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Complex geophysical Investigation of some characteristics of some strong local Guria (Georgia) magnetic anomalies

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Abstract

It should be mentioned, that the "man-made" magneto therapy has a wide application in the world, however the Ureki (Georgia) - Black sea-side health resort, is the only place of natural magneto therapy. In some case it will be a possibility of foundation of a new health resort of natural magneto therapy on the territory of the local magnetic anomaly within the Guria (Georgia) lowland. The local magnetic anomaly detected in the village of Atsana which, like the known Ureki seaside health resort, represents a natural laboratory" with the curative magneto therapeutically environment. The normal value characterizing the magnetic field in Georgia is To= 48800nT. The full T component of the magnetic field in Atsana is liable to significant variations within a small area, maximum to 9000 gamma (Whereas the intensity of magnetic storm in our latitude is within 600-800 gamma). Special mention should be made of Atsana north-western slope, where the full T component of magnetic field varies from 45800 to 54800 gamma. Also, significant magnetic field gradients were registered in the river Atsaura basin (47900 - 55600 gamma) and in other places. Gradients in respect of the normal value have been fixed in Atsana, whose characteristic value is ΔTo=1000nT/m (T-tesla, m-meter, pitch-10m). When moving on a preliminary fixed route path, or "magnetic terrain course" on such anomalous territory (300m^2), one will find himself under the therapeutic effect of the magnetic field variations.

Key words: *Magneto therapy, environment, Ureki, Atsana.*

In the late 20th century, a basically new, so-called synergic approach was established to study a wide spectrum of natural phenomena. The basis of the synergic approach is the taking account of cooperative phenomena/events influencing a specific system. The advances of scientific research attained in various branches made it possible to analyze the processes ongoing in open, unbalanced, dynamic systems, such as the environment where man has to live.

Man represents an open, dynamic, unbalanced selforganized system exchanging substance and energy with the surrounding environment. The second half of the 20th century was characterized by a plethora of studies of the effects of different physical fields on human beings and on bio systems in general.

All physical fields where man had to function, may, by its nature, by divided into three principal groups: (1) Cosmic fields - generated principally by the Sun and possibly other space objects; (2) Geomagnetic and geological-geophysical fields - which are generated by geological bodies, the Earth and its nucleus; and (3) Technogenic fields - generated by technical objects: radio, television, communications systems, electrical devices, etc. The objective of the research is to determine quantitative parameters of the cooperative impact of the fields generated by different sources - from cell to man.

Special importance in our research is given to the study of the effects of the geomagnetic field

and of the fields generated by: lithospheric structures. As is well known, the Earth's geomagnetic field consists of internal and external components. The internal is conditioned by the Earth's structure as of a space body and these components give rise to slow and secular variations of the Earth's constant magnetic field. The external effect includes the ionosphere and the electrical fields related to it.

The Earth's magnetic field is the habitat of all living organisms. Man is especially responsive to any variations of the geomagnetic field.

The stationary effect of different geophysical anomalies caused by geological bodies also impacts geomagnetic fields and vital activity.

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 aero-magnetic 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 of40-45 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 (p_m=5-16 ohm) is detected in the depth. In the south, according to the data of YES #3 and #4 (electro drill), approxi-mately after the 10m depth, a layer of high electric conduction and of up to 30 m thickness (p_n= 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 /7= 100-120 ohm resistance layer is detectable which, in some cases, is being overlapped by high-conductivity (1000 ohm series) lenses, hi the north and the south this layer is encircled by high-conductiv- ity 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 Bicjivinta, 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 /7=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 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 (p_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.

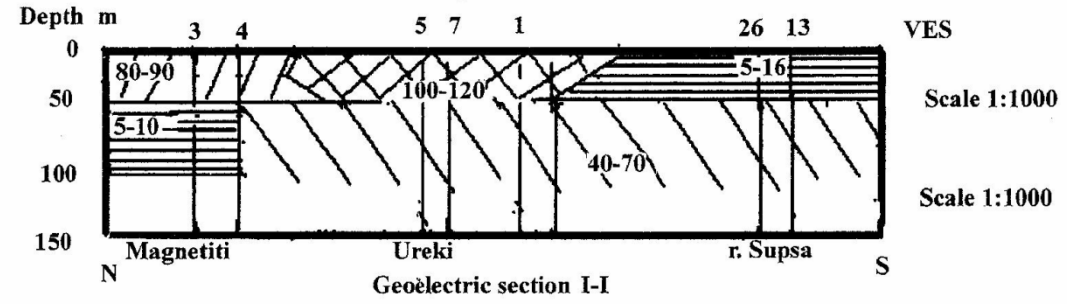
3. Based on point 2 above, the littoral of the Ureki area within section I-Ia may be represented electrically as a "peninsula" that is high-conductivity seawater bound in the west, and by a low-conductivity environment in the north and the south, the so-called "conventional sea". The said redistribution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

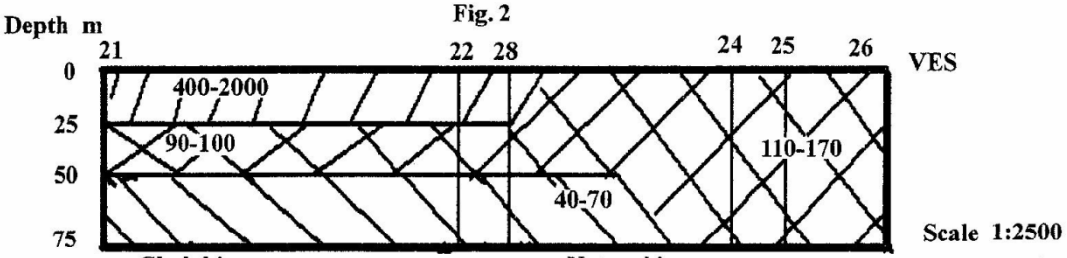
6. If we assume that fluvial deposits of increased resistance (with high content of magnetic minerals) constitute one of the factors contributing to the curative properties of the area, then interest will attach to die study of the so-called "productive layer", both in the southern direction, where geologically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

Fig. 1



Geoëlectric section I-I

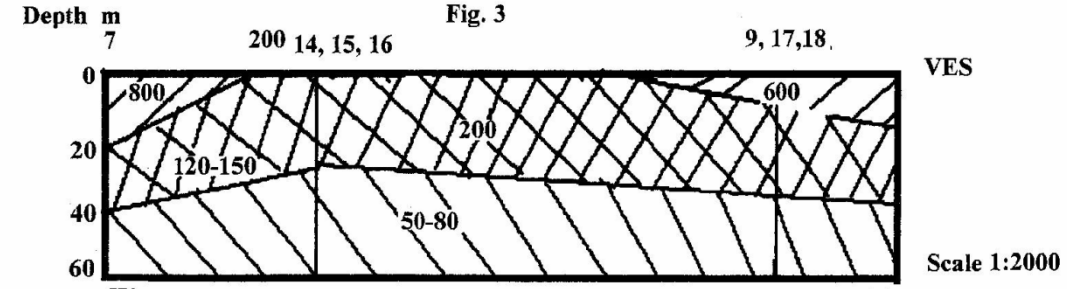
Fig. 2



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

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. to 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.

Since the territory of Georgia is known for both regional and local magnetic anomalies, their research, identification of the ranges, recording the upper and lower levels of the magnetic field intensity growth is a vety urgent problem, especially as significant gradients of the magnetic fields

in various districts of the Guria regional anomaly have been detected as a result of repeated measurements of the magnetic field intensity by a complex field expeditionary team (the measurements were made by means of a proton magnetometer MMP- 2003). A large volume of literary material on magnetic prospecting has been studied. It has been found that under the South Caucasus conditions, namely in Georgia, taking into consideration its mountainous terrain, the tested aeromagnetic prospecting is adequately effective [10]. Accordingly, all magnetic anomalies need to be thoroughly studied by the earth surface magnetic research method, especially, given the contemporary scientific views that electromagnetic fields (including local magnetic anomalies) exert a significant impact on the health of living beings (both positive and negative) [11,12].

From this standpoint, special importance will be given to the study of Guria regional magnetic anomaly.

The expedition has studied in detail Ureki, Tsqaltsminda, Mamati, Guliani, Atsana, and other local magnetic anomalies within the Ureki regional anomaly. The full T component of the magnetic field is liable to significant variations within a small area, maximum to 9000 gamma (whereas the maximum intensity of magnetic storm in our latitude is within 600-800 gamma). Special mention should be made of Atsana north-western slope, where the foil T component of magnetic field varies from 45800 to 54800 gamma. Measurements were made by a standard 10- meter step. In our opinion, the anomaly should be associated with the volcanic rocks containing ferromagnetic minerals, which are characterized by significant gradients. Also, significant magnetic field gradients were registered in the River Atsaura basin (47900-55600 gamma), as well as in (the North-Eastern) Serbeti area adjoining Atsana (46400- 51400 gamma) and in other places.

The volume of the work performed and of the results obtained by the expedition and the value of the obtained information make it possible to hope that, in cooperation with medical men and on condition the above organizational problems are settled, further research will yield results and conclusions that will prove useful not only for Georgian geophysics but also the future of this country.

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Комплексное геофизическое исследование некоторых строго локализованных Гурийских (Грузия) магнитных аномалий.

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Резюме

«Искусственная» магнитотерапия широко используется во всем мире, тогда как единственным известным природным магнитотерапевтическим курортом, рекомендуемым при лечении заболеваний опорно-двигательного аппарата, ревматизма и пр., является уникальный черноморский курорт Уреки, расположенный в западной части Гурийского региона. Однако интенсивные локальные магнитные аномалии выявлены по всей территории Грузии. В данном случае исследуются геофизические характеристики территории локальных магнитных аномалий низкогорной Гурии (с. Ацана), что является первым этапом исследования возможности создания здесь природного магнитотерапевтического курорта. Особенно важными являются также комплексные исследования локальных аномалий Гурийской региональной аномалии с целью составления детальных магнитных карт. Нормальное значение, характеризующее магнитное поле в Грузии имеет величину T=48800 гамма. Максимальная величина полного вектора магнитного поля T в с.Ацана меняется на 9000 гамм (тогда как интенсивность магнитных бурь на данной широте не превышает 600-800 гамм). Следует особенно отметить северо-западней склон территории, где T меняется от 45800 до 54800 гамм. Значительные изменения T были зарегистрированы в бассейне реки Ацаура (47900-55600) и в других местах. Градиенты T относительно нормального поля для с. Ацана можно характеризовать величиной 1000 гамма/м (м-шаг 10м). Выявленная в с. Ацана на небольшой территории (около 300кв.м.) локальная магнитная аномалия позволяет наметить сеть «терренкуров», перемещаясь по которым на определенной скорости, можно создать определенные величины T. Таким образом, данная территория представляется природной «лабораторией», пригодной для многостороннего изучения воздействия магнитного поля на человека, а в дальнейшем - создания природного магнитотерапевтического курорта.

ზოგიერთი ძლიერი ლოკალური გურიის (საქართველო) მაგნიტური ანომალიების მახასიათებლის კომპლექსური გეოფიზიკური კვლევა

ჯ.ლომინაძე, კ.ქართველიშვილი, გ.ბერიშვილი, ნ.მებაღიშვილი, მ.ნიკოლაიშვილი, გ.ტაბაღუა, ა.თარხნიშვილი

რეზიუმე

ადამიანი წარმოადგენს ღია, დინამიურ, არაწონასწორულ, თვითორგანიზებულ სისტემას; იგი ცვლის ნივთიერებასა და ენერგიას გარემოსთან, რომელიც მას გარს ერტყმის. სტატიის ავტორთა კვლევები შეეხება დედამიწის მაგნიტური ველის საქართველოში არსებული ძლიერი ლოკალური მაგნიტური ანომალიების

არეების გამოვლენას, მათი ფიზიკური მახასიათებლების დადგენასა და, მედიკოსებთან თანამშრომლობით, ადამიანზე მათი შესაძლო გავლენის შესწავლას, განსაკუთრებით, თუ გავითვალისწინებთ თანამედროვე მეცნიერულ შეხედულებებს, რომ ელექტრო- მაგნიტური ველები (მათ შორის ლოკალური მაგნიტური ანომალიები) მნიშვნელოვან გავლენას ახდენენ ცოცხალი არსებების ჯანმრთელობაზე, მათ განვითარებაზე (როგორც დადებითს, ასევე უარყოფითს). ავტორთა მიერ დაფიქსირებული ლოკალური ანომალიური მაგნიტური ველების გრადიენტები რამდენიმეჯერ აღემატება ჩვენს განედებზე მაგნიტური ქარიშხლების მაქსიმალურ მნიშვნელობებს. შესწავლილ ტერიტორიებზე მაგნიტური ველის სრული T მდგენელი მცირე ტერიტორიაზე განიცდის ძალზე მნიშვნელოვან ცვლილებებს - რამდენიმე ათასი გამის ფარგლებში (მაშინ, როდესაც ჩვენს განედებზე მაგნიტური ქარიშხლის მაქსიმალური ინტენსივობა არ აღემატება 600 - 800 გამას).