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Determination of the Hydrochemical Composition of Water from Some Georgian Springs (In the village of Khidari, Kharagauli Municipality) by different Analysis Methods

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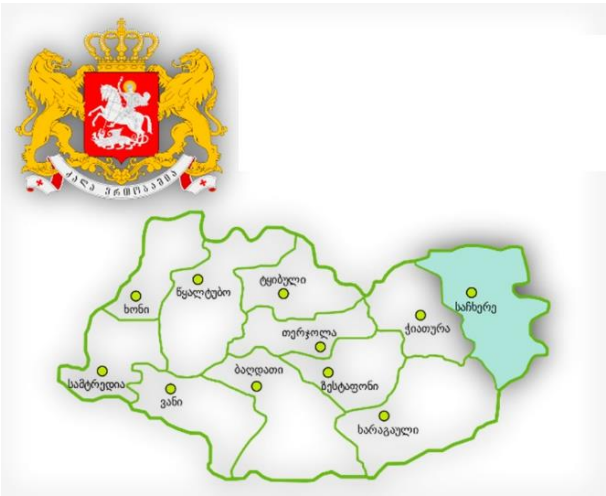
Abstract. A hydrochemical study of water from some springs in the village of Khidari, Kharagauli Municipality, was conducted in Georgia for the first time. (**Khidari** — A village in Georgia, in Kharagauli Municipality of Imereti region, located on the banks of the Borimeli River. 520 meters above the sea level. 16 kilometers from Kharagauli. First mentioned in sources in the 50s of the 17th century).



Kharagauli Municipality

Village Khidari

The content of magnesium, calcium, hydrocarbonate, sulfate, chloride ions, total iron and arsenic, permanganate oxidizability, dissolved oxygen, biochemical indicator for oxygen with 5-day exposure and total carbon dioxide were determined. Relatively simple and rapid chemical and physico-chemical methods with good repeatability were selected for the determination. Biogenic substances were studied by the photometric method. The amount of these mentioned ions in the

spring waters in village Khidari, Kharagauli Municipality is within the norm and its use for drinking and agricultural purposes is appropriate.

Goal: The purpose of our work was to study the hydrochemical composition of some springs in village Khidari, Kharagauli Municipality. Using highly sensitive methods, we determined:

Mg^{2+} , Ca^{2+}, HCO_3^-, SO_4^{2-}, CI^- -ions, permanganate oxidation, dissolved oxygen, biochemical indicator for oxygen with 5-day exposure, total iron and arsenic, carbon dioxide and the content of biogenic elements in the spring waters in village Khidari, Kharagauli District. The relevance of the issue is that the content of the above-mentioned ions was determined in these waters for the first time. The analyzes were carried out in in Yason Mosheshvili's Hydrochemistry Laboratory of the Chemistry Department of the Faculty of Exact and Natural Sciences of Akaki Tsereteli State University.

Introduction: A Spring — natural exit point at which groundwater emerges from an aquifer and flows across the ground surface as surface water. The classification of springs is different. There is also a difference according to the flow rate. For example, there are permanent, weakly variable and variable springs. Permanent, periodic, seasonal and other sources are distinguished. According to chemistry, they distinguish: fresh, mineralized and saline springs; according to temperature: boiling, hot, warm and cold springs.

The temperature of the springs depends on the depth of the groundwater, the nature of the outlet channel, the geographical and hypsometric location of the spring, and the temperature regime of the surrounding groundwater. There are about 2,000 springs in Georgia, which are distinguished by their great diversity.

Water is an invaluable resource and has always been considered the primary source of life. It is widely and universally used, modern man can influence the biosphere, use its resources to develop production and create material well-being. Today, great attention is paid to the rational use and protection of water resources. [1].

Chemically pure water does not exist in nature. When moving along the Earth's crust, water comes into contact with many minerals, dissolves them and carries them along the entire path of circulation Natural water is a solution containing substances of various nature and state. Therefore, the study of natural waters requires knowledge of the basic properties of solutions [1].

Water is the most common substance in nature, it is in a liquid, solid and gaseous state, water is mainly found in the form of oceans, seas, rivers and lakes, which occupy almost ¾ of the Earth's

surface. In the gaseous state, water mixes with the air of the atmosphere, where its amount varies depending on meteorological conditions and reaches up to 4%, in the solid state (in the form of ice and snow) water is found in high snowfields and the polar zone [2].

Kharagauli is located in the western Georgia, on the banks of the Kherimeli River. The climate is subtropical, humid, with moderately cold winters and relatively dry and hot summers. The region includes parts of the Meskheti and Likhi ranges. The main river of the region is the Dzirula. Humus-carbonate soil is widespread in the lowland zone of the region, as well as a complex of forest sphagnum and humus-carbonate soils formed in fragments [3].

Evaluation of the experiment: Thus, the content of magnesium, calcium, hydrocarbonate, sulfate, chloride ions, total iron and arsenic, permanganate oxidation, dissolved oxygen, biochemical indicator for oxygen with 5-day exposure, total carbon dioxide and biogenic elements were determined for the first time in the spring waters of village Khidari in Kharagauli Municipality by chemical and photometric methods. The results of the analysis are shown in Table #1.

The pH of the tested spring waters varies from 6,56 to 7,11.

The hardness of the spring water of village Khidari varies within wide limits. Its content is highest among the studied spring waters in Bachiashvili spring at 9,12 mg/l, and lowest is in Glunchadze spring at 4,46 mg/l.

The Ca^{2+} ion content is variable. Its relatively high amount was recorded in Tamazelashvili spring at 18,46 mg/L, while content of mg/L. is low in Tsverava spring at 2,82 mg/l.The highest amount of magnesium ions is contained in Bachiashvili spring - 18,86 mg/L. The lowest content is in Tamazelashvili spring, 0,36 mg/L.

Tsverava spring contains a relatively large amount of total iron - 0,27 mg/l. Its mass content is small in Nekerchkhali spring – 0,18 mg/l.

Kote spring contains a relatively high amount of SO_4^{2-} ions - 0.1360 mg/l, while a small amount is recorded in Tsverava spring - 0.0028 mg/l.

The HCO_3^- ion content is highest in Berikelashvili spring at 1.52 mg/l, while the hydrocarbonate ion content is lowest in Jondo spring at 0.36 mg/l.

High concentrations of total arsenic are recorded in Berikelashvili and Blikve springs (0.018 mg/L). A small amount of total arsenic is contained in Tamazelashvili spring (0.011 mg/L).

Blikvebi spring contains a relatively large amount of chloride ions - 1.56 mg/l. While its mass content is small in Jondo spring - 0.37 mg/l.

The content of free carbon dioxide is highest in Tsverava spring, 1.82 mg/l. Jondo spring contains a small amount of carbon dioxide, 0.42 mg/l.

Permanganate oxidation is relatively high in Jondo spring at 2.46 mg/l, while its small amount is recorded in Bachiashvili spring at 0.16 mg/l.

The dissolved oxygen content is high in Tsverava spring, 2.26 mg/L. A relatively low concentration of oxygen is recorded in Glunchadze spring, 1.34 mg/L.

The highest concentration of biochemical indicator for oxygen with 5-day exposure is in Tsverava spring (1.94 mg/l), and the lowest is in Blikvebi water (1.14 mg/l).

The content of NO_2^-, NO_3^-, NH_3, PO_4^3 biogenic elements is below the detection limit and their content is not recorded in the water of the tested spring in village Khidari, Kharagauli Municipality.

Experimental Part. Methodology for Determining Chemical Elements in Water

The analyses were conducted in the Hydrochemical Chemistry Laboratory of Kutaisi Akaki Tsereteli State University. Methods proven in hydrochemical practice were used for the analysis [4, 5, 6].

The acidity index was measured by the potentiometric method (potentiometer *pH* 673-M).

The calcium and magnesium content, as well as the total water hardness in the test waters, were determined by the complexometric method (titrant 0.01N complexon III. Eriochrome was used as an indicator to determine the magnesium ion content, the recommended zone was created with ammonia buffer, and meroxide was used as an indicator to determine the calcium ion. The Alkaline environment was created with 2N sodium hydroxide).

Total iron in water is determined by the photometric method after preliminary oxidation in an alkaline environment (photometric reagent sulfosalicylic acid) (photoelectrocolorimeter).

The mercurimetric method (titrant 0.01 $Hg(NO_3)_2$. indicator (diphenyl carbazole)) was used to determine chlorides.

Hydrocarbons were determined by the acidimetric method (titrant 0.1-0.01N *NCl* indicator methylene-orange).

Sulfate ions were determined by the classical gravimetric method, the precipitated form being $BaSO_4$.

Total arsenic was determined by the iodimetric method, titrant 0.05 N iodine solution. Indicator starch.

Free carbon dioxide gas was determined by the alkalimetric method. Titrant 0.1-0.01N sodium alkali. A small amount of Segnet's salt and 1-2 drops of phenophthalein indicator were added to the titrant solution.

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Oxidability was determined by the permanganatometric method (oxidizer 0.01 N $KMnO_4$, in acidic medium. Titrant 0.01 N $H_2C_2O_2$).

The oxygen content and biochemical indicator for oxygen with 5-day exposure were determined by the iodometric method (titrant 0.01 N. NaS_2O_3 In an alkaline medium $Mn(OH)_2$, it is oxidized by oxygen dissolved in water and converted into a tetravalent manganese compound, which upon acidification of the solution in the presence of excess KI gives I_2).

Biogenic substances were determined by photometric methods: NO_2^- with the shell reagent, NO_3^-, with sodium salicylate, NH4+– with Nessler reagent, PO_4^{3-} – with ammonium phosphomolybdate [6].

Results of Hydrochemical Analysis of Water from Some Springs in village Khidari, Kharagauli Municipality

Table N 1.

N	Local Name of Spring Waters	*pH*	Mg.eqv/l	Mg/l										
			Hardness	Ca^{2+}	Mg^{2+}	Common iron	HCO_3^-	SO_4^{2-}	Cl^-	O_2	$BCOO_5$	Permanganate oxidation	Free CO_2	Common arsenic
1	Tsverava	6,60	6,64	2,82	0,84	0,27	0,80	0,0028	1,06	2,26	1,94	0,43	1,82	0,013
2	Tamazelashvili	6,65	6,82	18,46	0,36	0,26	0.84	0,1318	0,63	1,49	1,39	0,96	1,28	0,011
3	Glunchadze	6,80	4,46	5,61	13,64	0,28	0,48	0,0086	0,38	1,34	1,67	0,24	0,76	0,014
4	Bachiashvili	6,74	9,12	15,62	18,86	0,25	0,56	0,0078	0,74	1,71	1,53	0,16	1,78	0,016
5	Kote	6,96	6,46	10,08	7,64	0,29	0, 78	0,1360	0,78	1,67	1,46	1.04	0,55	0,012
6	Berikelashvili	6,85	7,24	9,65	1,68	0,22	1.52	0,0049	1,26	1,62	1,50	0,88	1.84	0,018
7	Nekerchkhali	6,93	5,35	7,22	10,48	0,18	0,57	0,0045	0,76	1,68	1,74	0,86	0,97	0,014
8	Blikvebi	6,56	6,54	5,68	3,26	0,21	0,78	0,0058	1,56	1,67	1,14	0,46	1.46	0,018
9	Jondo	6,72	4,27	6,84	6,08	0,24	0,36	0,0057	0,37	1,63	1,57	2,46	0,42	0,015
10	Davladze	7,11	7.38	5,66	15,25	0,26	1,16	0,0079	0,89	1,44	1.34	0,56	0.68	0,017

Conclusion: The acidity index, water hardness, magnesium, calcium, hydrocarbonate, sulfate and chloride ions, free carbon dioxide, permanganate oxidation, oxygen, biochemical indicator for oxygen with 5-day exposure, total iron and arsenic content of the studied spring waters in village Khidari, Kharagauli Municipality are within the normal range and its use for drinking and agricultural purposes is appropriate.

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