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Geophysics

Some Results of Electrometric Survey of the Territory of Magnetic Sands of the Ureki Seaside Resort

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ABSTRACT. The curative properties of Ureki seaside resort are widely known, although this region is not practically distinguished for climatic and geological peculiarities from other areas of the Black Sea coastal area, by being affected by space geophysical fields and other clearly notable factors. In addition, the beach line is definitely uniform in terms of the coastal sands and their content of magnetite. According to geomorphologic research, the geological structure of this region must have been formed with the participation of river sedimentation represented in the paleobed of the River Supsa, this being evidenced by electrometric data. The said dislocation of the sediments represented on Ureki territory, electrically, the so-called "peninsular" model, by its hydro geological peculiarities is an exception to the littoral strip of the region. Further research is advisable to be carried out as a complex one – with participation of physicists, geophysicists, medical men, and specialists from other related branches, whereas for the purpose of identifying new prospective areas, detailed field work should continue in the Poti-Batumi littoral area. *© 2008 Bull. Georg. Natl. Acad. Sci.*

Key words: *Electrometric, Ureki.*

The curative properties of the seaside resort Ureki are well known in Georgia and abroad. Notwithstanding the research carried out in various directions of natural sciences – geology, geophysics, geomorphology, climatology, medicine, etc., the factors that condition the unique properties of the area have not been identified and established yet as a single and clear-cut scientific concept concerning the causes determining the curative properties and the scope of prevalence of this "magic" facility itself.

The Ureki medicinal facility is not pronouncedly distinguished from other Black Sea coastal areas for climatic conditions or for particular effects of cosmophysical fields within the area. In addition, the beach strip is also definitely uniform in terms of beach sands and the content of magnetite in them.

Then what is the cause, in what direction should the research be directed and what factors should be prioritized?

During the period of its existence, the M. Nodia Institute of Geophysics has carried out interesting researches in various directions of applied geophysics.

The first magnetic observations on the territory of Ureki resort were carried out by Prof. M. Nodia in the 1930s [1]. Similar research in the seaside area, land and sea was conducted by an expedition of the Georgian Geology Department [2]. Magnetic measurements on a local site were made by the Georgian Institute of Geophysics in the 1990s [3]. During the 1970s-1980s, an aeromagnetic regional surveying at three different elevations was carried out on almost the entire territory of Georgia, encompassing the areas adjoining Ureki as well [4].

The data of the above-mentioned magnetic research make it possible to characterize the magnetic field structure of the region, its spatial distribution, and the causes of abnormal zones.

The first electrometric work of investigatory nature in Ureki and in its adjacent zone was carried out by us in 2006-2007. The objective of the research was to study the geoelectrical, geological and hydrogeological peculiarities of the region and further to compare the obtained data with the neighboring areas, the curative properties of which still need detecting and reporting.

As seen from section I-Ia, an electrical layer with a 100-120 ohm resistance has been detected in Ureki and its adjacent zone (northward of the River Supsa and southward at a 2-2.5-km distance) section, at the depth of 40-45 m. In the northern part, according to the data of VES (vertical electric sounding) #13 and #26, a layer of high electric conduction, up to 50 m thickness (ρ_m=5-16 ohm) is detected in the depth. In the south, according to the data of VES #3 and #4 (electro drill), approximately after the 10m depth, a layer of high electric conduction and of up to 30 m thickness (ρ_m=5-10 ohm) is also detected.

Thus, in the upper part of the cited section, between VES #2 and #8 a layer of increased resistance is recorded, being surrounded in the north and in the south by a low-ohmic environment. The layer below it, of 50-80 ohm resistance, nearing the surface at sight #8, can be regarded as the supporting electrical horizontal line.

Proceeding from the above, deposits represented within the section, at up to 50m depth, are characterized by abrupt facies changes. In the central part, in the resort Ureki and abutting areas, from the magnetite to the River Supsa, an ρ=100-120 ohm resistance layer is detectable which, in some cases, is being overlapped by high-conductivity (1000 ohm series) lenses. In the north and the south this layer is encircled by high-conductivity areas - at the magnetite in the south and in the River Supsa-Grigoleti section in the north.

Based on the above description, the geological section of the Resort Ureki and its adjoining areas may be represented electrically as a "peninsula" that is sea bound in the west, and by a high-conductivity layer in the north and the south, the so-called "conventional sea", as a result of mineralized water seepage into the land area. The existence of such a "peninsula" in the Black Sea coastal area shall be geologically considered as a rarity.

A question arises – what is the increased resistance layer of the "peninsular" that encompasses the Resort Ureki and its adjacent area, and in what does it differ from low-resistance areas, when the littoral area in the region gives the impression being of uniform in composition?

To this end, two issues, which represent problems of engineering geophysics and are successfully solved by electrometric methods, are to be considered. These are: 1. the sea water effect on the formation of the seaside area's hydrological regime, and 2. the study of the paleobed of the river.

Let us consider these issues separately:

The sea water, due to high mineralization, is characterized by the value of one and tenth ohm resistance. As for the resistance of the water-saturated littoral area soil, it makes the unit and first tens of ohm.

The mineralized sea water effect on the seaside soil resistance was studied in different years in the areas of Bichvinta, Gagra and Poti, as well as in the tributary regions of some big rivers [5], where the soil resistance values used to fall to one ohm. In the beach areas, low resistance was also recorded on the eastern littoral of the Mediterranean Sea, in the littoral part of the Syrian Arab Republic, Latakia region [6]. In this region, electrometric surveys detected a sea water and fresh ground water interface under the land, amounting to 100-120 m.

On the territory of the Resort Ureki, in the northern and southern areas of the geoelectrical section I-I, low resistance of the soil, similar to the above, must have been caused by the sea water seepage into the coastal area.

On the other hand, the deposits in mountain river beds represented by grits, gravel or other form, due to low mineralization of ground waters, create an increased resistance of 100 ohm and over. Based on the above, increased resistance at the tributary of the river Supsa in section I-I is quite natural. However, as seen from the geoelectrical section, these deposits are widely spread in the south of the Supsa, up to magnetite (VES #3, #4) and significantly distanced from the present channel of the Supsa (2-2.5km).

Very likely, the said electrical layer in the area must be completely represented by fluvial deposits in the Supsa paleobed.

Geomorphologic surveys indicate that the southwestern rivers of Georgia were undergoing migration from the south to the north in the historical past [7], as well as the river Rioni, the old channel of which was located in the north and was known as "Narionali".

The searching of river paleobeds by means of electric methods is fairly effective. We conducted such research in Syria [8] with a view to study the underground

water resources and to establish the paleobed of the river Mashavera in Georgia [9].

Proceeding from the above, it is likely that in the lower part of the stream the Supsa riverbed was located 2.5km southward in the historical past, the deposits of which are known for increased electrical resistance in comparison with the lower layers.

Thus, it is evident from the geoelectrical section I-Ia that the Resort Ureki area is geologically different from the neighbor areas of the littoral due to the fact that a 40-45 m thick surface layer is represented here by the Supsa paleobed which, along the entire section, is impregnated with magnetic minerals (sands).

If this distinctive sign is one of the factors contributing to the curative properties of the area, then the study of the so-called "productive layer", both in the littoral area and from shore to land, evokes interest.

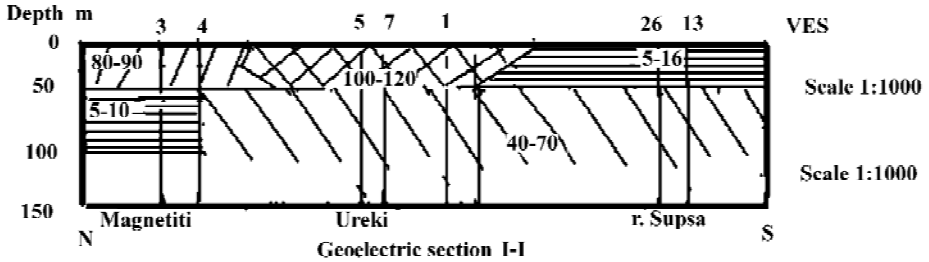
For this purpose, field work continued in the southern direction, on the territory of the Natanebi and Choloki rivers (geoelectrical section II-IIa. The deposits represented here are geologically of the same origin as in the Ureki Resort area, while the so-called "productive layer" of 90-170 ohm resistance contains the same quantity of magnetic minerals. Based on the above, research of these areas with a view to determine their medico-biological property is of considerable interest.

Inside the land, with a view to study the geological situation, observations were held on the perpendicular section of the seaside strip (section III-IIIa). In this area too the electric parameters of the rocks seem to be similar to those of other represented sections –resistance of the contour horizon is ρ=50-80 ohm, the thickness of the so-called 'productive layer" is 30-80m, the resistance increasing to 170 ohm. This fact is quite natural given that abrupt facies changes are a characteristic feature of fluvial deposits.

As a result of the electrometric surveys conducted on the territory of Ureki Resort, the following conclusions and recommendations can be made:

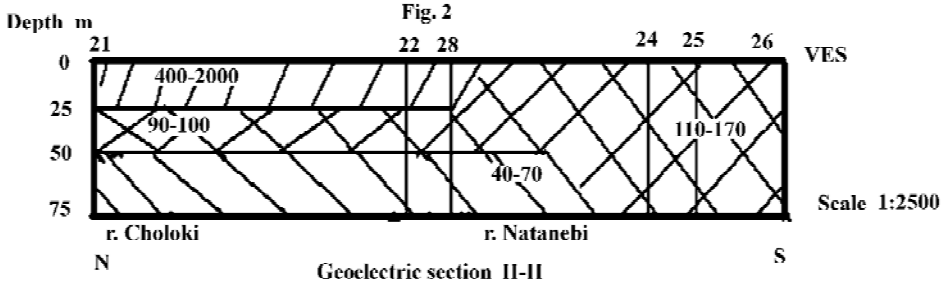
1. The deposits represented within a 100 m section

Fig. 1



Geoelectric section I-I

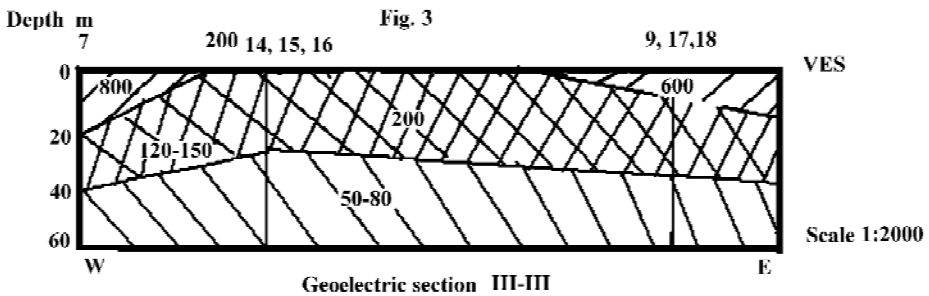
Fig. 2



Geoelectric section II-II

I-I

Fig. 3



Geoelectric section III-III

120-150- Portion electric resistance for all Figures
9, 17.18-Number and location of VES for all Figures

of the area under research are characterized by abrupt facies changes, both horizontally and vertically. The resistance of deposits in the section between Supsa and Magnetite, at a 45-50m depth. a horizon of 80-120 ohm resistance is detectable. In the river Supsa-Grigoleti area, the resistance of deposits falls to 5-16 ohm, the same being observable to the south of the magnetite, where a 30-35m thick low-ohm (ρ_m=5-10 ohm) environment is observable under a 10m layer. The contour geoelectrical horizon is represented by a strong electrical layer h>50 m, of 40-80 ohm resistance, being detectable along the entire area under study. The same is noted in the perpendicular section of the seaside, with the difference that the first layer's resistance increases to 150-170 ohm.

2. According to the geoelectrical surveys I-Ia and III-IIIa and the research conducted by us, the seawater-saturated areas are characterized by one, seldom first tens of resistance values, while the fluvial deposits with fresh groundwater filtrates – of first tens of ohm.

3. Based on point 2 above, the littoral of the Ureki area within section I-Ia may be represented electrically as a "peninsula" that is high-conductivity seawater bound in the west, and by a low-conductivity environment in the north and the south, the so-called "conventional sea". The said redistribution of deposits in the Ureki area, the so-called "peninsula" should be considered as a rarity in contrast to other areas of the littoral.

4. The geomorphologic and electrical surveys suggest that the increased resistance horizon in the Ureki area must have been represented only by fluvial deposits that used to be formed in the paleobed of the Supsa in the historical past.

5. The establishment of the Supsa paleobed is of practical importance because such deposits are associated with magnetic minerals which contribute to the commercial accumulation of iron. In the future, electrometric methods of study can be effectively applied to prospecting iron ore deposits in the riverbeds and the littoral of Ajara.

6. If we assume that fluvial deposits of increased resistance (with high content of magnetic minerals) constitute one of the factors contributing to the curative properties of the area, then interest will attach to the study of the so-called "productive layer", both in the southern direction, where geologically it resembles the Supsa area deposits, as well as in land the littoral area, eastward.

7. Deposits represented in geoelectrical section II-IIa, encompassing the Natanebi and Choloki river basins are, like in the Ureki Resort area, characterized by high content by magnetic minerals and the same electric parameters. Therefore, this area too deserves attention in terms of further investigation of its curative properties.

8. In future, in order to establish the causes of the unique medicinal properties of the Ureki Resort and to identify similar areas in the Black Sea littoral which are of great scientific and practical significance, we consider it necessary that detailed geophysical observations be continued involving the efforts of scientists of different directions, ranging from natural sciences to medical men.

გეოფიზიკა

კურორტ ურეკის მაგნიტური ქვიშების ტერიტორიის ელექტრომეტრული შესწავლის ზოგიერთი შედეგი

გ. ბერიშვილი*, ა. თარხნიშვილი*, ჯ. ლომინაძე, ნ. მებალიშვილი*, გ. ტაბაღუა*, კ. ქართველიშვილი***

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კურორტ ურეკის სამკურნალო თვისებები ფართოდაა ცნობილი, თუმცა ეს რეგიონი შავი ზღვის სანაპირო ზოლის სხვა უბნებისაგან პრაქტიკულად არ გამოირჩევა კლიმატური და გეოლოგიური თავისებურებებით,

მასზე კოსმოგეოფიზიკური ველების ზემოქმედებითა და სხვა ცხადად მიმანიშნებელი ფაქტორებით. ამასთან, პლაჟური ზოლიც გარკვეულად ერთგვაროვანია სანაპირო ქვიშებისა და მასში მაგნეტიტის მინერალის შემცველობის თვალსაზრისით.

გეომორფოლოგიური კვლევების მიხედვით ამ რეგიონის გეოლოგიურ აგებულებაში მონაწილეობას უნდა ღებულობდეს მდ. სუფსის პალეოკალაპოტში წარმოდგენილი მდინარეული ნალექები, რაც ელექტრომეტრული მონაცემებითაც დადასტურდა. ურეკის ტერიტორიაზე წარმოდგენილი ნალექების აღნიშნული გადანაწილება, ელექტრულად ე.წ. "ნახვარკუნძულის" მოდელი, თავისი ჰიდროგეოლოგიური თავისებურებებით გამონაკლისს წარმოადგენს სანაპირო ზოლის ამ რეგიონისთვის. შემდგომი კვლევა მიზანშეწონილია ჩატარდეს კომპლექსურად ფიზიკოსების, გეოფიზიკოსების, მედიკოსებისა და სხვა მონათესავე დარგის სპეციალისტების მონაწილეობით, ხოლო ახალი, პერსპექტიული უბნების გამოვლენის მიზნით დეტალური საველე სამუშაოები გაგრძელდეს ფოთი-ბათუმის სანაპირო ზოლში.

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