

On the Restoration of the Ionization Properties of “Tetra” Cave (Tskaltubo, Georgia)

Avtandil Amiranashvili¹, Victor Chikhladze¹, Kukuri Tsikarishvili², Khatuna Tsiklauri³

¹TSU, Mikheil Nodia Institute of Geophysics, Tbilisi, Georgia
avtandilamiranashvili@gmail.com

²TSU, Vakhushiti Bagrationi Institute of Geography, Tbilisi, Georgia

³Agency of Protected Areas of Georgia, Tbilisi, Georgia

Abstract

The cave “Tetra” is located in the northern part of health resort Tskhaltubo. Taking into account the microclimatic and ionizing properties of the cave (the high concentration of light ions) at the beginning of the seventieth years of the past century it was used for treating the patients with the respiratory and cardiovascular system. During the expedition of 2008, it was discovered, that the special door into the cave was broken up. The tracks of the unsanctioned presence of people were revealed inside the cave. I.e., the natural state of the cave was disrupted (sealing, air cleanliness, etc.). As a result, the unique bioclimatic and radiation properties of the cave were disrupted. Accordingly, the concentration of light ions was the same, as in strongly contaminated industrial cities. The urgent measures for the restoration of the natural therapeutic potential of the cave “Tetra” were proposed. Recently, Agency of Protected Areas of Georgia several measures to restore the original state of the cave carried out, which practically led to the restoration of its unique microclimatic and bioclimatic properties. In particular, the results of expeditionary works in 2018 showed that the restoration of a radioactive and ionizing state of the cave was occurred. Therefore, the cave “Tetra”, as in the early years, will be possible to use for therapeutic purposes. The organization of regular studies of the microclimatic, bioclimatic and ionizing properties of the caves in Georgia is planned.

Key words: Radon, Light Ions, Cave, Speleotherapy, Speleotourism

Introduction

Georgia is rich in the karstic caves, which possess unique microclimatic and bioclimatic properties. With the specific limitations to a large number of visitors, who are necessary for retaining properties these prevailing during the prolonged historical period of time, the use of caves for tourist and therapeutic purposes is possible [1-3].

At present treatment in the microclimate of natural caves has extensive application in the entire world [3]. In particular, caves frequently are used for the so-called ionotherapy [3,4], to what contributes that increased of the content in them of radon and, correspondingly, high of the concentration of light ions.

Preventive and hygienic is considered the concentration of light ions from 10³ to 10⁴, which corresponds to their content in pure air. The content of the ions higher than 5·10⁴ into cm³ negative influences on the health of humans [5-7]. The influence of aeroions on the human is diversified; it depends on the polarity of aeroions. For example, with the insufficient and excess concentrations of aeroions it can be unfavorable, and with the optimum concentrations of the ions of negative polarity - stimulating. Respiratory organs and skin are the zones, which receive aeroions in the organism.

Aeroions it makes it possible to decrease fatigue, restoring forces. All this contributes to an improvement in the fitness for work strengthens immunity and morbidity sharply is reduced. Beneficial influence render aeroions both to that growth and to the growing old organism. Aeroions together with inhaled air penetrate the blood, which resounds them on the entire organism. Ionization successfully is used during the treatment of many illnesses: the disease of the cardiovascular system, hypertonia, stenocardia, bronchopneumonia, pulmonary tuberculosis, disease of the upper respiratory tract, etc. [3,4]. Ionized air is also a powerful preventive and stimulating factor.

So, the acceptable aeroionization properties for these purposes possess such caves of Tskhaltubo cave system [1,2] as “Tetra”, “Sataplia”, “Prometheus” [4,7-11]. The analyses of natural radioactivity and content of aeroions in the caves of this system in the cave “Tetra” for the first time were begun.

The cave “Tetra” is located in Western Georgia, 195 km away from Tbilisi in the northern part of the health resort Tskhaltubo city (Fig. 1.2). Into 1970-1971 and 1973 summary air alpha- radioactivity on both halls of cave varied from 777 to 7104 Bq/m³, the concentration of positive ions was varied from 3483 to 7290 cm⁻³, and negative - from 3402 to

5832 cm⁻³ [8]. Taking into account the microclimatic and ionizing properties of the cave in the indicated years it was used for treating the patients with the respiratory and cardiovascular system [11].

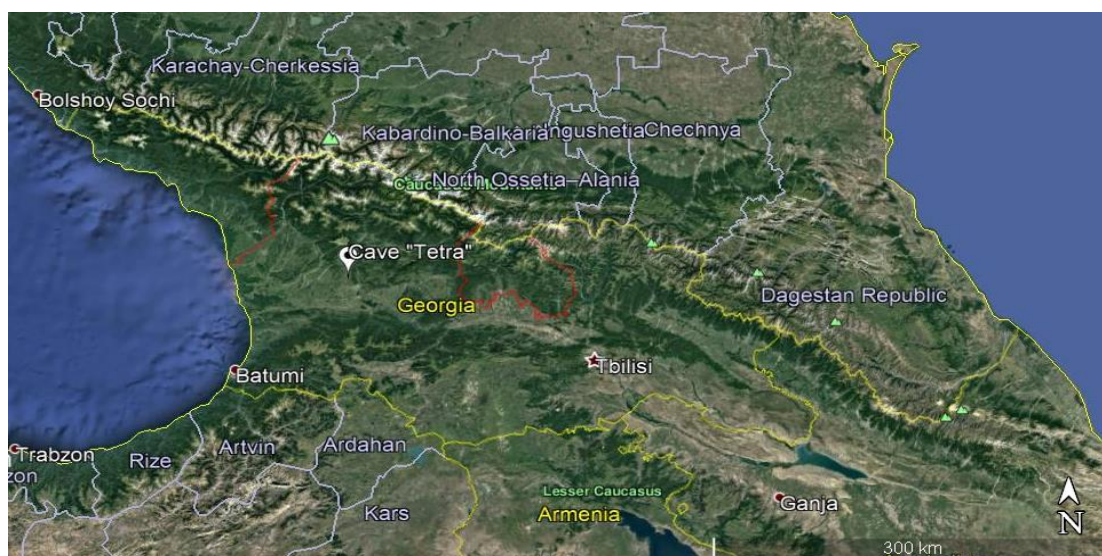


Fig. 1. Location of cave “Tetra” in Georgia.

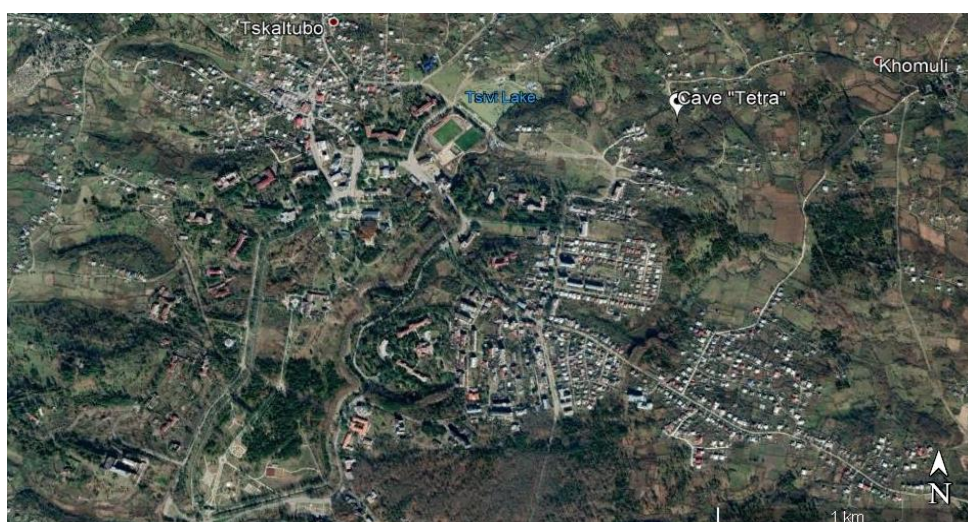


Fig. 2. Location of cave “Tetra” in Tskaltubo city.

Unfortunately, during the expedition of 2008, it was discovered, that the special door into the cave was broken up. The tracks of the unsanctioned presence of people were revealed inside the cave. I.e., the natural state of the cave was disrupted (sealing, air cleanliness, etc.). As a result, in the cave, radon content was less than 20 Bq/m³. Accordingly, the concentration of light ions was 250 cm⁻³ for positive and 100 cm⁻³ for negative [10], which is characteristic of the strongly contaminated industrial cities [7]. The urgent measures for the restoration of the natural therapeutic potential of the cave “Tetra” were proposed [10].

Recently, Agency of Protected Areas of Georgia a number of measures to restore the original state of the cave carried out. In connection with that in summer 2018, the new studies of the aeroionization state of the cave were carried out, results are given below.

Methods and Materials

The content of radon and its short-lived decay products in the air with the aid of the radiometer PB-4 was measured. The error of measurement was not worse than 30 %. The measurements of the concentration of light ions with the mobility of more than 0,8 cm²/v·sec with the aid of the portable counter of the aeroions of the production of the firm “AlphaLab, Inc.” The USA was carried out (Fig. 3). Range of measurements - from 10 to 2000000 ions/cm³. The duration of the measurement of positive and negative ions - several tens of seconds. An error of measurement is not worse than 25 % [7].

Measurements on 24 June 2018 were carried out.

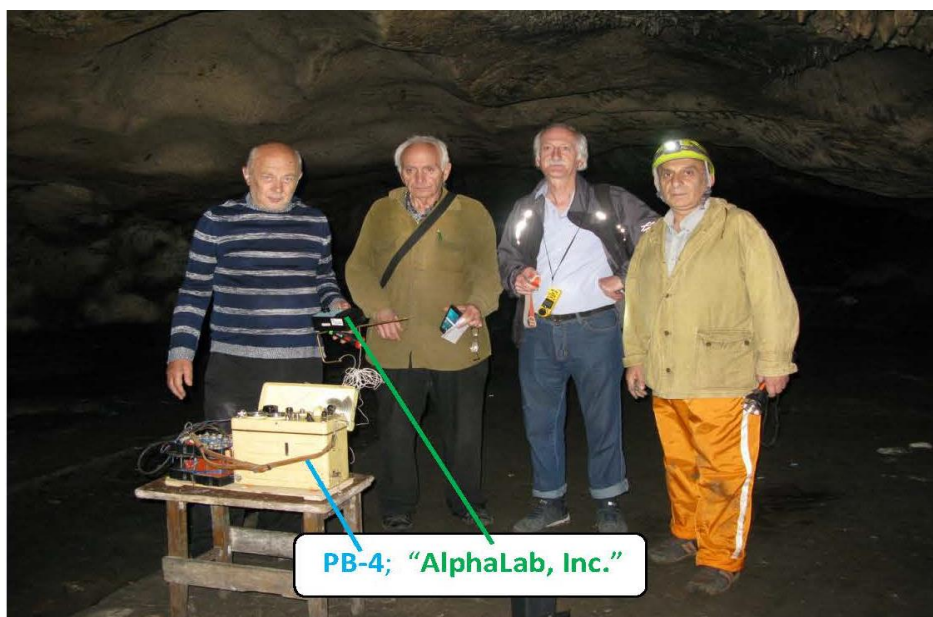


Fig. 3. Conducting measurements in the “Tetra” cave. From left to right: V. Chikhladze, A. Amiranashvili, K. Tsikarishvili, Z. Lezhava

Results and Discussions

The results in Tab. 1 is presented.

Tab.1 The content of radon and light ions in the courtyard and inside the cave “Tetra”.

No of measurement	Location	Radon content, Bq/m ³	Positive ions concentration, cm ⁻³	Negative ions concentration, cm ⁻³
1	Cave courtyard	12.5	470-480	1600-1800
2	Inside the cave	200	18200	24000
3	Inside the cave	257	22250	24280

In particular, the results of expeditionary works 2018 showed that radon content in cave composed 200÷257 Bq/m³ (or the summary air alpha-radioactivity – 600÷771 Bq/m³); light ions concentration comprised: 18200÷22250 cm⁻³ for positive and 24000÷24280 cm⁻³ for negative ions. Thus, the restoration of radioactive and ionizing state of the cave was occurred. So, the cave “Tetra”, as in the early years, will be possible to use for therapeutic purposes.

Conclusions

Bioclimatic characteristics of recreational zones are an important component for the promotion of the health resort – tourism potential of Georgia [12]. One of the varieties of this potential is health-resort speleo tourism based on its richest speleo resources. The organization of regular studies of the microclimatic, bioclimatic and ionizing properties of the caves in Georgia is planned.

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მღვიმე "თეთრა"-ს მაიონებელი თვისებების აღდგენის შესახებ
(წყალტუბო, საქართველო)

ავთანდილ ამირანაშვილი¹, ვიქტორ ჩიხლაძე¹, კუკური წიქარიშვილი², ხათუნა წიკლაური³

¹ თსუ, მიხეილ ნოდიაშვილის სახელობის გეოფიზიკის ინსტიტუტი, თბილისი, საქართველო
avtandilamiranashvili@gmail.com

² თსუ, ვახუშტი ბაგრატიონის სახელობის გეოგრაფიის ინსტიტუტი, თბილისი, საქართველო

³ საქართველოს დაცული ტერიტორიების სააგენტო

რეზიუმე

მღვიმე "თეთრა" მდებარეობს კურორტ წყალტუბოს ჩრდილოეთ ნაწილში. მღვიმეს მიკროკლიმატური და მაიონებელი თვისებების გათვალისწინებით (მსუბუქი იონების მაღალი კონცენტრაცია) გასული საუკუნის სამოცდაათიანი წლების დასაწყისში იგი გამოიყენებოდა რესპირატორული და გულ-სისხლძარღვთა სისტემის დაავადებების მქონე პაციენტების სამკურნალოდ. 2008 წლის ექსპედიციის დროს გაირკვა, რომ მღვიმეს შესასვლელი სპეციალური კარი გატეხილია. ხალხის არასანქცირებული ყოფნის კვალი აღმოჩენილ იქნა მღვიმეში. ანუ, მღვიმეს ბუნებრივი მდგომარეობა იყო დარღვეული (ჰერმეტიზაცია, ჰერის სისუფთავე და ა.შ.). შედეგად, მღვიმეს უნიკალური ბიოკლიმატური და რადიაციული თვისებები დაიკარგა. შესაბამისად, მსუბუქი იონების კონცენტრაცია იგივე იყო, როგორც ძლიერად დაბინძურებულ ინდუსტრიულ ქალაქებში. შემოთავაზებული იქნა გადაუდებელი ღონისძიებები მღვიმე "თეთრა"-ს ბუნებრივი სამკურნალო პოტენციალის აღსადგენად. ცოტა ხნის წინ საქართველოს დაცული ტერიტორიების სააგენტომ ჩატარა რიგი ღონისძიებები მღვიმის პირველადი მდგომარეობის აღსადგენად, რის შედეგადაც მისი უნიკალური მიკროკლიმატური და ბიოქიმიური თვისებები პრაქტიკულად აღდგა. კერძოდ, 2018 წელს საექსპედიციო სამუშაოების შედეგებმა აჩვენა, რომ მოხდა მღვიმის რადიოაქტიური და მაიონებელი მდგომარეობის აღდგენა. ამრიგად, მღვიმე "თეთრა", როგორც ადრეულ წლებში, შესაძლებელია სამკურნალო დანიშნულებისთვის იქნეს გამოყენებული. დაგეგმილია საქართველოში მღვიმეების მიკროკლიმატური, ბიოკლიმატური და მაიონებელი თვისებების რეგულარული შესწავლის ორგანიზება.

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