

# COMPREHENSIVE STUDY OF CERTAIN THERMAL WATERS IN ADJARA FOR THE MANAGEMENT OF NATURAL RESOURCES

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## Abstract

*A comprehensive study of certain thermal waters in the Autonomous Republic of Adjara was carried out. In order to study the vegetation of the landscapes surrounding the study sites, cenotype identification and analysis of structural characteristics were carried out in the areas of Daba Makhinjauri (Khelvachauri Municipality) and the villages of Akhalsopeli and Leghva (Kobuleti Municipality). The organoleptic properties of the waters were also assessed. The studies revealed that the highest concentrations of Ca<sup>2+</sup>, Mg<sup>2+</sup> and Cl<sup>-</sup> ions were found at the Leghva site. Analysis of nitrates, nitrites, ammonium ions, phosphates and sulphates confirmed that the thermal waters are free from chemical contamination. The Makhinjauri thermal water is characterised by a hydrogen sulphide--sulphide composition, while the Akhalsopeli thermal water has a chloride--sodium ionic composition with elevated levels of fluorine and boron. Makhinjauri thermal water (temperature 37.62°C) is not classified as mineral, while Akhalsopeli water is classified as mineral-thermal (temperature 37.63°C and mineralisation > 1g/L). Leghva water is highly mineralised (mineralisation ≈ 2.1 g/L). No traces of Cd, As, Hg, Pb, V, Ti, Tl, Cu, Co, Cr, Mo, Ni or Zn were detected in the waters. The Akhalsopeli water contains insignificant amounts of Mn, Sb, Se and Ba, while low concentrations of B, Li, Mn, Sb and Ba were found in the Leghva water. Sanitary-microbiological analysis confirmed that the waters are free from contamination. The hydrocarbon composition of the accompanying gases showed a 100% methane content at all three sites. In addition, a thermal water map was produced using geo-information systems, highlighting the buffer zones of the thermal waters.*

**Keywords:** thermal water, formations, chemical content, associated gases, map

## I. Introduction

In the XXI century, amidst global warming, irreversible atmospheric pollution and the depletion of fossil fuels, the search for alternative, renewable and cost-effective energy sources have become increasingly important. Utilizing such sources can mitigate environmental harm, conserve resources and address the global energy crisis. Alongside solar and wind energy, thermal waters are recognized as an alternative energy source that is economical, environmentally sustainable, reliable and inexhaustible.

Thermal waters, as a renewable energy resource, offer numerous undeniable advantages, making them competitive not only with traditional thermal energy sources but also with other renewable options. Traditional sources often have high costs and significant environmental impacts, while many renewable sources, such as solar and wind, are subject to fluctuations depending on the time of day or weather conditions. In contrast, thermal waters provide a stable and reliable energy supply, unaffected by weather or seasonal changes. Their utilization requires no energy carriers or dams and does not release harmful substances into the environment.

The issue of water resources is highly relevant today, as global warming has led to a reduction in water availability in many countries, significantly impacting their economies. Addressing Georgia's strategic and tactical challenges - spanning sectors such as the economy, agriculture, resort management, energy, balneology and more - requires up-to-date and comprehensive information on the water resources of specific regions and their anticipated changes [1, 2]. In the context of modern climate warming, it is essential to examine the factors influencing the formation of groundwater as a natural resource and to predict potential changes [3, 4]. Georgia, with its varied tectonic, lithological, geochemical, geothermal, and hydrogeological conditions, is abundant in fresh, mineral, and thermal groundwater. This richness is largely attributed to the substantial atmospheric precipitation the country receives (93.3 km<sup>3</sup> annually). Of these reserves, 63% are located in Western Georgia, 24% in Eastern Georgia and 13% in Southern Georgia. Georgia's hydromineral resources are notably diverse, with over 2,000 mineral water sources identified. Among them, more than 1,700 emerge naturally, while over 300 are extracted through wells. The chemical and physical properties of the aforementioned mineral waters highlight the therapeutic benefits of many of these sources [5, 6]. Additionally, Georgia is home to numerous thermal springs, which represent a renewable and environmentally friendly energy resource.

The country possesses abundant high-temperature thermal water resources, yet, out of 250 known deposits, only 44 geothermal water wells have been registered, with temperatures ranging from 30°C to 112°C. The total flow rate of naturally occurring thermal waters, with temperatures between 20°C and 100°C, exceeds 1,000 L/s. Georgian thermal waters display a wide range of chemical compositions, from fresh hydrocarbonate-calcium to highly mineralized chloride-sodium. Generally, the deeper the water, the hotter it is upon emergence; however, some sources are highly mineralized, which complicates their extraction. The Adjara-Trialeti folded system is regionally known for its favorable geothermal conditions, which contribute to the prevalence of thermal water sources in the area. Many of these water sources have been utilized for balneological and hygienic purposes for centuries. As a result, the region is home to numerous geothermal water deposits, whose heat is applied in balneology and various sectors of the national economy. The waters of this region are renowned for their diversity, offering both low and high mineralization and are well-suited to meet a wide range of consumer needs. It is important to note that geothermal heat is 5-6 times more cost-effective than heat generated by other methods, and the payback period for properly invested funds is relatively short. While thermal waters are primarily used for balneological purposes today, they have the potential for broader applications across many sectors of the national economy. Georgia represents an inexhaustible source of

affordable, deep energy, with its thermal waters offering healing properties, high temperatures, low mineralization and a rich content of chemical elements [7, 8].

The use of groundwater as a subsoil resource is governed by the "Law on Subsoil," which was adopted by the Parliament of Georgia in 1996. According to this law, Georgia's subsoil is considered state property and its management aims to ensure the rational use of subsoil and mineral resources. This is done while considering natural processes, environmental potential, the needs of current and future generations, and the principles of sustainable development [9, 10]. A significant portion of Georgia's thermal and mineral waters remain untapped. Our ancestors recognized the unique properties of this resource and have been using it for the treatment of various ailments since ancient times. Active research and development in this area continued until the 1980s and 1990s. However, since the early 1990s, no systematic state hydrogeological studies have been conducted in Georgia. As a result, the available information on the quantitative and qualitative characteristics of groundwater is based on previous studies.

The relevance of this issue is primarily driven by the need for each region in Georgia to have its natural resources assessed at a modern scientific level, particularly in the context of regional management. There is also significant potential for utilizing thermal water resources for heat and energy purposes, although this potential has been minimally tapped so far. In light of ongoing global warming and the resulting transformation of various natural landscapes, conducting a comprehensive study of groundwater in the Adjara region is timely. This study is crucial for assessing the potential of water resources, ensuring their effective and rational use, and supporting the sustainable development of the region's economy, agriculture, energy, and other sectors.

Given the strategic importance of thermal waters for the development of the national economy, the goal of this research is to conduct a comprehensive study of thermal waters at various locations in the Autonomous Republic of Adjara. The aim is to evaluate these waters and identify potential directions for their future use. The study focused on the thermal waters of three locations in the Autonomous Republic of Adjara: Makhinjauri (Khelvachauri Municipality), Akhalsopeli (Kobuleti Municipality), and Leghva (Kobuleti Municipality). It is important to note that modern, comprehensive studies have not been conducted on these waters, the extent of their bacteriological contamination remains unknown and there is a lack of up-to-date geographical data on these sources. The research objectives included: studying the vegetation in the landscapes surrounding the study sites; analyzing the chemical and microbiological characteristics of the thermal waters; examining the gases associated with the thermal waters; conducting multielement analysis of the thermal waters using plasma atomic emission spectrometry (ICPE-9820, Szimadzu); and creating a map of the water locations using a GIS system [11].

## II. Research Materials and methodology

For the research, literature sources related to the natural resources and physical-geographical conditions of the Autonomous Republic of Adjara were used. These sources provided valuable information on geothermal waters to assess their historical use. It was found that, to date, no comprehensive studies have been conducted on the organoleptic, physicochemical, and microbiological characteristics of the waters mentioned. Additionally, there has been no analysis of their ionic composition or multi-element content, nor has the composition of their accompanying gases been determined. These gaps highlight the need for complex studies to identify potential directions for the use of these waters.

To collect water samples from the aforementioned locations, a field scientific research expedition was organized. This expedition involved a field reconnaissance survey of the surrounding areas, a background study of the vegetation and measurements of various

parameters under field conditions, including temperature, air pressure, pH, electrical conductivity and salinity. Additionally, organoleptic indicators such as color, odor, taste, appearance and transparency were evaluated. In the laboratory, a multielement analysis of the thermal waters was conducted using ICPE-9820. A comprehensive analysis of the organoleptic, physical, chemical, and microbiological properties of the waters was performed using titrimetric, photometric, potentiometric, and plasma atomic emission spectrometry methods. The hydrocarbon content was determined through gas chromatography.

Water samples were collected in chemically clean containers with screw-on stoppers. To ensure accurate measurements of physicochemical parameters, the containers were filled to the top, minimizing the possibility of air under the stopper and reducing the risk of shaking the contents during transportation. For microbiological analysis, separate, pre-sterilized 0.5-liter glass containers were used, which were not filled completely to prevent accidental contamination and to allow for light mixing of the sample before analysis [12]. The total volume of water collected at each location was 2 liters. Upon placement in the water container for analysis, each sample was labeled with relevant details, including the sample number, description, sampling location, environmental and climatic conditions, and the study's purpose.

The determination of variable physicochemical parameters and microbiological analysis of the samples was conducted within 6-8 hours of collection. For other cases, samples were stored according to the technical regulations, which involved cooling them to 2-5°C with a storage period of up to 24 hours. Once cooled, analysis began when the sample temperature reached room temperature. In the field, the following parameters were measured using the Combo Water Quality Meter AZ 86031 device: water temperature, air pressure, pH, electrical conductivity, and salinity. Immediately after collecting the water samples, organoleptic indicators such as color, odor, taste, appearance, and transparency were evaluated, as these properties can change over time in the water [13]. A comprehensive laboratory analysis of the thermal waters was conducted, focusing on the determination of several key parameters: The pH was measured potentiometrically using a laboratory pH meter (Mettler Toledo) [14]. The concentrations of HCO<sub>3</sub><sup>-</sup>, Ca<sup>2+</sup>, Mg<sup>2+</sup> ions, and carbonate hardness were determined through titrimetric methods [15, 16, 17]. The concentrations of ammonium, nitrate, nitrite, fluoride, sulfate, phosphate ions, and hydrogen sulfide were assessed using photometric methods [18, 19, 20, 21, 22, 23, 24]. Multielement analysis of the thermal waters was performed using plasma atomic emission spectrometry with an ICPE-9820 instrument [25]. For microbiological analysis, saprophytic microorganisms were identified, including mesophilic, saprophytic aerobes, and facultative anaerobes, which are capable of forming colonies on nutrient agar and are visible under 2x magnification. The primary indicator of fecal contamination in water is lactose-positive *Escherichia coli*, which consists of gram-negative, non-spore-forming rods capable of fermenting lactose into acid and gas at 37°C within 24 hours. The number of saprophytic microorganisms and the quantity of lactose-positive *Escherichia coli* bacteria were determined using microbial cultivation methods followed by titration [26]. The hydrocarbon content in the thermal waters was analyzed using gas chromatography. The analysis was performed on a Thermo gas chromatograph with an aluminum ionization detector (model Focus GC, S/N 20032872), equipped with the automatic program Chrom-Card/PIANO and a Supelco DH 100 quartz capillary column (100 m in length, 0.25 mm internal diameter, stationary phase methylsiloxane). Chromatography was conducted in constant pressure mode at 345 kPa, with helium as the mobile phase. The test sample was injected using a microsyringe, with a volume of 5 µl. The injector temperature was set to 250°C, and the sample introduced into the column was split in a helium flow at a 1/13 ratio. Chromatography was performed in a single stage with a temperature gradient. The process began at 35°C, which was maintained for 13 minutes. The quantitative content of hydrocarbons was determined by internal normalization of the peak area, with accuracy to 0.001% [27].

### III. Results and Discussion

**Main vegetation formations of the study locations and their conservation value.** To study the vegetation of the landscapes surrounding the study locations in Makhinjauri and Kobuleti municipalities, coenotypes were identified and structural features were examined. The diversity of relief, climatic conditions, soils, and anthropogenic factors contributes to the mosaic nature of the vegetation, with clear evidence of vertical zonation and exposure. The buffer zones around the study sites are predominantly covered by forest vegetation (Table 1). These forests consist of oriental beech, Caucasian linden, chestnut, alder, and Caucasian hornbeam, forming mixed coenoses. Alder forest formations, with the presence of elm, larch, willow, and other species, are found near river valleys. The majority of the forest areas are utilized for agricultural crops and subtropical introduced woody species. In forests impacted by anthropogenic activities, there is a high potential for the invasion of non-native species, and the conservation value of the natural ecosystems is considered moderate.

**Table 1:** Main vegetation formations of the study locations

| Object   | Buffer zone formations   | Category  | Conservation value | Anthropogenic influence quality   | Note  |
|--|--|---|--------------------|---|---|
| Kobuleti<br>(Akhalsofeli)<br>X 732420.5559<br>Y 4633694.242<br>Z 8.178 | Alder forest with fern-willow; Alder forest with evergreen Colchian undergrowth; Hornbeam forest with birch undergrowth; Hornbeam-chestnut forest with birch undergrowth, etc. (Alnus, Betula, Populus, Salix, etc.) | Natural / Modified                                  | Average            | Agricultural lands  | High in Invasive potential of foreign species: Pueraria ; Acacia, crypto-meria. River Achkva is present |
| Legva<br>X 742433.8613<br>Y 4638118.757<br>Z 83.4                      | Hornbeam-beech forest; Chestnut-beech forest; Hornbeam-chestnut-beech forest; Chestnut-hornbeam-alder forest; Alder-alder-alder forest.  | Natural / Modified                                  | Average            | Soviet period Tea and citrus fruits were developed; today Corn fields are drawn | Widespread subtropical Plants, there are many advents . River Skura is present                          |
| Makhinjauri<br>X 725075.2039<br>Y 4616596.988<br>Z 28.294              | Typical formations of Colchian forests: Hornbeam-beech forest; Hornbeam-chestnut forest; Hornbeam-alder forest; Chestnut-hornbeam-alder forest; Chestnut-hornbeam-beech forest; Hornbeam-beech-alder forest          | Natural/ Modified . Bordering Mtirala National Park | Average            | Settlement; Botanical garden is established nearby                              | It is high in foreign species Invasive potential (trees, shrubs, herbs). River Sakalmakhe is present    |

**Field Measurements:** Field measurements taken at the study locations revealed that the waters of Makhinjauri and Akhalsopeli are warm (37.62°C to 36.99°C), while the water in Leghva is cooler (18.34°C). The atmospheric pressure at the thermal water sites ranged from 1012.4 to 1016

mbar (Table 2). The pH of Makhinjauri thermal water is alkaline, Akhalsopeli's is moderately alkaline and Leghva's is weakly alkaline. Leghva water exhibits the highest electrical conductivity (9717  $\mu\text{S}/\text{Sm}$ ), while Makhinjauri water has the lowest (495  $\mu\text{S}/\text{Sm}$ ). Correspondingly, the salinity is highest at Leghva (9717 mg/L) and lowest at Makhinjauri (247 mg/L).

**Table 2:** Evaluation of Physicochemical Parameters of Thermal Waters under Field Conditions

| Location    | Physical and Chemical Parameters |                    |     |   |                |
|-------------|----------------------------------|--------------------|-----|---|----------------|
|             | Water Temperatures °C            | Air Pressure, mbar | pH  | Electrical Conductivity of Water, $\mu\text{S}/\text{Sm}$ | Salinity, mg/L |
| Makhinjauri | 37.62                            | 1014.2             | 9.0 | 495   | 247            |
| Akhalsopeli | 36.99                            | 1016.0             | 8.3 | 1232  | 6165           |
| Leghva      | 18.34                            | 1012.4             | 7.4 | 1942  | 9717           |

**Organoleptic Parameters.** In contrast to the waters of Makhinjauri and Akhalsopeli, Leghva water has a yellowish color. Makhinjauri water had a distinct hydrogen sulfide odor (Table 3). The taste of the waters from Makhinjauri and Akhalsopeli was mildly brackish, while Leghva water was strongly brackish. All three water sources appeared similar, free from foreign impurities, with a natural sediment of mineral salts. However, Leghva water was slightly turbid, unlike the clear waters of Makhinjauri and Akhalsopeli.

**Table 3:** Organoleptic Parameters of Thermal Waters

| Indicator    | Location    | Description  |
|--------------|-------------|--|
| Color        | Makhinjauri | Clear liquid   |
|              | Akhalsopeli | Clear liquid   |
|              | Leghva      | Yellowish liquid   |
| Odor         | Makhinjauri | Distinct odor of hydrogen sulfide  |
|              | Akhalsopeli | characteristic of complexes formed by substances dissolved in water          |
|              | Leghva      | characteristic of complexes formed by substances dissolved in water          |
| Taste        | Makhinjauri | Weak saline  |
|              | Akhalsopeli | Weak saline  |
|              | Leghva      | Strong saline  |
| Appearance   | Makhinjauri | Free from foreign impurities, containing a natural sediment of mineral salts |
|              | Akhalsopeli | " "  |
|              | Leghva      | " "  |
| Transparency | Makhinjauri | Transparent  |
|              | Akhalsopeli | Transparent  |
|              | Leghva      | Weak turbidity   |

**Water chemical content and bacteriological analysis.** Leghva thermal water is classified as highly hard, Akhalsopeli water as moderately hard, and Makhinjauri water as soft (Table 4). The highest concentrations of  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$  and  $\text{Cl}^-$  ions were observed at the Leghva location. Analysis for nitrates, nitrites, ammonium ions, phosphates, and sulfates confirmed that the thermal waters

are free from chemical pollution. Ionic analysis revealed that these waters do not belong to iron or silicon water categories. Makhinjauri thermal water is characterized by a hydrogen sulfide-sulfide composition. Akhalsopeli thermal water likely has a chloride-sodium ionic composition, with elevated levels of fluorine and boron. Leghva thermal water also exhibits a high  $Mg^{2+}$  content. Makhinjauri thermal water (temperature - 37.62°C) is non-mineral. Akhalsopeli water is mineral-thermal (temperature - 37.63°C, mineralization > 1 g/L). Leghva water is highly mineralized ( $\approx 2.1$  g/L).

Through multielement analysis, the following order of macroelements was identified:

At Makhinjauri location -  $Na > Si > K > Ca > Al > Mg > P$ . Water does not contain iron; at Akhalsopeli location -  $Na > Ca > K > Al > Si > Mg > P$ . Water does not contain iron; At Leghva location -  $Na > Ca > Mg > K > Al > Si > Fe > P$  (Table 5). There were no traces of heavy metals - Cd, As, Hg, Pb, V, Ti, Tl, or microelements - Cu, Co, Cr, Mo, Ni, Zn. There was insignificant level of Mn, Sb, Se, Ba in Akhalsopeli water. Low levels of Li, Mn, Sb, Ba were detected Leghva water. In this regard, the waters fall under the following studies.

Assessment of fecal contamination in the studied waters confirmed that they are not contaminated (Table 6). The total count of saprophytic microorganisms is as follows: Makhinjauri - 8/1 ml, Akhalsopeli - 18/1 ml and Leghva - 12/1 ml, all within the permissible limit of no more than 100/1 ml. The total count of Escherichia coli bacteria is <300/1 L at all three locations.

**Table 4:** Ionic Content of Thermal Waters

| Parameter<br>Unit of Measurement     | Location         |             |        | Standard |
|--------------------------------------|------------------|-------------|--------|----------|
|                                      | Makhinjauri      | Akhalsopeli | Leghva |          |
| pH                                   | 9.5              | 8.5         | 7.8    | 6-9      |
| HCO <sub>3</sub> <sup>-</sup> , mg/L | 73.2             | 54.9        | 30.5   | 400      |
| Hardness, mg-eq/l                    | 0.3              | 6.8         | 30.0   | 7-10     |
| Ca <sup>2+</sup> , mg/L              | 4.0              | 132.3       | 420.8  | 140      |
| Mg <sup>2+</sup> , mg/L              | 1.22             | 2.4         | 109.5  | 85       |
| Cl <sup>-</sup> , mg/L               | 33.65            | 1250        | 1538.4 | 250      |
| NH <sub>4</sub> <sup>+</sup> , mg/L  | 0.028            | 0.098       | -      | 2.0      |
| NO <sub>2</sub> <sup>-</sup> , mg/L  | -                | -           | -      | 0.2      |
| NO <sub>3</sub> <sup>-</sup> , mg/L  | 4.31             | 2.1         | 2.25   | 50       |
| PO <sub>4</sub> <sup>3-</sup> , mg/L | 0.069            | 0.045       | 0.066  | 3.5      |
| F <sup>-</sup> , mg/L                | 0.414            | 2.62        | -      | 0.7      |
| SO <sub>4</sub> <sup>2-</sup> , mg/L | -                | -           | -      | 250      |
| H <sub>2</sub> S, mg/L               | 6.8              | -           | -      | 0.03     |
|                                      | Hydrogen Sulfide |             |        |          |

**Table 5:** Multielement analysis of thermal waters using plasma atomic emission spectrometry. Macroelements (mg/L)

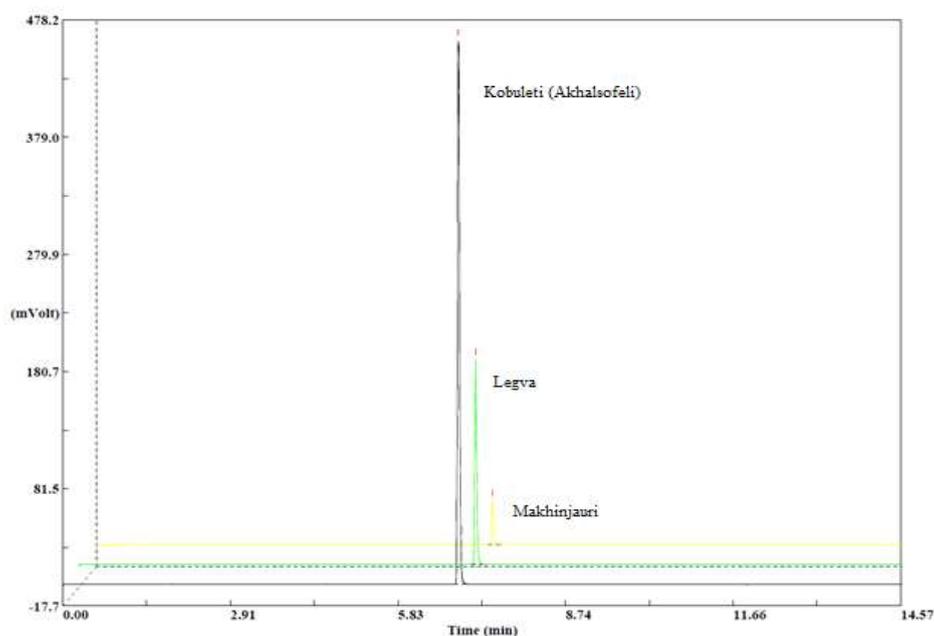
| Location    | Al   | Fe    | K    | Ca    | Mg    | Na   | P      | Si   |
|-------------|------|-------|------|-------|-------|------|--------|------|
| Makhinjauri | 1.42 | -     | 12.1 | 9.19  | 0.184 | 394  | 0.0775 | 18.2 |
| Akhalsopeli | 18.6 | -     | 98.4 | >271  | 0.182 | 5976 | 0.0484 | 7.52 |
| Leghva      | 24.9 | 0.162 | 93   | > 854 | >136  | 3998 | 0.0861 | 9.38 |

| Microelements (mg/L) |       |        |        |         |         |         |        |
|----------------------|-------|--------|--------|---------|---------|---------|--------|
| Location             | B     | Li     | Mn     | Sb      | Se      | Be      | Ba     |
| Makhinjauri          | 0.17  | -      | -      | -       | -       | <0.0002 | -      |
| Akhalsopeli          | >14.8 | -      | 0.0058 | <0.0117 | <0.0012 | -       | 0.0093 |
| Leghva               | 2.75  | 0.0538 | 0.236  | <0.0170 | -       | -       | 0.0003 |

**Table 6:** Microbiological analysis of thermal water quality

| Parameter, Dimension   | Location    |             |  | Limit |
|--|-------------|-------------|--|-------|
|  | Makhinjauri | Akhalsopeli | Leghva   |       |
| Total number of saprophytic microorganisms, units per 1 mL                   | 8           | 12          | Total number of saprophytic microorganisms, units per 1 mL                   | 8     |
| Lactose-positive Escherichia coli bacteria count (Coli index), units per 1 L | < 300       | < 300       | Lactose-positive Escherichia coli bacteria count (Coli index), units per 1 L | < 300 |

**Hydrocarbon Composition of Waters and Mapping.** Gas-liquid chromatography analysis revealed the presence of methane in the hydrocarbon composition based on retention time (Fig. 1). The accompanying gases at all three locations showed 100% methane content. Based on peak areas, the methane concentration increases in the following order: Makhinjauri < Leghva < Kobuleti. Therefore, in terms of gas composition, these are classified as methane waters.



**Figure 1:** Hydrocarbon profile of thermal waters

During the research, a map of the aforementioned thermal waters was created using geoinformation systems, enabling a visual representation of their locations (Fig. 2). GPS coordinates of the selected sites were recorded and mapped.

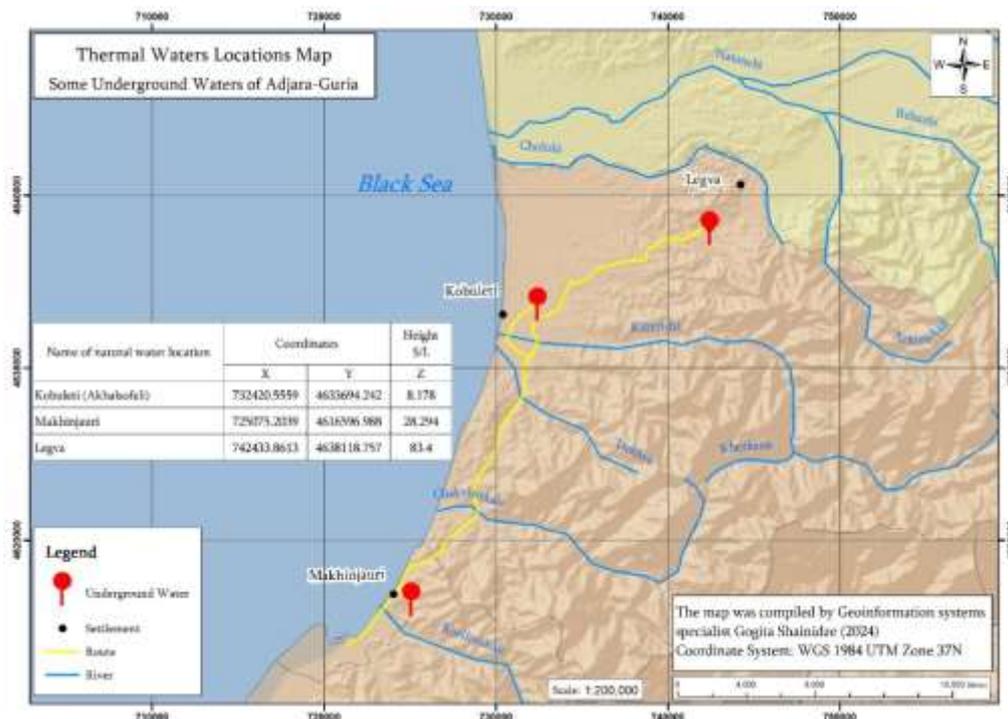


Figure 2: Location maps of thermal waters

#### IV. Conclusion

A significant portion of the thermal waters in the Autonomous Republic of Adjara remains unexplored, with their locations not marked on current maps. Their classification (mineral, thermal, or mixed) and potential uses (balneological, drinking, cosmetic, or energy) have not been studied. As a result, these waters are often used indiscriminately by the local population, which could pose serious risks instead of offering benefits. Furthermore, the gases associated with these waters have not been studied, yet they could play a crucial role in improving the living conditions of the Adjara region's residents, particularly in terms of gas supply. Research is ongoing in the field of comprehensive thermal water studies. Based on the final experimental results, relevant recommendations will be provided, which will be crucial for addressing the needs and interests of the local population. We also hope that the findings will enable the proper utilization of the studied waters for their intended purposes, including balneological, medical-preventive, and energy-related applications. Upon completion of the research, modern geodatabases of thermal waters will be developed using geoinformation systems (GIS), incorporating classifications based on the chemical analysis results of geothermal waters. These maps will be accessible to anyone interested, and the geodatabases can be shared and integrated into various maps. Given that thermal water resources are also abundant in other regions of Georgia, the findings from our research in Adjara will serve as an impetus for similar studies in other areas, helping to identify previously unexplored natural thermal water resources and make them available for public use.

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#### CONFLICT OF INTEREST.

Authors declare that they do not have any conflict of interest.

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