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# The Concept of an Expanding Earth

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**Abstract**—This paper is a review of the results of different authors relating to the growth of the Earth's mass and energy during geological history, as the planet was absorbing the energy and matter of the space vacuum (the ether). The result must be simple chemical elements and compounds. In fact, the "gas breathing" coming from the Earth's interior transports great amounts of hydrogen, helium, nitrogen, methane, carbon monoxide and dioxide, water, and other simple compounds to the Earth's surface. Apart from expanding the size of the planet, the absorption of energy and matter from the vacuum also intensifies volcanic, tectonic, and other geological processes as time goes on. For this reason the evolution of the Earth can be considered as antientropic. The consequences of the concept of an expanding Earth should be taken into account in studies in tectonics, petrology, lithology, petroleum geology, ecology, volcanology, and seismology.

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## A BRIEF CONSIDERATION OF THE VIEWS OF INVESTIGATORS ON THE EARTH'S EXPANSION

In recent years the expanding Earth concept has been very attractive to investigators. The pioneer of the concept was the Russian scientist I.O. Yarkovskii, who published the book "Universal Gravitation as a Consequence of the Generation of Gravitating Matter inside Celestial Bodies" in 1889 [56]. He was the forerunner of A. Einstein in that he called attention to the possible equivalence of mass and energy and their possible mutual transformations in natural processes. According to Yarkovskii [56] and his follower W. Carey [19, 57], mass and energy are created in the inner parts of celestial bodies, which are revolving along their orbits, because these bodies absorb energy and matter of the space vacuum (ether or gravitational field). The creation of mass and energy produces the growth of the energy, mass, and volume of celestial bodies and the transfer of energy and mass from the interiors of these bodies to the Universe, but the mass and energy acquired by the celestial bodies exceeds the loss of these [12, p. 98].

R.M. Bembel' sought to describe the mechanism of energy and mass transfer in the Earth [5–7] by suggesting the term *geosoliton*, which he uses to refer to solitons[2] and soliton-like formations of the Earth's geodynamic field, which are born in the core, travel outward in an impulsive mode from the deeper geospheres, traverse the mantle, the crust, the hydrosphere, and the atmosphere, and travel to the Cosmos in the form of soliton and photon radiation. Geosolitons facilitate the generation of subvertical zones of cracked and less dense rocks, which serve as channelways for defluidization [5–7].

Larin [20] put forward the hypothesis of an originally hydride Earth. This author thinks that the subsequent expansion of the Earth was caused by metal hydrides being converted to metals, resulting in an increased overall volume and the release of free hydrogen, but does not accept the notion of new matter being generated within the planet.

The problem of the expanding Earth was the subject of the 1981 All-Union conference in Moscow [32] and an international symposium in Sydney, Australia [58].

Based on the data from observations of extragalactic radio sources (quasars) by NASA (USA) the Earth's radius is currently increasing at a rate of 2 cm per year and similar values are derivable from other data as well [19, 54]. Calculations based on the idea that the Earth's radius increases annually by 2 cm show that the planet's mass increases annually by $5.6 \cdot 10^{16}$ kg [54].

L.M. Yakushin [54] explains the fact that the Earth receives energy via the interaction of our planet with the space ether; he thinks that the Earth receives an annual supply of energy equal to $3.6 \cdot 10^{24}$ J, assuming the velocity of ether particles (amers) as they enter the Earth to be equal to the second space velocity, 11200 m/s.[3] This amount of energy exceeds that released by seismic and volcanic activities in the Earth's interiors ($10^{18}$…$10^{19}$ J/yr [41]) by at least five orders of magnitude. This excess energy is transformed into inertial mass (ordinary matter), causing the Earth to expand and grow in mass. Ether [1] is

[1] This paper is published as an invitation to a discussion.

[2] A soliton is a structurally stable solitary wave propagating in a nonlinear medium. Solitons behave like particles (they are particle-like waves): when interacting among themselves or with some other disturbance they are not destroyed, but diverge, conserving their structure [39].

[3] If we assume the velocity of ether particles as they enter the Earth to be higher than that proposed by L.M. Yakushin [54], namely, equal to 30% of the speed of light, i.e., $9 \cdot 10^7$ m/s, then the amount of energy acquired by the Earth according to this calculation would be higher and closer to the figures derived by other authors (Table 3).)

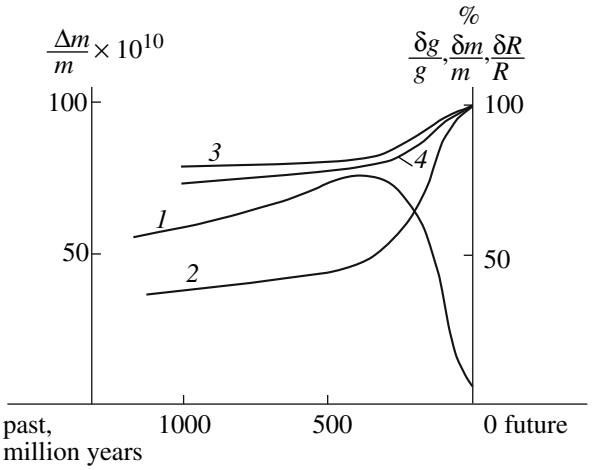


**Fig. 1.** The variation of some Earth parameters in the past after [16]: (*1*) relative increment in the Earth's mass per year ($\Delta m/m$); (*2*) percent change in the Earth's mass and acceleration due to gravity relative to the present-day values ($\Delta m/m$, $\Delta g/g$); (*3*) percent change in the Earth's radius relative to the present-day value ($\Delta R/R$); (*4*) percent change in the Earth's radius after [19] relative to the present-day value.

the term applied to the universal medium which fills all space and which generates all kinds of matter, as well as being responsible for all kinds of interactions. Ether is an extremely rarefied gas that is compressible within wide limits and which consists of minute particles, or amers, that are moving chaotically at enormous velocities.

The density of ether is from $8.85 \cdot 10^{-12}$ [1] to $3.1 \cdot 10^{-10}$ [54] kg/m$^3$ according to different workers.

Yakushin [54] used the following equation to find the increment of energy and mass:

$$\Delta E = \frac{\Delta m_i \cdot V^2}{2}, \qquad (1)$$

where $\Delta E$ is the energy increment, $\Delta m$ the mass increment, and $V$ the velocity of amers as they enter the Earth.

K.E. Veselov [14–16] gave detailed arguments to support the concept of the expanding Earth from the standpoint of geophysics, geology, energy, and cosmological considerations. This author came to the conclusion that the Earth's mass and the acceleration due to gravity have increased by about twofold during the last 500 million years (Fig. 1). This inference coincides with E.E. Milanovskii's results [27], viz., that the Earth's surface has increased by one third and its radius by 18% since the Jurassic Period. The inflection in the curves (Fig. 1) that occurred at a time of about 500 million years ago, approximately at the very beginning of the Phanerozoic, shows that substantial quantitative changes took place in the Earth's evolution at that time. Veselov explains the fact that the Earth receives energy using his own corpuscular model of gravitation and inertia (CMG and I), as follows [16, pp. 5–39]. Revolving on an elliptical orbit, the Earth experiences periodic accelerations and retardations of its motion. In both of these cases the Earth acquires energies of inertia and gravitation amounting to $5 \cdot 10^{32}$ J/yr [14]. The mass increment rate is $5.6 \cdot 10^{15}$ kg/yr.

P.P. Timofeev [46] thinks that the expanding Earth concept will become one of the leading paradigms of geology in the first quarter of the 21st century. The concept is dealt with in [48]. A.V. Nikolaev [28] thinks that the expanding Earth concept has promise and calls attention to the necessity of finding a viable physical process that could have increased the Earth's radius by a factor of 1.4 during the last 180 million years.

Yu.V. Chudinov [52] believes that paleomagnetic data provide evidence that the Earth's size has increased during geological history. According to his calculations, the Earth's radius was 0.6–0.85 of the present-day radius in the Late Paleozoic and Mesozoic. He examined the spatial distribution of volcanoes and earthquake hypocenters at island arcs to propose the eduction theory [51], i.e., the ascent of deep mantle material along the lower boundary of the continental mantle block caused by the Earth's expansion. In his opinion, the eduction theory is a better fit into the observed distribution of volcanoes and earthquake hypocenters than the subduction theory, as put forward by plate theory proponents. Eduction causes an expansion of the Earth's surface, similarly to spreading at mid-oceanic ridges.

Ideas relating to the expansion of the Earth are examined in detail and substantiated by V.F. Blinov [12]. According to his calculations, the Earth's mass receives an annual increment of $5.5 \cdot 10^{16}$ kg owing to the planet absorbing the material carriers of gravitation from the space vacuum. This value is in approximate agreement with the increment of the Earth's mass, as inferred by Yakushin [54], $5.6 \cdot 10^{16}$ kg/yr. The amount of energy the Earth absorbs from the space vacuum is estimated by Blinov as ~$4.9 \cdot 10^{33}$ J/yr [12]. He supposes that the Earth has passed through several phases during its evolution, from the asteroid to the present-day terrestrial phase (Table 1). The asteroid phase is supposed to have taken place during Catarchean time, and we have nearly no information regarding that period. An approximate variation of the acceleration due to gravity on the Earth during the last 280 million years as estimated by Blinov [12] can be found in Table 2.

E.V. Barkovskii [3] put forward a new theory of gravitation for celestial bodies, a physical theory of gravitation, which unlike I. Newton's kinematic theory implies the existence of a material carrier for the gravitational field (the physical vacuum). Barkovskii explains the increase in the mass of celestial bodies as time goes on by invoking the absorption of particles (which are the material carriers of the gravitational field) by the bodies, otherwise one encounters the "momentum paradox problem." These particles are very small ($10^{-34}$ m) and have a mass of $10^{-46}$ kg. Using the law of momentum conservation for such a material gravitational field, Barkovskii derived

**Table 1.** Comparison of stratigraphic units with the cosmic phases in the Earth's evolution [12]

| Cenozoic | Mesozoic | Paleozoic | Precambrian | |
|---|---|---|---|---|
| Terrestrial | Martian | | Lunar | Asteroidal |
| Cosmic evolution phases | | | | |

an equation to describe how the mass of a gravitating body (e.g., Earth) varies:

$$\frac{dM_3}{dt} = \frac{4\pi \cdot m_p \cdot G \cdot M_3}{\delta_{\text{eff}} C}, \quad (2)$$

where $M_3$ is the mass of the gravitating body (the Earth) equal to $6 \cdot 10^{24}$ kg, $m_p$ is the mass of a proton (as a trial body) equal to $1.67 \cdot 10^{-27}$ kg, $G$ is the gravitational constant equal to $6.67 \cdot 10^{-11}$ $m^3 kg \cdot s^{-2}$, $\delta_{\text{eff}}$ is the effective proton section equal to $1.8 \cdot 10^{-28}$ $m^2$, and $C$ the velocity of light equal to $3 \cdot 10^8$ m/s.

From Eq. (2) it follows that for our planet to exert the actually observed force of gravity, the Earth must increase its mass by a certain amount.

Substituting specific values in Eq. (2), we get the rate of mass increase as $\frac{dM_3}{dt} \approx 1.55 \cdot 10^8$ kg/s $\approx 1.3 \cdot 10^{13}$ kg/day $\approx 4.9 \cdot 10^{15}$ kg/yr.

The mass of material particles absorbed by the Earth from the gravitational field is concentrated in the deeper central interior of the planet and is transformed into the chemical elements of D.I. Mendeleev's periodic table. The first to be generated are the simplest chemical elements found at the beginning of the table (hydrogen, helium, nitrogen, and others) followed by simple chemical compounds. This finds confirmation in the actually observed release from the planet's interiors of hydrogen, nitrogen, and simple chemical compounds (methane, hydrogen sulfide, water, and carbon dioxide). These substances and simple chemical compounds are moving in great amounts along tectonic faults (especially along intersecting faults) and in gases from volcanoes, including mud volcanoes, which has been noted by many investigators. The Earth's interior can apparently be viewed as a natural giant reactor that transforms the absorbed matter of the physical vacuum into ordinary atomic and then molecular matter.

The increase in the mass of our planet causes a corresponding increase in its volume. The simplest estimate for the volume increase due to mass increase can be deduced assuming the mean density of the planet to be 5.5 g/cm$^3$. However, a more correct estimate of the Earth's volume increase can be obtained, as suggested by Barkovskii, by using the mean of the mean density of the Earth (5.5 g/cm$^3$) and that of the Earth's core (~10.5 g/cm$^3$), that is, a density of ~8 g/cm$^3$. The volume increase for the Earth will then be 1.5 km$^3$/day or ~550 km$^3$/yr. This must entail an increase in the Earth's surface by ~750 m$^2$/day or ~0.27 km$^2$/yr, with the mean radius of the Earth increasing by ~1.5 mm/yr.

Barkovskii used the law of conservation of energy for the gravitational field to derive an equation that describes the total flux of gravitational energy $W_{\text{gr}}$ that the Earth absorbs per unit time:

$$\frac{dW_{\text{gr}}}{dt} = \frac{4\pi \cdot m_p \cdot G \cdot C \cdot M_3}{\delta_{\text{eff}}}. \quad (3)$$

Substituting the parameter values listed above in Eq. (3), we get

$$\frac{dW_{\text{gr}}}{dt} \approx 1.4 \cdot 10^{25} \text{ J/s}, \approx 4.4 \cdot 10^{32} \text{ J/yr}.$$

Table 3 summarizes the ideas of different investigators as to the processes involved in the increase of mass and energy of the Earth.

E.E. Milanovskii [25, 26] thinks that the Earth is expanding at a nonuniform rate in the pulsating mode providing for a net increase of the Earth's size over time. If one relates the growth of the Earth to space factors, then the nonuniform pulsating growth can be explained by time-dependent changes in position experienced by the Earth and the solar system, perhaps the Galaxy as a whole in the Cosmos, since space affects the processes that occur on the Earth [12, 26, 49]. This problem is complex and requires a special study. A.V. Peive [30, 31] noted that the gravitational and inertial forces of the Earth and space factors may affect the Earth's evolution.

## THE EVOLUTION OF THE EARTH AS AN ANTIENTROPIC PROCESS

The fact that the Earth acquires substantial amounts of energy due to the interaction of the planet with space factors (the space ether and gravitational fields), added to the increasing mass and volume of the Earth, provide for an antientropic evolution of the Earth [12]. Several investigators have noted the accelerating occurrence of many geological processes, including the growth of volcanic and tectonic activities. There are data [23] showing that the acceleration of volcanic activity manifests itself as increased discharge of volcanic products during shorter time intervals. It is emphasized that many geological processes are being accelerated [35].

**Table 2.** Approximate variation in the acceleration due to gravity on the Earth during the last 280 million years [12]

| Million years | 0 | 40 | 80 | 120 | 160 | 200 | 240 | 280 |
|---|---|---|---|---|---|---|---|---|
| $g$, m/s$^2$ | 9.81 | 8.8 | 7.7 | 6.8 | 6.0 | 5.3 | 4.7 | 4.2 |

**Table 3.** Some characteristics of and results from the growth of the Earth's mass and energy as found by different authors

| Authors | Characteristics, some parameters, formulas | Rate of growth | |
|---|---|---|---|
| | | mass $m$, kg/yr | energy $E$, J/yr |
| K.E. Veselov [14, 16] | The Earth acquires energy of inertia and gravitation due to revolution on an elliptical orbit where the Earth experiences accelerations and retardations. Formula to calculate by: $\Delta E = \Delta m \cdot C^2$ [16, pp. 5–39]. | $5.6 \cdot 10^{15}$ | $5 \cdot 10^{32}$ |
| E.V. Barkovskii [3] | The Earth absorbs particles of the material carrier of gravitation (the physical vacuum) moving chaotically in the outer space with the velocity of light. The particle size is $10^{-34}$ m, the mass is $10^{-46}$ kg. Formulas to calculate the growth of mass (2) and energy (3) are given in the main text. | $4.9 \cdot 10^{15}$ | $4.4 \cdot 10^{32}$ |
| L.M. Yakushin [54] | The Earth absorbs material particles of the space ether (amers). The amer mass is $1.1 \times 10^{-37}$ kg. The number of amers in 1 m$^3$ is $2.8 \times 10^{27}$. The velocity with which amers enter the Earth is 11200 m/s [54] with N.P. Betelev's correction it is equal to 30% of the velocity of light, i.e., $9 \times 10^7$ m/s. Formula: $\Delta E = \frac{\Delta m \cdot V^2}{2}$ (1). | $5.6 \cdot 10^{16}$ [1] | $3.6 \cdot 10^{24}$ [2]<br>$2.3 \cdot 10^{32}$ [3] |
| V.A. Atsyukovskii, V.G. Vasil'ev [2] | The Earth absorbs material particles of space ether (amers). The amer mass is $< 1.5 \times 10^{-114}$ kg. The number of amers in 1 m$^3$ is $> 5.8 \times 10^{102}$. The velocity with which amers enter the Earth is 11180 m/s. For the derivation of formulas see [1, Chapter 10]. | $5.6 \cdot 10^{16}$ | $2.3 \cdot 10^{32}$ |
| V.F. Blinov [12] | The gravitational field is an energy flux toward the Earth. The growth of the Earth's mass and energy occurs as the Earth absorbs material carriers of gravitation. For the derivation of formulas to calculate the growth of the Earth's mass and energy see [12, pp. 100–109]. | $5.5 \cdot 10^{16}$ | $4.9 \cdot 10^{33}$ |

Note: [1] assuming the Earth's radius to increase at a rate of 2 cm/yr and its mean density equal to 5.5 g/cm$^3$; [2] assuming the velocity with which the particles of space ether enter the Earth to be equal to the second space velocity, 11200 m/s [54]; [3] assuming the velocity with which the particles of space ether enter the Earth to be equal to 30% of the velocity of light, i.e., $9 \times 10^7$ m/s (N.P. Betelev)

The Late Precambrian and Phanerozoic volcanism increased over time [33]. There are numerical data [50] on the rate of growth for the area of continental crust, amounting to 0.05, 0.1, and 0.2 km$^2$ per year during the Baikalian, Caledonian/Hercynian, and Cimmerian/Alpine folding epochs, respectively. These figures corroborate the accelerating growth of the continental crust. The same is also confirmed by the plot in Fig. 2 [53]. The plot from [12] (our Fig. 3) shows the accelerating growth of the area of oceanic crust during the last 140 million years (see the relevant data in [12, p. 57]). The curve (Fig. 3) is given by the equation $A = A_0 \cdot e^{-\kappa t}$, where $A$ is the area of oceanic crust at each time instant in the past, $A_0$ is the present-day area of oceanic crust, $\kappa$ the tangent of the angle of slope for the line in Fig. 4, and $t$ the time from the present to a time of interest in the past. Since the rate of growth of oceanic crust is given by the derivative $\frac{dA}{dt} = -\kappa \cdot A_0 \cdot e^{-\kappa t}$, substitution of various values of $t$ gave [12] a rate of 1.3 km$^2$/yr for the early Cretaceous and 3.12 km$^2$/yr for the present. This furnishes numerical confirmation of an increasing rate of growth of oceanic crust for the last 140 million years and the antientropic character of the evolution of the Earth.

It is possible that the generation of mantle plumes [27] is related to the generation of matter and energy in the Earth's interior, resulting from the processes that are considered in the theory of the expanding Earth [5, 12, 14–16, 54].

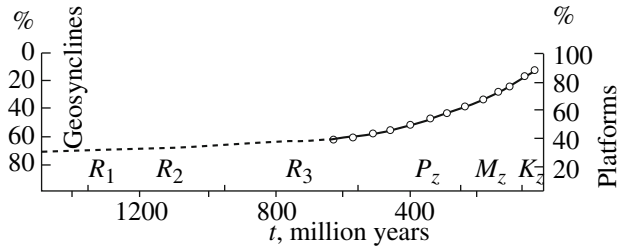


**Fig. 2.** The evolution of continental crust after [53].

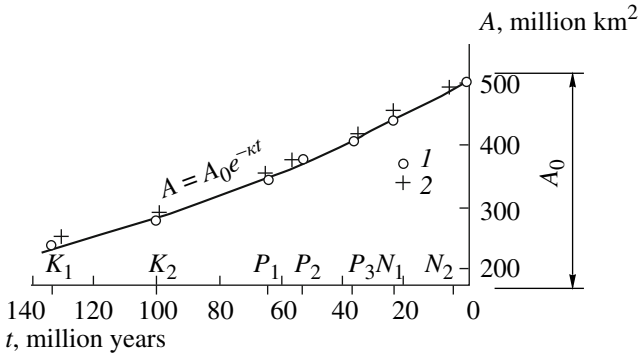


**Fig. 3.** Accelerated growth of oceanic crust after [12]: (*1*) areas of oceanic crust $A$ calculated at the beginnings of epochs [12]; (*2*) analogous data after [34].

## THE GROWTH OF THE EARTH AND PROBLEMS ARISING IN PETROLOGY, LITHOLOGY, PETROLEUM GEOLOGY, ECOLOGY, VOLCANOLOGY, AND SEISMOLOGY

In contrast to classical petrology, which is concerned with differentiation and rearrangement of the Earth's material without appealing to the new generation of this material [24], the expanding Earth concept incorporates the possible generation of matter and energy in the Earth's interior owing to the transformation of the matter and energy coming from the cosmic vacuum and absorbed by the Earth into inertial mass [9, 10, 11].

When inertial mass (ordinary matter) is generated from energy, the first matter to appear must be the simplest molecules and chemical compounds [15]. As a matter of fact, such simple chemical elements and their compounds are traveling from the interior to the near-surface zones in great amounts during degassing in the form of hydrogen, helium, nitrogen, argon, radon, carbon monoxide and dioxide, methane, water, and so on [16, 17]. As estimated in [17] by summing up the gas discharges in various geostructural zones, the annual amounts that are supplied to the terrestrial atmosphere include $6.1 \cdot 10^{12}$ g hydrogen, $24.7 \cdot 10^{12}$ g nitrogen, $272.9 \cdot 10^{12}$ g carbon dioxide, and $223.5 \cdot 10^{12}$ g hydrocarbons, with methane prevailing in the latter; methane is not of biochemical origin as demonstrated by the comparatively heavy isotope composition of its carbon.[4] Enormous amounts of deep helium come to the upper crustal horizons and are released from the Earth's surface; the generation of this helium is unrelated to the decay of uranium ore [55].

Many processes considered in petrology require a reduction environment, which in the opinion of A.A. Marakushev [24], F.A. Letnikov [21] and others, is produced because hydrogen that originally was in the Earth's core comes to the overlying geospheres. It is possible that the hydrogen that is required to produce the necessary reduction environment can be generated within the Earth as a result of the above-mentioned processes related to the expanding Earth concept.

The increase in the Earth's size and the acceleration due to gravity during geological history finds confirmation in the fact that some features of sedimentation vary over time, as well as in other lithologic data. L.S. Smirnov [36, 37] gave a detailed argument for the growth of the Earth based on data relating to the decreasing (in time) angle of slope found in the cross-bedding of sand rocks. He reviewed a great deal of statistical material to come to the conclusion that the angle of slope in the cross-bedding of subaqueous sand rocks has decreased by 5°–7° during the last $2 \cdot 10^9$ years. One also finds a decreasing angle of slope for

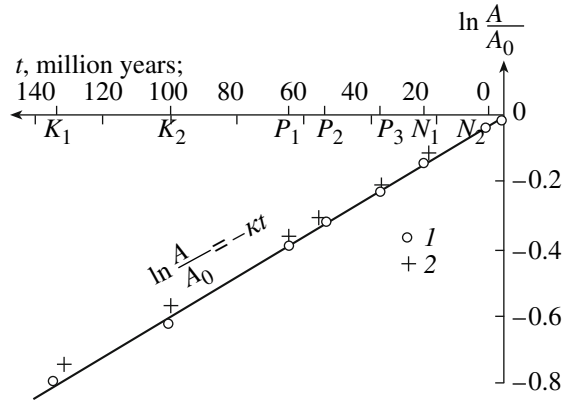


**Fig. 4.** Linear relation ln $(A/A_0)$ as a function of age $t$ after [12]: (*1*) values of ln $(A/A_0)$ [12]; (*2*) analogous data after [34].

cross-bedding in eolian deposits. Since the leading factor that controls the angle of cross-bedding, that is, essentially the angle of repose in sedimentation, is the force of gravity, it follows that the variation in cross-bedding angles provides evidence of increasing gravity, hence an increasing size of the Earth. Based on experiments, one can hypothesize from this decrease in cross-bedding angles that the acceleration due to gravity has increased greatly since Proterozoic time [38].[5] This persistent increase in gravity during geological history also finds confirmation in the changes in the structure and texture of sand–silt rocks [37].

The data of A.P. Vinogradov and A.B. Ronov show that the concentration of heavy minerals has been decreasing in the sand rocks of the Russian Platform during the last $8 \cdot 10^8$ years. This may have been due to reduced ability of these minerals to migrate, owing to increased gravity, hence the size of the Earth, during that time [36].

The data relating to the growth of the Earth should be taken into consideration when examining the possibilities and limits to the application of the principle of uniformity to geological history, since variation of the acceleration due to gravity caused by the variation of the Earth's size and mass (Fig. 1) exerts a great influence on sedimentation and the other processes involved in the generation of sediments and rocks. Recalling that the inflection in the curves showing the time variation of some parameters of the Earth (mass, radius, and acceleration due to gravity) (Fig. 1) occurred about 500 million years ago (approximately at the very beginning of the Phanerozoic), one may assume that the principle of uniformity is applicable up to that time, possibly with modifications that become greater as one moves back in time.

The incorporation of the processes considered by the expanding Earth concept enhances and deepens the potential of formation analysis [45].

[4] If one calculates the amount of methane coming to the terrestrial atmosphere based on its quasiconstant concentration in the atmosphere and the mean residence time in the atmosphere for methane molecules (1–5 years), then the annual amount of deeper methane that come to the terrestrial atmosphere would be $1 \cdot 10^{15}$ to $5 \cdot 10^{15}$ g [17].

[5] Similar results were obtained by Blinov [12] in his calculation, which gave the result that the acceleration due to gravity varies over time based on his calculations of the Earth's size variation (Table 2).

Classical lithology has long been concerned with volcanogenic sedimentary formations [4, 13, 22, 29, 42–44]. It appears that the analysis of the endogenous component in the volcanogenic sedimentary process should incorporate the possibility that the sedimentation region may receive energy and deeper material that are generated from the energy and matter which the Earth acquires from outer space, as envisaged by the expanding Earth concept.

B.A. Sokolov and A.N. Guseva [40] note the rapidity of present-day hydrocarbon generation, thus regenerating their reserves in developed fields. This is also stressed by many other investigators. Cases have been found in which the total extraction of hydrocarbon from a field is much greater compared with preliminary estimates of the recoverable reserves [18]. Proponents of the organic origin of petroleum [40] explain these features by the rapid occurrence of chemical reactions to transform organic matter into hydrocarbons. We think that one is well entitled to suppose that this rapid reconstitution of hydrocarbon reserves, as well as their original generation, involves the abovementioned processes related to the expanding Earth concept (the hydrogen, methane and other hydrocarbons that have been transformed from the mass and energy absorbed by the Earth from the outer space into ordinary matter are supplied along subvertical tectonic faults and permeable zones of rock destruction due to geosolitons) [8].

Letnikov [21] noted that the oils, produced by deep-seated degassing, transport a wide range of elements upward that are not as a rule found in high concentrations in the near-surface crustal horizons where biological systems were generated, including man. This may disturb the ecologic equilibrium in the near-surface zones. For this reason, and in connection with the entire argument outlined above, the processes envisaged in the expanding Earth concept have a global ecologic importance.

In connection with the above ideas of the expanding Earth concept, one becomes aware of sources of matter and energy that are admitted in this concept but that have not been thought before to affect volcanic and seismic processes [47]. The generation of new matter and energy in the Earth's interior is probably occurring throughout the Earth's volume, while their outward transport to the surface is the most intensive along lineaments coinciding with volcanic belts and spreading zones within mid-oceanic ridges. One major lineament of this kind (the Earth's volcanoseismic belts) is the western and eastern margin of the Pacific Ocean.

## CONCLUSIONS

(1) In recent years the expanding Earth concept has attracted the increasing attention of researchers.

(2) In the opinion of several investigators, the growth of the Earth is caused by energy and matter from outer space that the planet absorbs and transforms in its interior into ordinary atomic and molecular matter.

(3) The idea of an expanding Earth is corroborated by geological, geophysical, astronomic, and geodetic data; according to this combined evidence, the mean radius of the Earth is increasing in its solid shell by as much as 2 cm/yr, according to observations of extragalactic radio sources (quasars) [19]. Yu.V. Chudinov [52] used paleomagnetic measurements of the Earth's size in the past to infer a mean rate of increase for the Earth's radius equal to ~12 mm/yr during the last 200 million years.

(4) The consequences following from the expanding Earth concept should be taken into account in all kinds of geological research.

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