content of hydrocarbons and carbon dioxide, but it also contains rare gases, especially argon and helium. This geothermal water is well fit for balneological use. Geothermal waters from wells 4028 Sanicolau de Munte, 4076 Sacuieni, 4014 Chislaz and 4094 Chiraleu correspond to the  $C^sCl^1Na^w$  type and they are included into Tamaseu basin.

Sacuieni basin presents some characteristic properties compared to those from geothermal water from Tamaseu-Chiraleu evens if they have the same formula  $C^sCl^1Na^w$ . The points from the triangular diagram tend to rather chloride waters. In this area the chloride: bicarbonate ratio is approximately 0.5. Due to the high floweret and temperature, waters from Sacuieni basin have been utilized for greenhouse heating.

Marghita basin is known for its three geothermal wells (4089, 1705 and 1714) and it is characterized by  $C^mCl^mNa^w$  formula. It is obvious the difference between this basin and Sacuieni or Tamaseu basins. The chloride: bicarbonate ratio is equal to one. From this basin geothermal well 4089 is used for therapy.

Sarcou basin is known by two geothermal wells: 1078 and 4079. Both of them have waters with  $Cl^wNa^w$ , formula. These waters are very different compared to the others from this area. The mineralisation of these waters is very high, more than 30 g/l, mineralisation that reminds about the chemical composition of sea water. It is probably a fossil reservoir.

Tasnad-Carei basin has a geothermal water with a higher concentration of chloride, while the bicarbonate concentration is lower. Waters from the studied wells have the following formulas:  $Cl^wNa^w$ , (4181 Tasnad),  $C^wCl^1Na^w$  and  $C^sCl^mNa^w$ . The chloride: bicarbonate ratio is more than five. It is interesting the chemical behavior of geothermal water from well 4181. Waters from different depths were sampled and analyzed. Waters from 936-785 m depth contain chloride in a big amount and the mineralisation is 7 g/l. Waters from 748-698 m have a low salinity, they are very rich in bicarbonate. The mineralisation is about 1 g/l.

In the northern part of the research area is located

Satu Mare basin. The chemical composition of geothermal water from this basin is dominated by bicarbonate, waters being bicarbonate type.

A general view over the chemical characteristics of geothermal waters from the northern part of Western Plain of Romania indicates an important of chloride anions from SV to NE, from Tamaseu - Sacuieni to Marghita – Tasnad – Carei. A similar phenomenon can be observed from Satu Mare to Carei and Tasnad (Figure 3).

We consider that it is necessary to tell about several wells, which present some characteristics, but they are not included in the basin where they are part. So, well 4045 Ciocaia has a low concentration of bicarbonate and the chloride: bicarbonate ratio is 0.17. Well 300 Adoni contains geothermal water with a mineralisation much less than the average of the collector. It also has a very low content of chloride, the chloride: bicarbonate concentration ratio being 0.013.

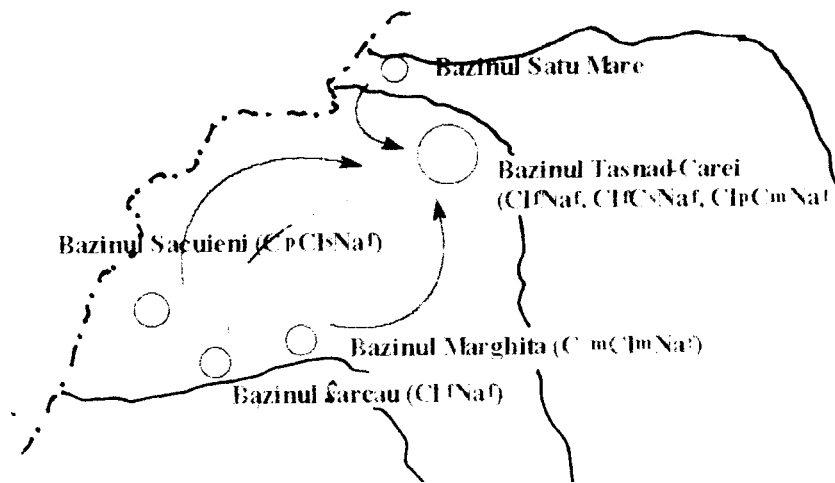
## CONCLUSIONS

The chemical characteristics of geothermal waters in the research area are rather similar. This indicates more or less the continuity of the aquifer with some peculiarities. The chemical composition of these waters must be studied in tight connection with the rocks they are connected with and with hydrocarbons and carbon dioxide accumulation. It is amazing that the sulfate concentration in these waters does not exceed 5 mg/l. This can be explained considering that waters from this aquifer have always been in contact with a big amount of organic compounds, which are able to reduce the sulfate into sulfide. Hydrogen sulfide, which is the product of this chemical process, probably makes bonds with the heavy cations.

The absence of calcium can be due to the precipitation as a carbonate or more probably it can be imagine an ionic exchange, when the calcium and the magnesium are restrained. Accepting this mechanism we can imagine how waters from this basin have concentrated in sodium, while the calcium and magnesium concentrations decrease.

An unusual characteristic presents the geothermal water from well Ciocaia 4045, which has a very high mineralisation rich in sodium bicarbonate. This can be the result of accumulation of carbon dioxide, because nearby there is a very big accumulation of carbon dioxide. As we approach

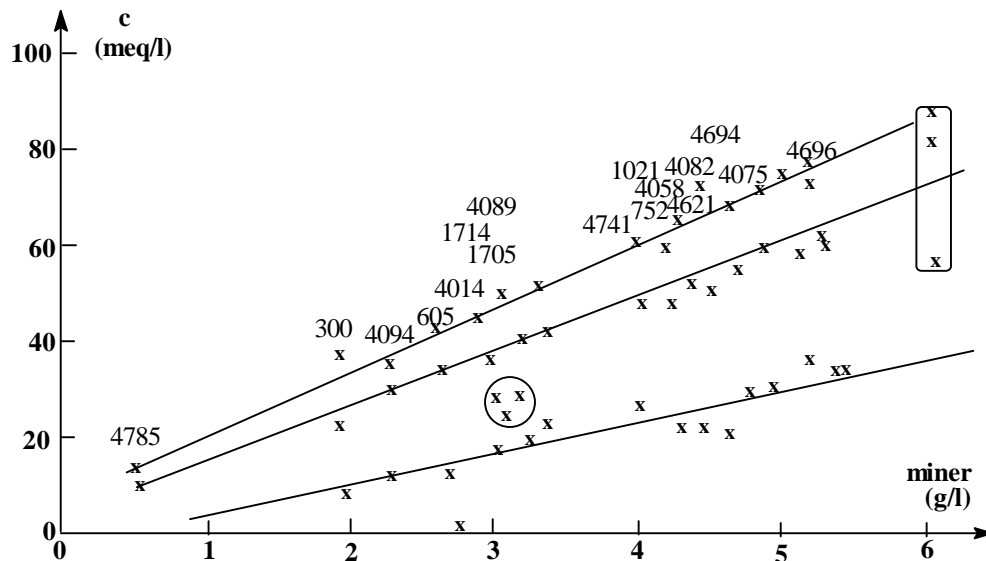
Figure 3. The geothermal fluid flow pattern



of the carbon dioxide reserve as much the chloride concentration decreases and the bicarbonate concentration into the water increases. This exchange can be explained by the catalytic activity of the clay that is in interaction with the geothermal water.

The bicarbonate concentration increases towards well 4045 Ciocaia, being influenced by the carbon dioxide reservoir. The figure 4 shows that the bicarbonate, chloride and sodium concentrations increase proportional with the mineralisation, except Marghita and Tamaseu basins.

Figure 4. The concentration of major ions against mineralisation.



Taking in account the microelements content (determinations were made by emission spectrometry) they can notice the absence of heavy cations, except ferrum, which is probably the result of corrosion of the pipe. From this point of view, the distribution of methaboric acid on the entire surface of the collector, is very important, the maximum concentration being recorded in

Sacuieni basin. The presence of methaboric acid in this aquifer can be explained by two possible mechanisms: it comes from fossil waters or it has an endogenous nature. Besides the presence of this acid they can observe the constant pressure of helium, that reaches the maximum concentration in the eruptions of the gases which appear at geothermal waters from well 1021 Tamaseu.

Table 2. The content of main ions from geothermal the Pannonian collector basin located in the north part the Western Plain of Romania, in meq/l .

Nr. crt	Sursa	[Cl <sup>-</sup> ] (%meq)	[HCO <sub>3</sub> <sup>-</sup> ] (%meq)	[SO <sub>4</sub> <sup>-2</sup> ] (%meq)	[Na <sup>+</sup> ]+[K <sup>+</sup> ] (%meq)	[Ca <sup>+2</sup> ] (%meq)	[Mg <sup>+2</sup> ] (%meq)
1	529	41,10	6,51	2,63	47,03	1,84	0,56
2	4155	43,26	6,05	0,69	48,98	0,22	0,31
3	4156	41,40	7,046	0,86	47,50	1,08	0,23
4	4158	41,11	6,39	0,62	47,26	0,90	0,15
5	1021	9,83	39,99	0,08	48,96	0,22	0,20
6	603	10,55	39,36	0,09	49,20	0,20	0,19
7	605	13,08	35,46	-	49,68	0,28	0,21
8	4045	6,49	43,43	0,07	49,49	0,06	0,07
9	4058	15,93	34,06	-	49,15	0,09	0,22
10	4076	12,94	36,82	0,24	47,66	0,27	0,12
11	4797	15,04	34,73	0,07	46,31	0,93	2,01
12	4696	14,18	35,09	0,72	48,29	1,26	-
13	1704	10,90	39,10	-	48,49	0,29	0,16
14	4692	6,64	43,04	0,29	47,75	1,30	0,92
15	4694	16,35	34,40	0,16	49,50	0,05	0,03
16	752	15,07	34,73	0,20	49,13	0,28	0,28
17	4691	14,62	35,28	0,09	49,13	0,23	0,53
18	4057	16,94	32,68	-	49,50	0,25	0,24
19	300	0,60	49,39	-	48,92	0,37	0,47
20	4075	11,57	37,54	0,88	46,87	0,61	1,18
21	4078	44,64	5,34	0,02	44,08	2,88	2,34
22	4014	13,34	36,56	0,09	48,66	0,36	0,20
23	4094	13,00	36,84	-	48,78	0,39	0,30
24	4028	9,88	40,03	0,09	49,29	0,23	0,21
25	4079	41,10	8,81	0,09	46,90	1,55	1,55
26	4089	19,88	31,74	-	48,87	0,41	0,48
27	4090	21,65	28,35	-	48,92	0,38	0,70
28	4741	6,98	38,98	-	49,08	0,10	0,10
29	4743	8,47	41,47	-	49,02	0,17	0,17
30	4063	5,84	44,12	0,04	48,54	0,32	0,29
31	4716	36,57	13,35	0,07	47,73	0,81	0,20
32	4060	6,17	41,72	0,23	48,27	0,54	0,32
33	4760	25,74	24,02	0,12	48,29	0,34	0,12
34	4777	44,20	5,75	0,47	48,50	0,48	0,84

- -<sup>w</sup> = very strong
- -<sup>s</sup> = strong
- -<sup>m</sup> = moderate
- -<sup>l</sup> = low

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Tabel nr. 1  
Chemical composition of geothermal waters in the research area

	529	4155	4156	4158	1021	603	605	4045	4058	4076	4797	4696	1704	4692	4694	75
	6,40	6,70	6,65	7,15	7,82	7,85	7,55	7,80	7,45	8,00	7,00	7,00	7,45	7,02	7,30	7,3
/cm	16300	23100	18000	22200	4139	5020	3700	10990	11350	8800	8500	8700	8000	14100	8600	91,
g/l	6734	12367	11860	11826	2800	3270	2091	8790	4330	3423	3483	3716	3386	8168	4590	41,
G	20,01	6,44	22,51	15,61	1,34	1,54	0,97	1,26	1,51	1,29	10,30	4,70	1,78	17,92	0,29	2,1
g/l	4387,9	6767,4	6282,8	6075,5	392,02	521,23	281,88	780,12	824,44	514,17	666,60	666,60	436,13	673,74	709,20	744
mg/l	123,74	190,00	180,00	171,33	11,055	14,699	9,034	22,000	23,254	14,500	18,799	18,799	12,899	19,000	20,000	21,0
g/l	a	a	0,12	4,41	1,99	a	a	a	0,21	a	a	a	0,21	a	0,19	0,1
mg/l	-	-	0,003	0,096	0,043	-	-	-	0,002	-	-	-	0,006	-	0,004	0,0
g/l	0,21	a	0,29	0,14	a	a	0,34	a	0,10	a	a	a	a	a	0,22	a
mg/l	0,003	-	0,005	0,002	-	-	0,005	-	0,002	-	-	-	-	-	0,036	-
g/l	1195,8	1621,1	1978,2	1685,9	2741,2	3347,2	1616,2	8980,5	3032,8	2516,8	2648,0	2837,0	2823,6	7508,1	2566,9	295
mg/l	19,603	26,575	32,418	26,638	44,937	54,853	26,495	147,22	49,705	41,259	43,410	46,508	46,289	123,08	42,080	48,3
g/l	379,8	144,8	173,6	139,5	4,51	6,07	a	12,35	urme	13,17	13,40	46,00	urme	39,91	9,46	13,
mg/l	7,913	3,018	3,740	2,906	0,094	0,126	-	0,257	-	0,274	0,279	0,958	-	0,831	0,197	0,2
mg/l	<b>150,54</b>	<b>219,59</b>	<b>216,17</b>	<b>201,03</b>	<b>56,129</b>	<b>69,678</b>	<b>34,534</b>	<b>169,48</b>	<b>72,961</b>	<b>56,033</b>	<b>62,496</b>	<b>66,273</b>	<b>59,188</b>	<b>142,91</b>	<b>62,281</b>	<b>69,6</b>
g/l	2,37	2,40	10,69	8,33	10,33	10,00	5,07	23,24	12,42	5,00	15,00	10,00	6,65	12,05	9,05	7,4
mg/l	0,132	0,133	0,591	0,463	0,574	0,554	0,282	1,291	0,688	0,278	0,833	0,555	0,369	0,669	0,503	0,4
g/l	3100,0	4950,0	4610,0	4484,5	1260,0	1570,0	800,00	3850,0	1640,0	1325,0	1322,0	1464,0	1325,0	3150,0	1400,0	155
mg/l	134,78	215,22	203,1	195,0	54,783	68,260	34,783	167,39	71,304	57,609	57,478	63,652	57,609	136,96	60,869	67,3
g/l	143,00	80,0	134,2	80,00	9,20	12,00	13,5	23,80	17,20	19,30	15,00	15,00	25,00	30,00	18,00	21,
mg/l	7,980	2,046	3,432	2,046	0,235	0,306	0,345	0,608	0,440	0,494	0,384	0,384	0,639	0,767	0,460	0,5
g/l	111,02	19,24	94,58	75,15	5,01	5,60	3,91	4,00	4,40	6,31	23,20	33,60	6,81	74,95	1,30	7,7
mg/l	5,540	0,960	4,720	3,750	0,250	0,283	0,195	0,199	0,219	0,315	1,158	1,677	0,340	3,740	0,065	0,3
g/l	20,38	16,29	40,37	22,19	2,79	3,26	1,82	3,04	3,89	1,77	30,60	urme	2,31	32,34	0,42	4,8
mg/l	1,677	1,341	3,320	0,630	0,229	0,268	0,149	0,250	0,320	0,145	2,516	-	0,190	2,659	0,034	0,3
g/l	2,22	0,19	28,40	0,63	0,15	0,06	0,02	0,16	0,20	0,39	3,00	1,00	0,72	2,16	0,40	1,3
mg/l	0,079	0,007	1,017	0,022	0,005	0,002	0,001	0,005	0,007	0,014	0,107	0,036	0,027	0,077	0,014	0,0
g/l	<b>150,18</b>	<b>219,71</b>	<b>215,64</b>	<b>201,05</b>	<b>56,076</b>	<b>69,673</b>	<b>35,354</b>	<b>169,74</b>	<b>72,978</b>	<b>58,855</b>	<b>62,476</b>	<b>66,304</b>	<b>59,308</b>	<b>144,20</b>	<b>61,945</b>	<b>69,1</b>
g/l	108,0	106,0	117,6	106,0	45,95	28,47	37,00	53,61	50,44	60,00	51,70	44,00	40,00	62,50	44,50	54,
g/l	180,0	451,72	285,0	249,5	31,62	49,52	11,90	59,13	98,50	38,20	33,40	41,22	78,00	40,20	49,60	44,
g/l	-	-	-	-	32,46	45,50	38,07	60,50	59,56	48,66	28,20	46,50	56,99	52,66	50,49	54,
g/l	0,84	1,22	2,12	1,30	0,62	0,60	1,14	4,50	5,19	4,53	3,89	4,40	3,90	4,50	2,80	6,0
g/l	9333,5	14023	13923	12794	4504,7	5543,5	2771,7	13791	5704	4500,1	4910,8	5281,8	4627,6	11626	4809,0	530

	4057	300	4075	4078	4014	4094	4028	4079	4089	4090	4741	4743	4063	4716	4060	47
	7,85	7,70	7,05	6,80	7,75	7,32	7,95	6,90	7,08	8,00	7,65	7,70	8,00	8,00	8,05	7,8
/cm	5900	3650	5800	38512	3490	5200	4650	40000	8600	6800	3104	3000	3102	1650	1600	200
g/l	4300	1919	2837	29910	1950	1703	3200	19852	2052	2600	2640	2540	2320	4010	1200	298
G	2,02	1,68	2,58	165,31	1,17	1,13	1,51	60,20	1,96	2,97	1,68	1,34	1,43	6,44	1,31	1,4

g/l	886,67	14,18	428,5	16902	354,60	279,24	425,52	10106	631,90	760,42	240,46	301,41	177,77	1890,2	111,88	100
q/l	25,005	0,399	12,084	476,65	10,000	7,786	12,000	284,68	14,983	21,444	6,781	8,500	5,013	53,305	3,155	28,1
g/l	0,15	0,06	0,05	a	0,30	0,15	a	a	a	a	a	a	a	a	a	a
q/l	0,002	0,001	0,001	-	0,006	0,002	-	-	-	-	-	-	-	-	-	-
g/l	0,12	0,06	a	a	0,30	0,41	a	0,19	0,36	a	a	a	a	a	a	a
q/l	0,003	0,007	-	-	0,006	0,009	-	0,002	0,006	-	-	-	-	-	-	-
g/l	2945,4	2013,0	2391,5	3481,0	1672,4	1345,5	2967,3	3721,9	1459,0	1713,5	2539,3	2540,6	2310,1	1187,2	1301,0	160
q/l	48,272	33,000	39,205	57,065	27,416	22,057	48,644	61,015	23,917	28,081	37,871	41,639	37,871	19,459	21,328	26,2
g/l	urme	a	44,10	8,62	3,20	urme	0,51	30,45	urme	urmr	7,93	2,90	1,75	4,99	5,61	5,6
q/l	-	-	0,919	0,179	0,067	-	0,107	0,634	-	-	0,165	0,060	0,036	0,104	0,117	0,1
q/l	<b>73,844</b>	<b>35,407</b>	<b>52,224</b>	<b>533,89</b>	<b>37,489</b>	<b>29,938</b>	<b>60,752</b>	<b>346,33</b>	<b>37,679</b>	<b>49,525</b>	<b>44,817</b>	<b>50,199</b>	<b>42,920</b>	<b>72,881</b>	<b>25,560</b>	<b>54,6</b>

g/l	11,54	2,70	25,00	74,14	10,36	5,50	5,61	3,42	2,40	-	11,40	10,39	12,96	18,24	6,30	12,1
q/l	0,640	0,150	1,389	4,119	0,575	0,305	0,312	0,190	0,133	-	0,633	0,577	0,720	1,013	0,350	0,6
g/l	1642,0	748,00	1119,6	10640	834,00	650,00	1360,0	7400,0	800,00	1100,0	1000,0	1125,0	950,00	1600,0	570,00	122
q/l	71,391	31,522	48,678	462,61	36,261	28,261	59,130	321,74	34,783	47,826	43,478	48,913	41,304	69,565	24,782	53,0
g/l	19,80	85,00	7,50	400,00	8,20	14,50	13,50	120,00	80,00	10,00	20,60	9,00	9,60	17,90	6,20	15,0
q/l	0,506	2,174	0,192	10,230	0,210	0,371	0,345	3,069	2,046	0,255	0,510	0,310	0,245	0,458	0,158	0,3
g/l	7,41	5,31	12,80	626,43	5,41	4,61	5,61	216,03	6,21	7,48	10,22	6,21	5,50	23,84	5,61	7,6
q/l	0,370	0,265	0,639	30,760	0,270	0,230	0,280	10,750	0,310	0,373	0,090	0,169	0,274	1,190	0,280	0,3
g/l	4,26	4,07	15,00	343,87	1,82	2,13	3,16	130,36	4,74	8,39	1,09	2,06	3,04	13,49	2,31	1,5
q/l	0,351	0,335	1,233	28,279	0,150	0,175	0,260	10,720	0,360	0,689	0,090	0,169	0,250	0,290	0,190	0,1
g/l	0,25	0,38	0,10	10,39	0,17	0,23	0,07	7,40	0,64	-	0,27	0,30	0,17	0,39	0,18	0,1
q/l	0,009	0,014	0,003	0,372	0,006	0,008	0,002	0,265	0,023	-	0,010	0,011	0,006	0,014	0,006	0,0
g/l	<b>73,627</b>	<b>35,460</b>	<b>52,134</b>	<b>536,37</b>	<b>37,472</b>	<b>29,350</b>	<b>60,329</b>	<b>346,26</b>	<b>37,676</b>	<b>49,143</b>	<b>44,811</b>	<b>50,210</b>	<b>42,799</b>	<b>73,349</b>	<b>25,773</b>	<b>54,9</b>
g/l	65,40	22,40	24,60	55,04	41,59	39,00	44,083	38,00	40,80	31,31	32,50	58,00	55,45	37,36	31,00	31,0
g/l	107,67	22,40	34,70	194,13	25,40	16,60	18,10	103,10	22,14	30,25	17,23	22,15	35,96	56,27	10,25	11,0
g/l	59,09	55,98	63,12	19,12	0,50	10,06	24,82	54,18	35,44	28,96	44,01	40,11	31,30	24,23	14,57	25,0
g/l	4,65	5,36	0,21	1,30	0,30	0,70	0,73	4,50	0,56	0,51	0,76	0,31	0,58	0,45	0,28	0,6
g/l	5690,7	2898,5	4121,4	32542	2932,1	2358,0	4829,9	24877	3047,8	3661,3	3938,8	4056,8	3526,4	4822,9	1984,4	389

