Bulgarian Academy of Sciences. Space Research Institute
Aerospace Research in Bulgaria. 17.2003. Sofia

MAN AS AN OBJECT OF GEOCHEMICAL AND GEOPHYSICAL INFLUENCES

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Abstract

There are an increasing number of papers in the last years that evidence of a correlation between geochemical and geophysical factors and human health parameters and human behaviour. The basic factors that could affect human health and behaviour are: the geochemical composition of the geographical environment; the tectonic processes; the geomagnetic field variations (GMV), the climatic changes and the changes of the solar activity as well as the fact that all of them could influence mutually each other. The subject of this paper is the theoretical basis of the geochemical and geophysical influences on human health. The biological mechanisms according to which the geomagnetic field influences the psychological and behavioural reactions of people are not highlighted or identified yet. We present some of the existing suggestions and theories trying to explain these mechanisms. The studies performed in this area and the obtained results will be very useful in developing measures to protect man from the harmful influence of geochemical and geophysical factors.

Introduction

There are an increasing number of papers in the last years that evidence of a correlation between geochemical and geophysical factors and human health parameters and human behaviour. The data confirming the existence of this correlation become much more convincing. The ratio between the two groups of investigations: those confirming the correlation to those that do not prove it is approximately 4:1. "The effect of geochemical and geophysical factors on human behavior is not an artifact or an occasional

event, but it is usually so complex that it could be easily omitted in the process of limited observations during the performed investigations" [1].

The basic factors that could affect human health and behaviour are: the geochemical composition of the geographical environment; the tectonic processes; the geomagnetic field variations (GMV), the climatic changes and the changes of the solar activity as well as the fact that all of them could influence mutually each other.

Geochemical Influences

The influence of the geochemical components on human health and behaviour is determined by the geochemical composition of the soil and the waters of a certain area; it is in direct relationship with the quantity of rock formations present in the same area. A number of geochemical components with regional variations are integral ingredients of blood, DNA and DRNA as well as of most of the human constitution enzymes [2]. There are a number of well-known cases demonstrating a close relationship between the geochemical composition in given geographical areas and human health as well as other cases known only to the specialists. But in all these cases, the existence of such a relationship is considered to be categorically proven. For example, there is a well-known relationship between the iodine content in human food diet and the development of endemic goitre which is a result of iodine deficiency.

The change of the copper (Cu) content in human constitution is considered as a consequence of the decrease of its quantity in soil. A disturbed copper metabolism in human constitution could cause the appearance of the Wilson disease (hepato-lenticular degeneration) as well as the symptoms of the Alzheimer's disease and old people dementia [4]. Copper is part of the content of some enzymes that are related with the Central Neural System (CNS) cell activity (dopamine, monoamine oxidase, cytochrome oxidase, etc.).

The high molybdenum (Mo) content of underground rocks in some Norwegian areas is considered as the main reason for the great number of cases of Multiple Sclerosis (MS) observed in these areas. Simultaneously, copper (Cu) and nickel (Ni) content in the environment is much less than the existing standards. It is considered that both metals have a balancing effect in respect to the great Mo content [5].

Aluminum (Al) is another soil, water and the food component related with the development of degenerative processes in some brain structures (Amyotrophyc Lateral Sclerosis – ALS). The frequent cases of this disease in

some geographical areas are explained by the great aluminum content found in the soil [6].[1]

It is found that the low zinc (Zn) content causes memory disturbances and psychological derangements [7].

The healing effect of lithium (Li) in the cases of cardio-vascular diseases and psychological problems is well-known.

Selenium (Se) is used successfully in the cases of immune system derangements as well as for potency improvement. This data evidences of a close relationship between environmental geochemical content and human health and psychological activity.

Tectonic Processes

The tectonic processes are a factor that could also influence human psycho-physiological processes. It is found that precursors of tectonic activity could be observed days or even months before the event and surprisingly in areas located even at distances of several hundred kilometers away from its epicenter. Such precursors are: the electrical field changes, the low frequency variations, the specific smell of underground gases, the Geomagnetic Field (GMF) changes and the low and high frequency acoustic phenomena. Unfortunately, the phenomena usually observed and human behaviour perturbations are accounted for only retrospectively. The most frequently established fact is that the number of the various mysterious or unusual events has increased. For example, various light effects are often qualified as meetings with UFO. The cases of extrasensory or clairvoyant abilities as well as the appearance of poltergeists become much more frequent. These strange phenomena are quite often related with seismic activity [8]. The progressive increase of the number of these phenomena could assume epidemic character, which in its turn might result in a large-scale public panic [9].

Geomagnetic Influence

Geomagnetic (GM) variations could involve somatic and psychological health problems. GMF variations and especially low frequency (less than 100 Hz) variations penetrate easily live tissue, thus influencing all living organisms, including man.

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[1] The review of the investigations concerning the influence of geochemical composition on human health in certain areas in Bulgaria is the subject of the present publication.

Earth GMF is about 0.5 gauss that corresponds to 50,000 gamma or 50 microtesla. Of coarse, it is not constant, but varies in the different geographical regions. It is approximately 25,000 gamma at the equator and about 70,000 gamma in the polar regions. The quantitative expression of these GMF intensity variations is presented by a variety of indexes – Kp, Ap, aa, Dst, etc.

Men possess varying degree of sensitivity to the GMF changes and perceive them in respect to both GMF waves intensity and their direction. There are people who can identify GMF changes of about 0.1 gauss/min. Some people even react to changes of 0.01 gauss/s.

Biological Mechanisms

The biological mechanisms after which GMF influence the psychological and behavioural reactions of people are not highlighted yet, albeit the various proposals and theories that have been forwarded. In ancient times, the magnetic forces were imparted a mysterious, supernatural and divine sense. In the Middle Ages, Parcelius used successfully the magnetic influences for medical treatment of various diseases. Later, in the middle of the 18th century (1766) F.A., Mesmer launched the idea of the existence of universal magnetic gravitation as well as of its influence on man. He explained all magnetic properties by the presence of a fluid causing magnetism. He even asserted that that fluid could not be seen or measured but it accounted for vital origin and it came from the universe depths, spreading over the planets and the earth and being felt by the people who passed it along to each other. He said that this fluid provided the reason, the feelings and the viability. Nobody could explain the origin of that fluid, but it really existed [10].

A much more real mechanism asserts that a very slight difference in the polarity between the CNS and the peripheral nerves of a degree of 15-29 mV could work like a primitive sensor in respect to the GMF change perceiving [11].

The electrical activity of some CNS structures and the endocrine glands is very sensitive to small changes of the GMF. Some of them are: pineal gland, thymus, gonads, thyroid gland, etc. These formations are involved in the cyclic recurrence of the psychological processes of live organisms and ..."the circadian periodicity could influence basically as well as could increase the psychological malfunction" [1].

The presence of biogenic magnetite containing bioorganic iron compositions could be accepted as one of the possible ways for perceiving of

GM changes. Magnetite has been discovered in a number of microorganisms, fishes, birds, mammals and also in the human organism. The crystal lattice of the biogenic magnetite structure is different from the other ferrous compositions of inorganic origin [12]. Magnetite has been found in the adrenals, in the area over the eyebrows, etc. The conducted studies reveal that magnetite quantity increases proportionally with age. The presence of magnetite of biological origin..."allows us to regard the problems of magnetic perceiving from a new point of view initiating as well the idea of the existence of the so-called "Sixth Sense" which plays an important role in the behaviour of organic world representatives as well as in their evolution" [12].

There are some assumptions that the occurring atmospheric and geophysical changes influence the cells of live organism directly or indirectly by changes in water molecules, membrane permeability and the systems supporting homeostasis.

There is an interesting theory, which considers human constitution's neural lines as antennas perceiving the changes in geomagnetic waves and solar irradiation. It is namely in these antennas that the internal influences of certain intensity and frequency are transformed into neural impulses. The last ones influence the functions of the internal organs and the endocrine glands in human constitution by the vegetative neural system.

Modern Investigations

The electrophysiological studies reveal that the changes in GMF intensity influence the Central Neural System by a change in the frequency of the background electrical brain activity. The changes in this field are about 0.002 V/m and they change the frequency of brain rhythms by 1 Hz [13]. There are also changes in the vegetative functions, which are manifested by changes of the heart activity, the blood pressure values and the respiratory parameters.

The GMF pulsations such as Pc (pulsations continues) and Pi (pulsations irregular) could also have a biogenic meaning. For example, the Pc1 pulsations have a period from 0.2 to 5 s, which corresponds to the heart muscle shortening frequency. The appearance of these pulsations could essentially influence the activity of the biological system.

The continuous activity of the changed geomagnetism involves in a common reaction the neuroendocrine and endocrinology systems as well. This is proven by the identified changes in the hypothalamus-hypophysis system as well as in the adrenals. Some changes occur also in the peripheral

blood and oxidation processes. Some more challenging investigations attempt to reveal the influence of earth magnetism on creative activity, talents and human genius [14].

While trying to highlight the influence mechanisms of the GMF on the CNS, Belov D. R. et al. found a positive correlation between the Ap index and brain electrical activity. The intensification of the synchronization processes during GMF changes were most clearly expressed in the frontal and central areas of the cortex [15]. The synchronization processes are considered a part of the total stress reaction involving biochemical and hormonal variations.

Nikolaev Y. S. et al. noted the influence of short-period GMF fluctuations which, in their opinion, are a main ecological factor influencing the biosphere. Their effect can be identified in both the amplitude increase as well as in the case of the fluctuation's complete disappearing [16]. An optimal level of the GM activity is necessary for a normal CNS activity. An abrupt GMF increase or its decrease to complete disappearing could result in various types of brain malfunction [17].

The vegetative neural system, playing an essential role in the function regulation of a number of human organism and systems is also sensitive to GMF changes. It is proven that the sympathetic vegetative neural system reacts mainly to slighter GM variations. The more abrupt and more intensive GMF changes cause a reaction of the parasympathetic vegetative neural system [18]. The duration of the activity of the GM parameter changes is of essential importance to all live organisms and especially to man. Thus, the idea of the need to determine the "dose" of GMF variations to which a live system is exposed originated. The need to design a "dosimetry" method regarding the cumulative exposure to unstable or abrupt GMF parameter changes was pointed.

The investigations aiming to identify the influence of the various geochemical and geophysical factors on human health and behaviour are as necessary as difficult to conduct because geophysical and solar phenomena are hard to isolate from the numerous physical factors of the environment as well as from the social and public cause-effect interrelations. "Further toxicological studies are required to assess the controls on the health effects of environmental hazards in different populations" [19]. In spite of the objective difficulties, the investigations in that area as well as the results obtained will be extremely useful in developing measures protecting man from the harmful effect of geophysical factors.

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ЧОВЕКЪТ КАТО ОБЕКТ НА ГЕОХИМИЧНИ И ГЕОФИЗИЧНИ ВЪЗДЕЙСТВИЯ

Ирина Стоилова

Резюме

През последните години значително нараства броят на публикациите, потвърждаващи корелацията между геохимичните и геофизичните фактори с параметри на човешкото здраве и поведение. Основни фактори, които могат да въздействат върху здравето на човека и неговото поведение, са геохимичният състав на географската среда; тектоничните процеси; вариациите на геомагнитното поле; климатичните промени и промените в слънчевата активност, като те взаимно влияят един на друг. Предмет на статията е обзорно представяне на някои теоретични постановки на геомагнитното и геохимичното влияние върху здравето и поведението на човека. Биологичните механизми, по които геомагнитното поле и геохимичният състав влияят върху физиологичните и поведенчески реакции на човека, не са изяснени и прецизирани, въпреки че съществуват различни предположения. Представени са някои от предложените в литературата теории и модели за обяснение на тези механизми. Изследванията в тази насока и резултатите, получени от тях, ще бъдат изключително полезни за разработването на защитни мерки, предпазващи човека от вредното влияние на геохимичните и геофизичните фактори.