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CHEMICAL CARACTERIZATION OF GEOTHERMAL WATERS FROM WEST FIELD OF ROMANIA. VI. GEOTHERMAL WATERS FORM SOUTH ZONE OF FIELD

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ABSTRACT

Chemical characterization of geothermal waters of Pannonian System from south region of Western Plain of Romania is presented in this paper. Both constituents like: Cl^-, NO_2^-, NO_3^-, HCO_3^-, CO_3^{-2}, SO_4^{-2}, PO_4^{-3}, Ca^{+2}, Mg^{+2}, Na^+, K^+ and microelements were found in these waters by using various methods. Based on the chemical composition geothermal waters could be classified as chloride-bicarbonate-sodium waters and bicarbonate-chloride- sodium. This work is a comparative study with Oradea geothermal area.

INTRODUCTION

Sanicolaul Mare area constitutes a part of the western Banat zone, that is a marginal subunit of Pannonian Depression. The Highis dorsal represents the western submersible prolongation of Highis-Dorcea Mountains, being extended on the hungarian territory by the elevation from Battonya. The submergence is realised by several structural steps, geophysical pointed out by the boreholes located to the west of Zarand-Lugoj fault.

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

In senonian, this depression zone has already functioned as a subsistence area, that accumulated dentritic formations over 1000 m thickness. The neogen stratigraphic sequence is about 4000 m thick. Within this thickness 3000 m belong to Pannonian.

The depression zone Sanicolau-Jimbolia represents in fact the central part of an area of neogen deposits orientated from north to south, extended both on Serbia and Hungary territory, where, within Mako fossa the preneogen basement is come down to 6000 m depth. [1,2]

RESULTS AND DISCUSSION

In this paper they studied the physical-chemistry properties of the geothermal waters located in the south area of the Western Plain of Romania. The studies were made for the following geothermal wells: 4630 Jimbolia, 1544, 4607, 4632, 4633 and 4636 Lovrin, 1521, 1526, 4608 and 4645 Sanicolau Mare, 1564, 4634 and 4653 Tomnatec and 2181 Racajdia. The distribution of the wells is illustrated in Figure 1. The establish the content of major elements of the geothermal waters it has determined in known mode. [3]

The experimental results are presented in Table 1. For the classification of these waters, Table 2 presents the composition in meq percentage of the major ions. In figure 2 it is shown the diagram by Florea for the distribution of meq of major ions from the geothermal waters and in figure 3.

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

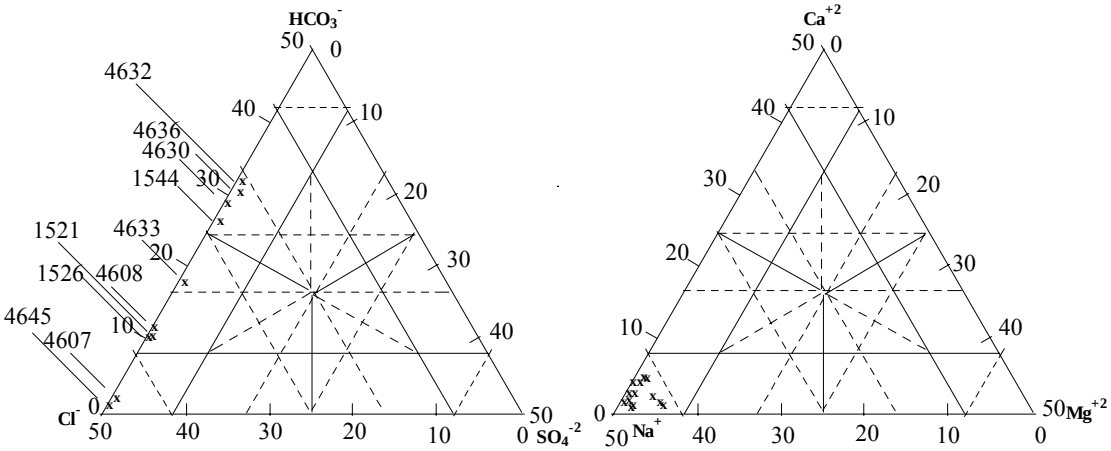
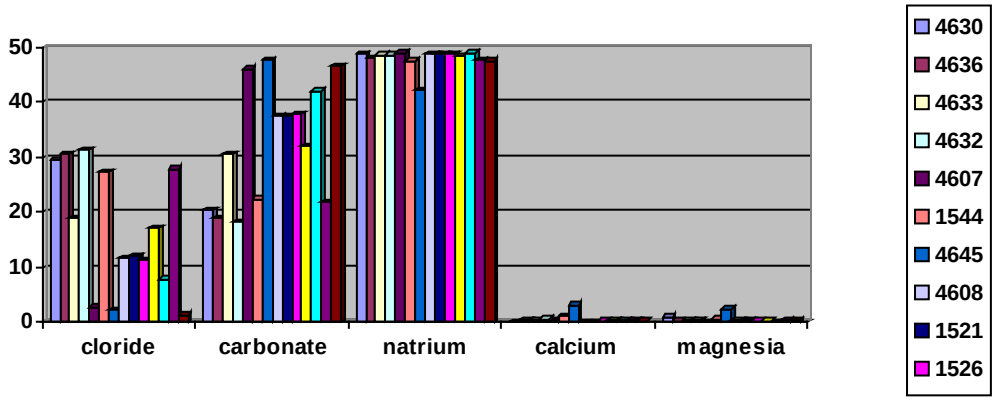


Figure 3. The chemical content of geothermal waters function of employed source



Water from well 4630 Jimbolia is classified as a moderate chloride, moderate bicarbonated and very strong sodium type of water ($Cl^{m}C^{m}Na^{w}$). To the north, at Lovrin, waters are richer in chloride, being strong chloride and moderate bicarbonated, like the geothermal wells: 1754 and 4639 ($Cl^{s}C^{m}Na^{w}$) and moderate chloride and bicarbonated ($Cl^{m}C^{m}Na^{w}$). In Sanicolau Mare basin waters tend to an alkaline character, being strong bicarbonated, moderate chloride ($C^{s}Cl^{m}Na^{w}$).

You can notice a general tendency to enrich in chloride concentration of the geothermal waters from the south of the Western Field. The presence of boric acid in these waters constitutes one more evidence regarding on the continuity of the geothermal collector over all the field.

Significant for this area is also the very high concentration of organic compounds. The presence of phenol could indicate a contact of underground waters with the reservoir of

hydrocarbons, phenomenon that takes place in the entire collector zone.

The sulfate concentration of these waters is insignificantly. This is not amazing, because it is a property found for most of the waters from the West Field.

CONCLUSIONS

The chemical characteristics of geothermal waters from the studied area are very close to those of the other waters which were analysed from the rest part of the Western Field of Romania. That indicates the continuity of the aquifer, obviously with local particularities.

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Tabel 1 Chemical composition of geothermal waters in the reasearch area

		Jimbolia	Lovrin					Sanicolau Mare				Tomnatec			Racajdia
		4630	4636	4633	4632	4607	1544	4645	4608	1526	1521	1564	4634	4653	2181
PH		8,00	7,95	6,70	6,70	6,80	6,75	7,60	7,70	6,90	7,40	7,81	7,00	7,60	7,40
Cond.	(µS/cm)	5140	5800	4600	6500	7000	6000	-	6000	6000	-	4300	2500	-	1400
Residue	(mg/l)	2993	2961	2203	2891	5362	2608	3558	3473	3423	3770	2704	1182	3390	546
Hardness	^oG	2,60	2,23	2,10	2,94	2,32	5,04	13,90	2,02	2,02	6,90	2,60	0,78	2,00	0,49
anions															
$[Cl^-]$	(mg/l)	1099,26	116,99	531,90	1099,26	120,56	886,50	49,20	460,98	450,02	436,00	467,36	113,47	1068,00	10,63
	(meq/l)	30,965	31,464	14,893	30,965	3,396	24,972	1,387	12,985	12,677	12,295	15,981	3,196	30,118	0,300
$[NO_2^-]$	(mg/l)	a	a	0,19	a	a	a	a	0,05	0,03	a	a	a	a	a
	(meq/l)	-	-	0,004	-	-	-	-	0,001	0,001	-	-	-	-	-
$[NO_3^-]$	(mg/l)	0,47	0,14	0,28	0,13	a	0,26	0,43	0,78	0,90	0,64	0,54	a	0,64	0,75
	(meq/l)	0,007	0,002	0,004	0,002	-	0,004	0,007	0,012	0,015	0,010	0,006	-	0,010	0,012
HCO_3^-	(mg/l)	1302,81	1195,96	1494,50	1128,50	3355,00	1281,00	1794,00	2616,79	2410,14	2511,00	1823,76	1067,50	1433,40	529,18
	(meq/l)	21,357	19,606	23,912	18,056	53,690	20,496	29,410	41,259	39,510	41,164	29,898	17,080	23,498	9,709
$[SO_4^{-2}]$	(mg/l)	a	13,56	6,17	13,58	53,06	5,76	4,00	43,62	30,25	38,00	28,86	a	17,40	18,93
	(meq/l)	-	0,283	0,126	0,285	1,115	0,121	0,083	0,909	0,630	0,792	0,497	-	0,362	0,394
$[PO_4^{-3}]$	(mg/l)	a	0,20	0,56	a	a	a	0,30	a	a	0,40	a	0,44	0,04	a
	(meq/l)	-	0,006	0,018	-	-	-	0,009	-	-	0,013	-	0,014	0,001	-
Total	**(meq/l)**	**52,329**	**51,361**	**39,290**	**49,358**	**58,191**	**45,594**	**30,896**	**55,166**	**52,828**	**54,274**	**46,386**	**20,290**	**53,989**	**10,418**
Cations															
$[NH_4^+]$	(mg/l)	7,41	12,53	5,24	5,80	6,00	7,53	23,20	7,41	7,40	9,54	11,10	1,80	30,80	4,83
	(meq/l)	0,412	0,696	0,288	0,319	0333	0,436	1,278	0,412	0,411	0,530	0,617	0,099	1,711	0,243
$[Na^+]$	(mg/l)	1160,00	1150,00	850,00	1050,00	1250,00	950,00	600,00	1224,00	1170,00	1200,00	1090,00	440,00	175,00	230,00
	(meq/l)	50,435	50,000	36,956	45,652	54,348	41,304	26,087	53,261	50,896	52,174	47,319	19,130	51,087	10,000
$[K^+]$	(mg/l)	28,00	9,30	43,00	80,00	80,00	70,00	13,90	3,90	3,90	16,50	13,00	23,00	16,00	1,30
	(meq/l)	0,716	0,464	1,099	2,046	2,046	1,790	0,355	0,100	0,100	0,422	0,332	0,588	0,409	0,033
$[Ca^{+2}]]$	(mg/l)	2,50	20,00	8,82	14,03	10,82	22,54	40,00	4,91	4,91	6,80	11,02	3,91	8,30	1,50
	(meq/l)	0,125	0,998	0,441	0,701	0,541	1,127	1,996	0,245	0,245	0,339	0,550	0,195	0,414	0,075
$[Mg^{+2}]$	(mg/l)	9,78	4,01	3,77	4,16	3,53	8,21	19,30	5,79	5,79	4,10	4,63	1,03	5,00	1,22
	(meq/l)	0,804	0,330	0,310	0,350	0,290	0,675	1,587	0,476	0,476	0,337	0,380	0,085	0,411	0,100
$[Fe^{+2}]$	(mg/l)	1,50	0,30	0,39	0,39	0,39	1,10	0,10	0,39	0,4	0,20	3,80	0,30	0,20	3,20
	(meq/l)	O,063	0,011	0,013	0,013	0,013	0,039	0,003	0,014	0,015	0,007	0,136	0,011	0,007	0,115

Total	(meq/l)	**52,560**	**52,495**	**39,107**	**49,081**	**57,568**	**45,371**	**31,306**	**54,508**	**52,143**	**53,809**	**49,334**	**20,108**	**54,039**	**10,566**
[SiO_2]	(mg/l)	53,50	45,00	45,50	41,24	39,52	56,23	31,00	54,00	45,00	42,00	45,00	48,00	36,00	29,00
[HBO_2]	(mg/l)	17,64	17,63	12,04	21,08	22,70	20,38	35,16	36,38	15,99	18,14	15,99	26,06	210,00	a
o. c.	(mg/l)	68,14	107,17	83,17	82,28	137,23	87,62	-	110,52	132,08	-	132,08	24,95	36,22	19,45
Phenols	(mg/l)	5,64	8,27	3,55	3,60	12,00	3,25	2,80	11,30	17,60	2,32	17,60	0,78	4,80	0,43
Mineral.	(mg/l)	3686,80	3549,20	3002,36	3458,20	4941,60	3339,91	2610,59	4173,81	3615,05	4283,32	3615,05	1725,51	3000,78	864,55

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

Nr. crt		Surse	[Cl^-] (%meq)	[HCO_3^-] (%meq)	[SO_4^{-2}] (%meq)	[Na^+]+[K^+] (%meq)	[Ca^{+2}] (%meq)	[Mg^{+2}] (%meq)
1	Jimbolia	4630	29,59	20,41	-	48,66	0,12	0,76
2	Lovrin	4636	30,63	19,07	0,27	48,06	0,42	0.31
3		4633	18,98	30,48	0.16	48,65	0,56	0,40
4		4632	31,37	18,29	0,29	48,59	0,71	0,36
5		4607	2,92	46,12	0,96	48,98	0,47	0,25
6		1544	27,38	22,48	0,13	47,49	1,24	0,74
7	Sanicolau Mare	4645	2,24	47,59	0,13	42,23	3,19	2,53
8		4608	11,77	37,39	0,82	48,95	0,22	0,44
9		1526	12,00	37,39	0,60	48,90	0,23	0,46
10		1526	11,33	37,92	0,73	48,87	0,34	0,31
11	Tomnatec	1564	`17,23	32,23	0,53	48,29	0,56	0,35
12		4634	7,87	42,09	-	49,03	0,48	0,21
13	Racajdia	4653	27,89	21,76	0,33	47,65	0,38	0,38
14		2181	1,44	46,60	1,89	47,48	0,35	0,47