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Possible Relation between Earth Expansion and Dark Matter
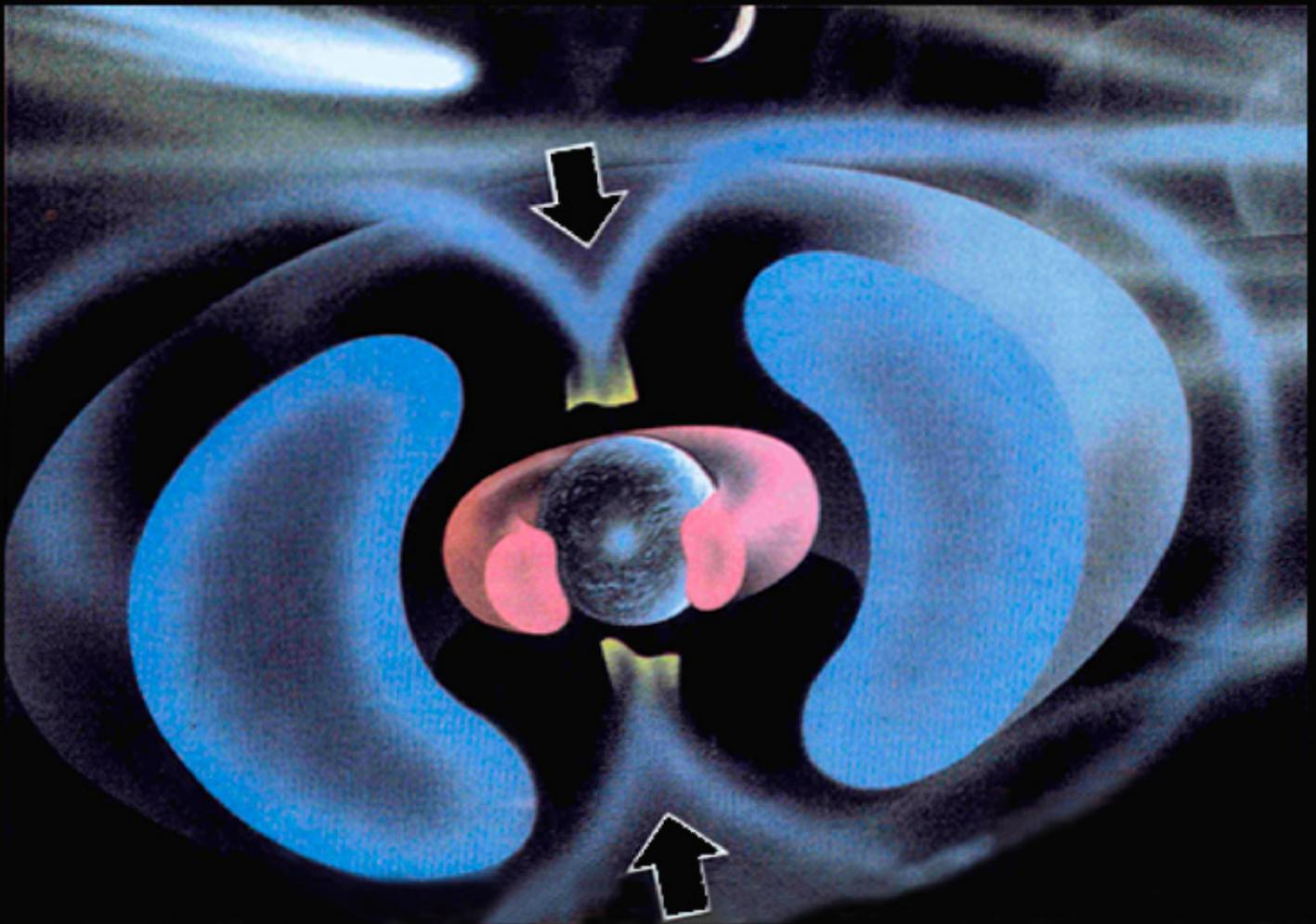
Frontiers of Fundamental Physics

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Cover

Earth magnetic field. Arrows point out expected inflow of dark matter.

The basic picture is according to Erich Übelacker "Die Sonne (WAS IST WAS), 1984 Tesslof Verlag, Nürnberg, modified (arrows) by J.K.

First page

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A. Introduction (2013)

I. General remarks

This introduction is provisional and is expected to be replaced in time with a more extensive version.

1. Logical (empirical) inference and causal explanation

In science, every new and often shocking phenomenon must be proved as a real phenomenon by means of *logical* inference from well established facts (empirical proof). There can be even some number of independent proofs as in the case of ancient Greek's proofs of the spherical shape of the Earth. And such proofs of the expansion of the Earth exist. Four of them were formulated already by Carey (Carey, 1958, 1976). For seven of them a reader may have a look at Koziar and Jamrozik (1985, p. 50; www.wrocgeolab.pl/Carpathians.pdf) in the chapter *"Plate tectonics – a theory on the wheels of circular arguments"*.

Lack of a casual explanation of some empirically well-proved phenomenon is no argument against it. This basic scientific principle seems to be unknown to many critics of the expanding Earth because many of them argue that the biggest failure of this theory is lack of such an explanation.

Below are examples of the essence and significance of the above rule.

1. The casual explanation of the spherical shape of the Earth was given only by Newton only after a lapse of two millennia since it was proved by the ancient Greeks. But long before Newton people were able to understand the proved phenomenon and make use of it.
2. Up to Newton's time the heliocentric system was not explained causally. But it was accepted earlier as a fact and so invention of the theory of gravitation became possible.
3. Up to the present day we still do not know the means by which of the Copernican rotation of the Earth about its axis. But against this circumstance people were able to accept the rotation as a fact and made use of it.
4. Up to the present day we do not know the cause of the inversions of the Earth's magnetic field. But this phenomenon was proved as a fact and we made a very successful use of it.

Another related rule:

For every proved and therefore a real phenomenon we can invent many false causal explanations. Falsification of any of them does not shake the existence of the phenomenon itself if it is empirically well-proved. The fate of the Wegener theory is the best example. The theory was rejected because of its false causal explanation of the moving apart of the continents but this process itself appeared to be real. Unfortunately, in spite of such clear experience in our own field many geologists reject expansion of the Earth on the basis of criticism critique of some of its many tentative causal explanations. Of course such criticism are needed and useful, but rejection in this way of the expansion as such is not valid.

However such conduct is very common and so invention of an additional causal explanation is "dangerous". It is better to work in the area of tangible geological phenomena clearly indicating expansion of the Earth than to speculate on its cause, and leave this problem for the future.

That is the reason why I had long avoided discussing this topic. However very resolute entry of Stanisław Ciechanowicz into the problem of a possible connection of dark matter with the expansion of the Earth resulted in my joining him. After all, the problem of the cause of the expansion of the Earth is very important.

A return to this topic after two decades in the present Introduction is useful because it allows presentation of some limitations and possibilities which are unknown also to some expansionists. After Carey's death the topic even suffers some regression among them. Apart from that I can make use of several cartoons which I have meanwhile prepared for my lectures on the Expanding Earth.

However the reader should take into account the preceding general remarks. In brief – the existence of the process of the expansion of the Earth is not affected by the absence of an explanation of its cause or by the presence wrong explanations of its cause.

Despite these remarks a reader will see that the casual explanation of the expansion of the Earth is now much better than in plate tectonics with its bankrupted hypothesis of mantle convection currents.

2. Main results of the reproduced paper

The title topic of the reproduced paper is dark matter but the most essential are the calculations of the present annual increment of the Earth mass (2.82×10^{19} g/year) and the present annual energy of expansion: 5.6×10^{12} erg/year per 1 cm^2 of the Earth surface. This amounts globally to 2.86×10^{24} J/year.

These parameters were calculated for the first time and are the most important contribution of the paper. Such empirical quantities should be satisfied by any casual explanation of the expansion of the Earth.

Another important result is the conclusion that growth of the Earth mass is not a simple function of its existing mass but depends on some specific contents and structure of the matter in the Earth's core. This explains differences between Earth and other terrestrial planets, moons and also the Earth matter in shallower geospheres.

3. Necessity of revision of the obtained function of the growth of the Earth's mass

The function of the growth of the Earth's mass which was a base for above presented annual increment of the mass, was calculated pursuant to Hladil's estimation of the Late Ordovician surface gravity acceleration (15 m/s^2). This value was calculated from measurements of the depth of the impact structure of drop-stones falling from ice floes. The value (though obtained in a very solicitous way) is in a disagreement with biological indicators of paleogravity especially with big masses of gigantic dinosaurs (Hurrell, 2011) and other sedimentological indicators as angles of repose of ancient cross-bedding (Smirnov and Lyubina, 1969; Mann and Kanagy, 1990). These latter results show that paleogravity was smaller than today and grows steadily at least since Proterozoic. This tendency is better documented for the Phanerozoic.

Because Hladil's result is the only one of this kind it should be repeated in other places and the differences should be explained.

The mentioned difference resulted also in some discrepancy in our paper. We refered to a dependency (pointed already by Carey (1976) that at constant Earth mass the gravity at the turn of Paleozoic and Mesozoic should have been about four times greater than today. Of course this would be too large for the tetrapods living at that time. But according to the function derived from Hladil's result it will also be too large. Hurrell (2011, 2012) and Strutinsky (2012) prove that the gigantic dinosaurs would be unable to walk even at the present day gravity. According to our function, the gravity at the turn of Paleozoic and Mesozoic was indeed far less than at constant mass of the Earth but it was still larger than today. So it would be a still more impassable obstacle for gigantic dinosaurs than the present gravity.

On this basis, we must first of all take into account the biological indicators of paleogravity and accept the most approximate assumption that the Earth expands at least since the end of Paleozoic at a constant mean density of the Earth's matter. This right assumption was made by Maxlow (2005). Such expansion gives a linear dependence of surface gravity acceleration on the Earth's radius. So at the time of gigantic dinosaurs the Earth's gravity would have been between half and three-quarters of its present value. This would have been very convenient to these enormous creatures.

On the basis of the constant-density assumption and his function of the growth of the Earth's radius Maxlow (2005) obtained a present annual increment of the Earth mass of 6 x 10^{19} g/year. The value is more than twice our 1994 estimate, but more nearly accurate.

Regardless of these differences the Earth mass is growing in both cases and the annual increment of the Earth mass is of the same order 10^{19} g/year. Thus the first historical calculation of the present annual Earth's mass increment preserves its importance.

II. Review of the applied explanations of the growth of the Earth's mass

As was mentioned earlier, empirical parameters connected with expanding Earth should be satisfied by any causal explanation of the expansion. There are plenty of such explanations. In the first stage of development of the theory many of these explanations consider expansion at the constant Earth's mass. They all should be excluded because the mass of the Earth is growing. This growth can be explained in two ways:

– by inflow of some matter from cosmic space to the Earth's interior

– by creation of matter in the Earth's core.

1. Inflow of some matter from the cosmic space to the Earth's interior

Some of the relevant authors only postulate in general some mater or energy, others are more specific and only their ideas are presented below.

a. Meteoric matter

This is the most improbable explanation. It is suggested by Shields (1983) and more recently by Hurrel (2011). But expanding Earth is growing from inside not outside, so there is a basic problem with getting meteoric matter into the interior of the Earth. Apart from that Carey (1983) rightly rejected this idea because Earth grows exponentially while meteoric fall diminishes with time.

b. Solar wind particles

Another specific solution is presented by Eichler (2011). The author assumes that protons end electrons in the solar wind are captured by the Earth's magnetic field, make their way to the deep interior of the Earth and there are transformed into atoms of different elements. Because a proton combined with an electron gives the simplest atom i.e. hydrogen, the more composite atoms should be generated by fusion. The author thus assumes some kind of so-called "cold fusion".

The capture of the Sun's plasma by a magnetic field is similar to our solution assumed for dark matter. But some quantitative problems arise. The total production of solar wind plasma is about 4–6 billion tones per hour. This quantity sums up to the Earth mass in 150 Ma. It could be enough for Earth expansion if the bulk of this plasma had been captured by the Earth. But the Earth occupies only a minute solid angle of the full solid angle (steregon) to which solar plasma is emitted. What is more, the Earth's magnetic field captures only a portion of solar-wind particles directed to the Earth. The field acts as a shield and the greater portion of the particles are deflected.

Next, penetration of charged particles in deep Earth's interior is very problematic or even impossible (contrary to uncharged dark matter particles). For opposite charged particle it demands opposite electric field in the Earth. The author refers to the new discovered process of proton conductivity in solid matter, also in perovskite of which the lower mantle is mainly built. But this process is much less effective than

the electron conductivity and diminishes with concentrations of iron (Yoshino, 2010) which grows towards Earth's center.

c. Ether

The first who postulated such a process was a Polish engineer and scientist Jan Jarkowski (Yarkovski) at the time of Russian annexation of Poland[1]. He is known today mostly because his "Yarkovski effect" is employed in satellite geodesy. Jarkowski was also the first who postulated the expansion of the Earth (Yarkovski, 1888, 1889). The author assumed absorption of cosmic ether, then popular in science, by the Earth (and other celestial bodies) and its transformation inside of our globe into chemical matter i.e. atoms. The absorption of the ether is an old alternative idea to Newtonian gravitation considered by Newton himself and others, especially by Bernhard Riemann. But the idea of creation of chemical elements inside the Earth was a quite new concept. Quite new was also the concept that a consequence of this creation of terrestrial matter is the expansion of the Earth.

The later founding father of the theory of the Expanding Earth Ott Hilgenberg (1933) followed Yarkovski's concept though he came to it independently and only then he discovered his predecessor. Recently such concept is developed by the Ukrainian scientist Vitaliy Blinov (2009, 2013) and Australian physicist Reginald Cahill in several papers (e. g. 2003; www.mountainman.com.au/process_physics/hps13.pdf , 2013). Achievements of the latter will be described separately in the next point.

As is well known the ether was excluded from physics by Einstein's relativity theory though not completely, since Dirac (1951,1953) returned to it.

Anyway the absorbed ether may be considered as a nickname for some enigmatic matter which enters the Earth and is transformed there into terrestrial matter.

However, as was mentioned, some limitations have appeared. The absorption and also the transformation of the enigmatic matter to atomic matter cannot be a function of existing matter as such because not all celestial bodies expand and also the Earth's shallow rocks (mantle and crust) do not. The ability of such process should be possessed only by the matter of a deep Earth interior which should fulfill some special conditions that would enable it to be a generator of a new matter. Such conditions should be fulfilled in other (but certainly not all) celestial bodies.

d. Quantum foam of cosmic space

A quite modern concept of ether is being developed by the mentioned author – Reginald Cahill from Australia. It is based, as in Dirac's case, on quantum physics and a so-called "3-D quantum foam" where 3-D is a three-dimensional cosmic space (without Minkowski – Einstein's geometrical time dimension).

Cahill's theory – the "Process Physics" is built on a sound experimental basis. Cahill refers to the famous Michelson – Morley experiment and its successors. Some of them discovered motion through absolute space, notably that made by Miller (1933) in 1930s. Others did the same, after critical analysis, including even Michelson-Morley's original results. Cahill (2003) calculated the velocity of Solar System through the space as 417 ± 40 km/s. The motion is directed to a point with celestial coordinates $\alpha = 78^0$, $\delta = -67^0$, that is in the direction of the Large Magellanic Cloud.

The motion through the absolute space should not be mistaken with the motion relative to Cosmic Background Radiation which has different velocity and direction.

Cahill's theory explains relativistic effects according to Lorentzian transformations (Lorentz himself did not exclude existence of the absolute space). The theory explains also bending of light near celestial bodies and some other phenomena which Einstein's theory does not explain.

Cahill points out that phenomena predicted by Einstein's theory do not result unambigously from

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[1] The biography of Jan Jarkowski was recently elaborated by Beekman (2005). The author used names "Ivan Osipovich" which are faulty. Jarkowski's first Polish name was "Jan".
    www.researchgate.net/publication/234291858_The_nearly_forgotten_scientist_Ivan_Osipovich_Yarkovsky

Einstein's postulates. However contrary opinion is common and this hampers discussion of potentially better alternatives. Many physicists believe that questioning Einstein's postulates means also questioning the real phenomena predicted by his special and general theories of relativity. But this is not true.

Cahill explains gravity like Riemann, Jarkowski, Hilgenberg and Blinov by inflow of the quantum foam (formerly ether) into material bodies. He immediately obtained a quantum theory of gravitation which is the main problem of modern physics since the beginnings of the former century.

In his main papers, the author does not develop the idea of transformation of the quantum foam into a bayronic matter inside celestial bodies. He does it only relative to the expanding Earth (Cahill, 2011, 2012). This places him in intermediate position between Riemann on the one hand (no transformation) and Jarkowski, Hilgenberg and Blinov (inevitable transformation depending only on existing mass as such) on the other. This situation is promising for better connection of former theories of ether as a cause of expansion of celestial bodies with reality of expansion recorded on the Earth and in its close cosmic vicinity.

Cahill postulates a mini black hole at the centre of the Earth. We will return to this idea later .

e. Dark matter

In our reproduced paper the concept of dark matter is used for explanation of the expansion of the Earth and we are the only authors (as far as I know) who dealt with such possibility.

In meantime however one of us (JK) has turned to another explanation which is the creation of matter in the Earth's core (see next section).

Different kinds of theories of creation of matter in celestial bodies tend to link mutually. It is very probable that they also can be linked with Cahill's general physical theory – the Process Physics and so also with concepts of his predecessors.

2. Creation of matter in the Earth's core

First should be presented here the hypotheses of the creation of matter in the Universe.

a. Creation of matter in the Universe

– *Dirac's Large Numbers hypothesis*

This hypothesis (LNH) was published by Dirac in 1938 and then returned to by him in 1974. The basis of this concept is a notion that the ratios of some similar quantities of the same dimensionality in the micro- and macro-world give large numbers of the same order of about 10^{40} or 10^{40n} (where "n" is a natural number). Examples are:

  – the ratio of the radius of the Universe to the radius of electron

  – the ratio of the electrostatic force between an electron and a proton in a hydrogen atom to their gravitational attraction (which is a force ruling in the macro-world)

  – the ratio of the mass of the Universe to the mass of a proton – this time the ratio is about 10^{80}.

Dirac believed that such a coincidence cannot be accidental and is a manifestation of some mysterious connections between the micro-and macro-world. What is more, when the age of the Universe is expressed in natural units of time given by atomic constants (which Dirac defined as e^2/mc^3) the result is the same – about 10^{40}. Dirac concluded that this means that all the previous ratios are time dependent.

Starting from this assumption he demonstrates that the gravity constant should diminish inversely with time ($G \propto t^{-1}$) and the mass of the Universe should grow proportionally to time squared ($M \propto t^2$).

The conclusions concerning the decrease in gravity "constant" was picked up by several authors (mainly physicists – Egyed, Jordan, Dicke, Hoyle) for explanation of the expansion of the Earth. However even if real, the postulated decrease in G could have not caused such a large expansion. Thus only the second aspect of Dirac's hypothesis, that is the creation of mass, is important for the expanding Earth.

Dirac considered two ways of creation. The first way he called additive creation; the matter is created in empty cosmic space.

The second way he called multiplicative creation; matter is created where the matter already exists. Only this second way is applicable to the expanding Earth.

– Tryon and Carey's Null Universe theory

Null Universe theory is another concept of creation of matter "from nothing" but which preserves the principle of conservation of matter-energy. It is based on another shocking coincidence. According to the present fairly precise estimation of mass of the Universe (M_U) and its radius (radius of Hubble horizon R_H) it appears that the following equation occurs:

$$\frac{GM_U}{R_H} = c^2$$

Let us consider a small mass m and multiply by it the both sides of the above equation:

$$\frac{GmM_U}{R_H} = mc^2$$

The left side means mutual gravitational potential of m and M_U. Such gravitational energy is negative. So:

$$- \frac{GmM_U}{R_H} = mc^2$$

The right side is energetic equivalent of mass m. So both of these kinds of energies are mutually canceling:

$$mc^2 + \frac{GmM_U}{R_H} = 0$$

This is the Null Universe. All partial masses in the Universe are balanced by their gravitational energy and the total sum is equal to null. If the new matter is born it simultaneously creates its negative potential energy and the sum is again null. So the new matter can appear from "nothing" without violation of matter-energy law of conservation.

The first scientists who pointed out the possibility of the Null Universe was (according to Carey, 1983) the Danish physicist Christian Møller at the 1958 Solvay Conference in Brussels. The second was the American physicist Edward P. Tryon (1973). This author applied the idea only to the very beginnings of the Universe. The third was Samuel Warren Carey (1976). He had hit on the idea independently and only later found his two predecessors. Of course Carey applied the idea to the expanding Earth. It means that the creation of matter according to Null Universe is not limited to the zero time but works all the time. This was Carey's big contribution to the theory of Null Universe.

Carey delivered a lecture devoted to the Null Universe theory, Dirac's large number hypothesis and Expanding Earth at the 1981 "Expanding Earth Symposium" in Sydney. The published version of the paper appeared two years later (Carey, 1983) . In the meantime several scientists (Brout et al. 1978; Dicke and Peebels, 1979; Brout at al. 1980) were developing Tryon's idea while still applying it only to the initial moment of the Universe.

Tryon was invited to Sydney conference. He presented his theory and expressed his doubts about applying it to the expansion of the Earth (Tryon, 1983). He saw a big problem in an alleged necessity of production of antimatter inside the Earth and alleged necessity of proportional expansion of all celestial body. The second of these problems was already mentioned above as a solved one . The first was solved partially within Big Bang theory by breaking the symmetry between matter and antimatter. The full solution was given by Hoyle who pointed out the possibility of creation of matter exclusively as "positive" matter (without any antimatter) – see next section.

The Null Universe theory was finally included in the Big Bang theory. This happened practically the same time as Carey's Sydney conference where the former was discussed. In the same year Allan Guth (1981) had published his inflation version of Big Bang theory in which the Null Universe concept was later employed. According to that author's phrase the whole Universe is a "free dinner". Guth (1997) refers to Tryon as an author of the idea in his first chapter entitled just "The biggest free diner".

The inflation was almost generally accepted in present cosmology and with the Null Universe concept. Steven Hawking presents Null Universe in his popular books (Hawking, 1988, 1993).

Tryon applied the creation of matter on the Null Universe principle only in zero time. Guth stretched it to the first very short period of the evolution of the Universe. Carey pointed out that it works all the time and, includingh among other places, under our feet. Carey also linked his Null Universe with the existence of the ether (Carey, 1996).

– Hoyle's field of matter creation

This concept originated from the steady state theory of cosmology (SSC) formulated at the end of 1940s by Hermann Bondi and Thomas Gold (1948) and independently by Fred Hoyle (1948). The theory was developed in opposition to the Big Bang theory. SSC theory postulated continual creation of mater[2]. Initially this creation was considered in the empty cosmic space and in a form of single hydrogen atoms. Later, since the paper by Stothers (1966), it has been considered in massive celestial bodies.

From the very beginnings Hoyle began to develop the concept of the field of creation of matter (C-field). Aspects of it were later adopted by his opponents and incorporated into the Big Bang inflation theory. From 1993 Hoyle, together with Geofrey Burbidge and Jayant Narlikar, began to develop a new version of SSC – the Quasi Steady State Cosmology (QSSC) presented in Hoyle at al. (1993, 2000). This version strongly refers to Ambartsumian's eruptive cosmology (see next section) and stressed the eruption of matter from the galactic centers where massive black holes are situated. So the latter develop in a manner quite contrary to the way than is generally conceived.

The C-field can produce a new matter only with cooperation with a strong gravitational field of black holes. The black holes which begin to throw out a matter are already not complete-black holes but near-black holes. The production of matter is associated with creation of a negative field, so energy conservation is preserved. It is like in the Null Universe, but it is explained on a local scale. Negative energy causes explosive effects and, on a large scale, the expansion of the Universe. So, in fact, the creation of matter causes this expansion.

New matter origins by the "opening-up" of space-time by a strong gravitational field of the near-black hole. There is a threshold energy of 6×10^{18} GeV for creation of matter. The biggest energy considered by the Big Bang theory at the beginnings of Universe is 2×10^{15} GeV, that is three order lesser. At this latter energy the symmetry of matter-antimatter is partially broken. At the C-field threshold energy the symmetry is totally broken and a newborn matter is exclusively a normal matter. It appears as so called Planck particles. These are particles which Schwarzschild radius is equal to its Compton wavelength, that is wavelength of quantum of radiation corresponding to its mass-energy. The mass of a Planck particle is expressed by the following formula:

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[2]   For the Expanding Earth the problem of beginning (Big Bang) or eternity (SSC) of the Universe is marginal problem.
     Foreground problem is just creation of matter.

$$m = \sqrt{\frac{hC}{2G}}$$

where: **h** is the Planck constant, **c** – speed of light, and **G** – gravitational constant.

The Planck particle is a mini-black hole of a mass 1.06×10^{-5} g and of corresponding energy 6×10^{18} GeV which constitutes the mentioned energy threshold for matter creation. The Planck particle is unstable and dissipates into an ordinary matter. It can produce 10^{19} neutrons and so all kinds of atoms by transforming some neutrons to protons and electrons. The production is by fission.

As was mentioned, the C-field theory is compatible with the Null Universe theory. Both are compatible with the mass-energy conservation law. The latter shows how it works in a general scale. The first explains, in a more detailed way, how it works on a local scale. Both of these and Dirac large numbers hypothesis seem to be connected in some way (Kurz, 2011).

The field of creation seems also to be compatible with Cahill's theory. In the first, space-time is an active medium for creation of matter. It is like in Cahill's concept except for the understanding of time as an additional and geometrical dimension of space. This interpretation is rejected in the Process Physics and hence only 3-D space is considered to exist in the latter.

The Planck particle threshold energy may be also crucial to the creation of matter from the quantum foam and help to explain the selective process of expansion by Process Physics.

b. Specific property of the Earth's core

As was shown, the process of creation of matter is explained and accepted in all main cosmologic theories and is considered by leading physicists and cosmologists. If one tries to disprove expansion of the Earth by alleged impossibility of such creation he only proves his limited knowledge of modern physics and cosmology.

There is no scientific barrier in considering creation of matter inside the Earth. What is more, a growing mass of the Earth becomes crucial empirical data for all cosmological theories. The Earth becomes again the most important part of cosmos. However not by its exceptional position but because it is the most accessible to observation celestial body.

As in the case of inflow of cosmic matter into the Earth, also in the case of creation of terrestrial matter, the Earth core must possess specific properties and neither processes can be dependent solely on the Earth's mass. It is determined by differential expansion and was already explained at the end of the section II.1.c.

The suspected device for production of terrestrial matter is the Earth's inner core. It is built of flat hexagonal crystals of iron oriented perpendicularly to the Earth's rotation axis. So they create a gigantic monocrystal or rather liquid monocrystal because of some share of liquid phase. Such a structure is by itself quite extraordinary. Recently seismologists discovered the innermost inner core with a radius of about 300 km (Ishii and Dziewoński, 2002).

Cahill (2012) postulates a mini black hole in the very center of the Earth on the basis of the so called borehole gravitational anomaly. Such mini black hole would explain the mysterious density surplus of the inner core. This surplus is about 4.5 g/cm^3. After multiplying it by the volume of the inner core this gives about $3,4 \times 10^{22}$ kg. It would be the mass of the mini black hole which might create the threshold energy for the production of a new terrestrial matter. Apart from that the whole structure of the inner core produces a strong magnetic field certainly in a different way than by assumed convection currents. This plate tectonics device does not work in the Earth's mantle. Still less could such currents operate in the Earth's core.

III. Origin of the Earth.
Ambartsumian's Eruptive Cosmology

Theories of matter creation should be supplemented by the Eruptive Cosmology developed in 1950s and 1960s by the Armenian astrophysicist and cosmologist Victor Ambartsumian and his team at the Byurakan Astrophysical Observatory. This theory does not directly deal with the creation of matter but can be easily connected with such a process. However its most important feature is an explanation of the origin of the Earth which is in full concordance with its subsequent expansion.

As is well-known, Edwin Hubble discovered the expansion of the Universe as a whole. Ambartsumian and his coworkers noticed also expansion and dissipation of cosmic structures of successively smaller scale: clusters of galaxies, galaxies themselves and cluster of stars. Apart from this they noticed eruption of matter from different celestial bodies and even their explosions. This includes such phenomena as black holes in galaxy centers, stars bursting into ring nebulas and even planets such as the hypothetical Phaeton which is thought to have produced the asteroid belt. Infall of dissipated cosmic matter on celestial bodies is a secondary process and plays only a marginal role.

Based on these observations Ambartsumian concluded that cosmic matter develops from super-dense states to less dense ones. So, a whole cluster of galaxies originated from one super-dense body which might have originated from the Big Bang itself. Spiral arms of galaxies originated from super-dense bodies coming oryginally from the central region, through a chain of less dense, but still super-dense, bodies. Thus, clusters of stars originated from super-dense bodies ejected from the centers of galaxies. Stars, multiple star systems, and stars with planetary systems originate from one super-dense body ejected from a star cluster's parent body, in turn ejected from the center of a galaxy. Such direct precursors of stars and planetary systems are composed of pre-stellar matter. At this stage of development the most suitable candidate for such a form of matter is the neutron matter of neutron stars.

Thus Ambartsumian's proposal is that our Solar System originated in this way. One proof for such an origin may be found in the fact that the highest age of matter in the Solar System as recorded by isotopic clocks $^{129}J \rightarrow {}^{129}Xe$ and $^{26}Al \rightarrow {}^{26}Mg$ is the same as the age of the Solar System itself.

There is no time for elements of our Solar System to be "fried" in a former star (or stars) by fusion and then dispersed and condensed again from a nebula, as alleged. The primordial atomic matter of Solar System simply originated by "overcooking" (fission) of neutron matter of our parent disintegrated neutron star.

Some scientists consider stability of small lumps of neutron matter in cosmic space. Zwicky (according Rees, 1997) called them "gremlins". So the Earth should evolve from such a proto-Earth gremlin. It implies an early expansion of Earth by transformation of its primordial neutron matter into atomic one. The corresponding growth of volume is in the proportion 10^{14}. Present matter of the Earth in the form of neutron matter should be a sphere of only about 250 meters of a diameter.

Of course this view does not deny that there is a long-lasting fusion process inside stars. However it is secondary to an opposing short-lasting fission process in disintegrated neutron matter.

The way of developing of matter, cosmic systems and celestial bodies in Ambartsumian's theory is tantamount to rejection of hypothesis of condensation of celestial bodies from gaseous-dusty nebulas. This hypothesis is connected with the names of Kant and Laplace but in fact it was originally sketched by Newton himself. Up to today it is the least well-founded but most widely accepted cosmological hypothesis. Time itself converted it into an unshakable dogma though it is impossible to explain how the condensation should work – especially in the case of galaxies. Hubble's discovery was undisputable and expanding Universe was generally accepted. But within this expanding Universe all remained as in the time of Kant and Laplace. It seems that the assumed Big Bang explosion into dispersed hydrogen-helium cloudy matter at the very beginning of the Universe was invented only for providing a suitable starting point for the supposed condensation. This may be seen on simply graphs from my lectures. In Fig.1 the change of degree of dispersion of matter is presented as it was assumed by Newton and his followers up to Hubble's discovery.
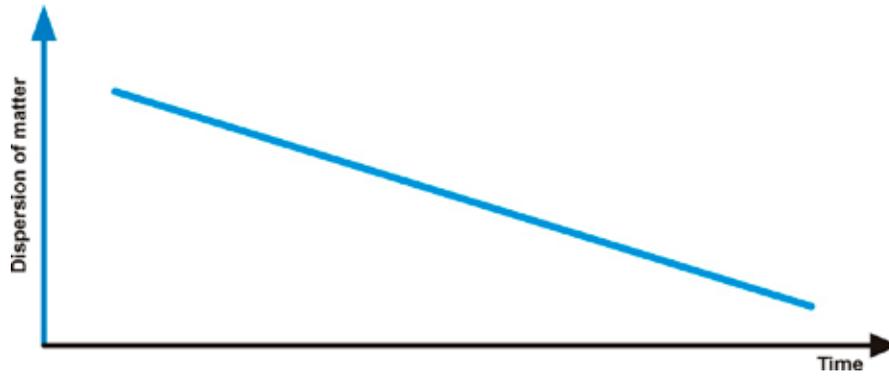
Fig. 1. Condensation of assumed primordial gaseous-dust cosmic matter according to Newton-Kant-Laplace theory

Hubble discovered a quite different evolution of the Universe (red line) as a whole (Fig. 2).
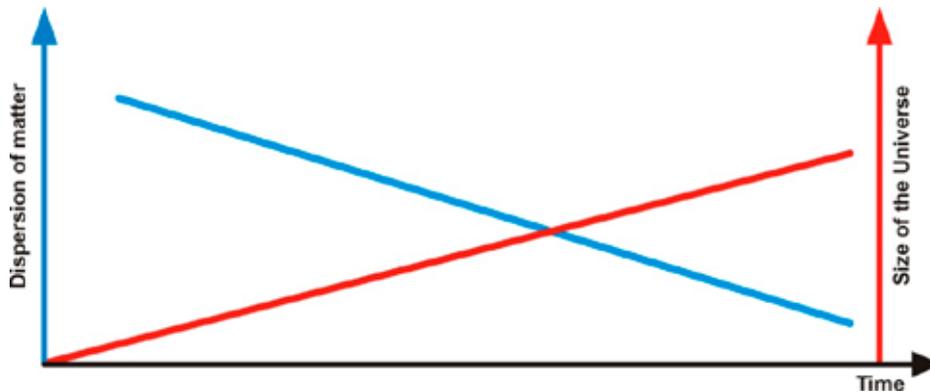

Fig. 2. Discovered expansion of the Universe (red) and its discrepancy with earlier assumed condensation

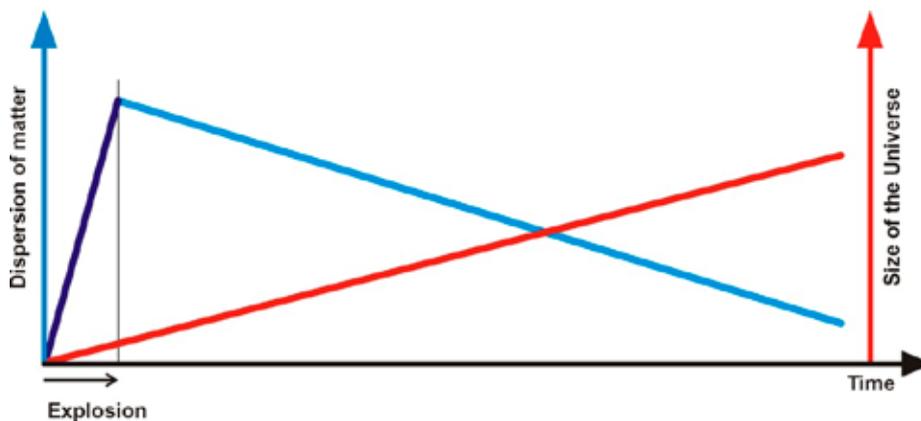The obvious problem with this scheme is the divergence of these two lines at the beginnings of the Universe. The following solution was invented (Fig. 3) as discussed above.

Fig. 3. The attempt of harmonize of the resultant discrepancy in the Big Bang theory

Such a complicated situation in itself suggests that there is something wrong. Ambartsumian's theory harmonizes the two most important cosmic processes (Fig. 4).
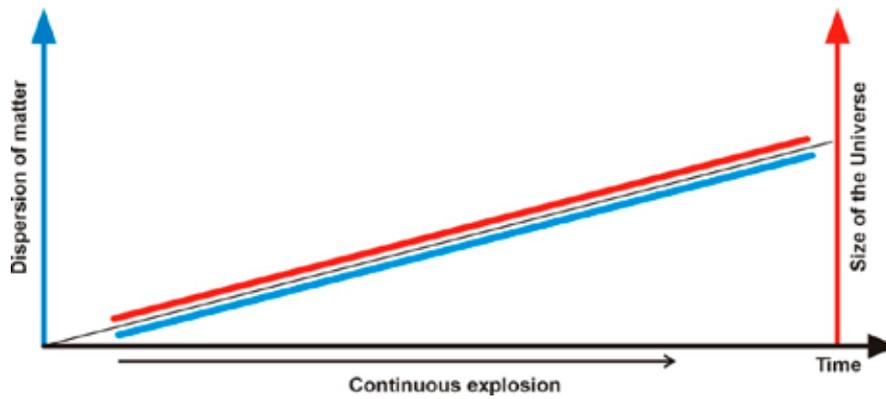
Fig. 4. Ambartsumian's solution of resultant discrepancy in Fig.3

The expanding Universe is continuously exploding.

The contrast between the two theories may also be seen in the following schematic diagrams (Figs. 5 and 6).
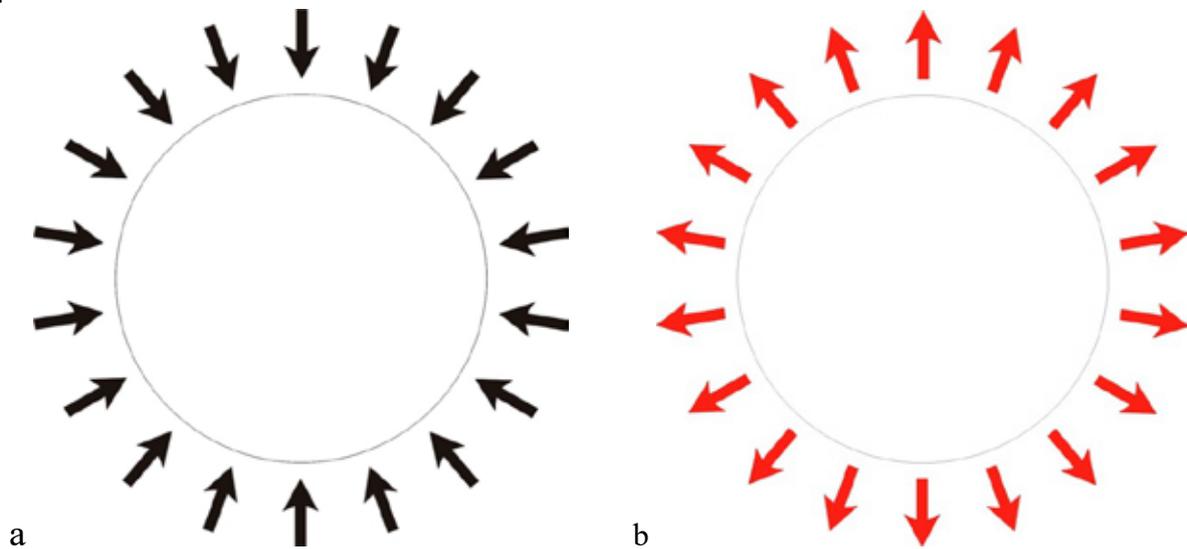

a   b

Fig. 5. Evolution of the Universe, a – before Hubble's discovery (passive, dying out process),
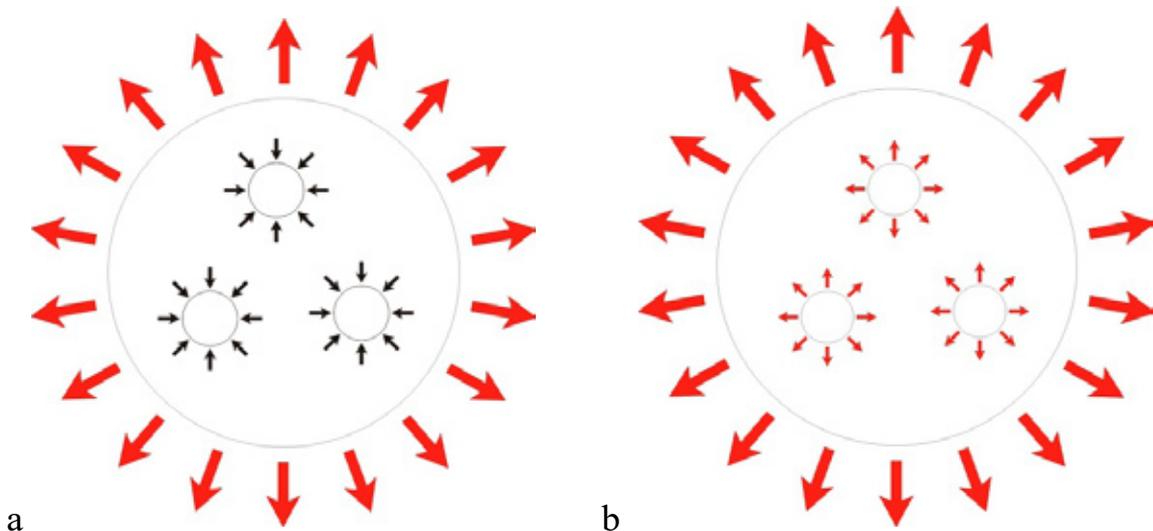b – after Hubble discovery (active, growing process)

a   b

Fig. 6. Evolution of matter in the Universe, a - modified theory of condensation after discovery of expansion of
the Universe, b - real processes

The theories are diametrically opposed on two levels, the macro-level of mature atomic mater and structures built of it (Fig. 7),
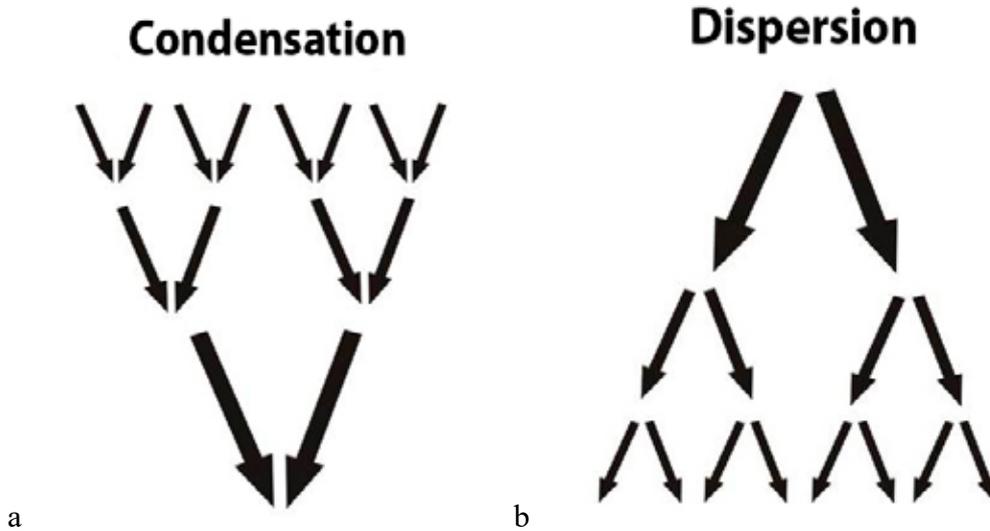

Fig. 7. Opposite development of matter in the macro-scale,
a – condensation theory, b – Ambartsumian's theory

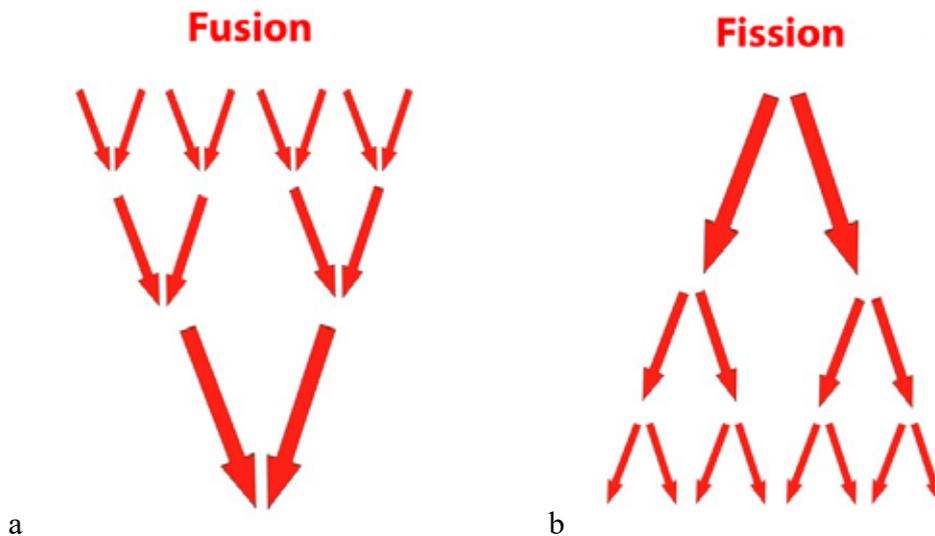and on a subatomic level (Fig. 8).

Fig. 8. Opposite development of matter in the subatomic scale,
a – condensation theory, b – Ambartsumian's theory

The closest to Ambartsumian's theory is now the Quasi-Steady-State-Cosmology. Hoyle at al. (2000) refer often to Eruptive Cosmology but labelling it the "Explosive Cosmology" in their terminology. Narlikar's (1996) description of the evolution of black holes is clearly opposed to the collapse concept which is up to today almost universally accepted. Black holes expand and become "white holes" which shine and throw matter outwards.

However QSSC has not yet wholly liberated itself from the condensation hypothesis.

The condensation theory is a big problem not only for cosmology but for geology as well. The most devastating geological theory, i.e. theory of contraction of the Earth, was introduced as a speculation that came directly from the condensation theory. Such established "contracting " thinking is continued in geology up to today and culminated in the plate tectonics paradigm. Now, the Eruptive Cosmological

theory and the Expanding Earth, both based on empirical approach and developed independently, document adifferent development of matter from that commonly understood.

It is not true that stars originate from condensation of gaseous-dusty nebulas. Quite the opposite – nebulas origin from exploding stars and superdense bodies.

No exponent of the Eruptive Cosmology referred to the Expanding Earth which in fact is a very important and lacking part of the former theory. They were simply unaware of it and at present, after Ambartsumian's death (1996) there is little further development of the theory.

On the other hand no exponent of the Expanding Earth apart from Pfeufer (1981)[3] and Koziar (1980, 2011; www.wrocgeolab.pl/geodesy1.pdf) referred to Ambartsumian's theory. However a strong affinity exists between the two. Expanding Earth verifies positively Ambartsumian's Eruptive Cosmology and in this way contributes significantly to cosmology as such, not only in the issue of creation of matter but also in rejection of hypothesis of condensation of celestial bodies from gaseous-dusty nebulas.

IV. Mechanism of the expansion of the Earth

1. Micro-mechanism of the expansion of the Earth

The micro-mechanism of the expansion of the Earth consists in creation of electron shells by a newly created atom nucleus.

At the beginning of the Solar System this process was connected with transformation of primordial neutron matter of the parent neutron star to atomic matter. The process has affected all the larger celestial bodies in our system apart from the such as smallest ones as asteroids and comets. The latter originated in a second step from larger bodies already transformed to atomic matter. Asteroids are products of an explosion of a parent planet called Phaeton while comets are erupted by giant planets and their larger moons (Vsiechsviatskij, 1969). Only later some of the newborn celestial bodies begin to create new matter themselves either by absorption from cosmic space or by creation "from nothing" in place. A necessary condition is the existence of some special generator of new matter in the center of celestial body – which the Earth possesses for sure.

In this way the oldest matter of our planets is in the outermost parts, that is in the continents. The continents consists also contain the highest proportion of heavy elements which probably stem directly from primordial neutron matter. The preponderance of Earth's matter was created later, adding to the primordial matter, and must have occurred with an extreme preponderance of four elements: Fe, O, Si and Mg.

The creation of electron shells gives an enormous increment in volume relative to atom nuclei, in the ratio of 10^{14} (Fig. 9).

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[3] May be it is because that the fundamental publication of Ambartsumian's team was translated only to the German language (Ambartsumian, 1976).
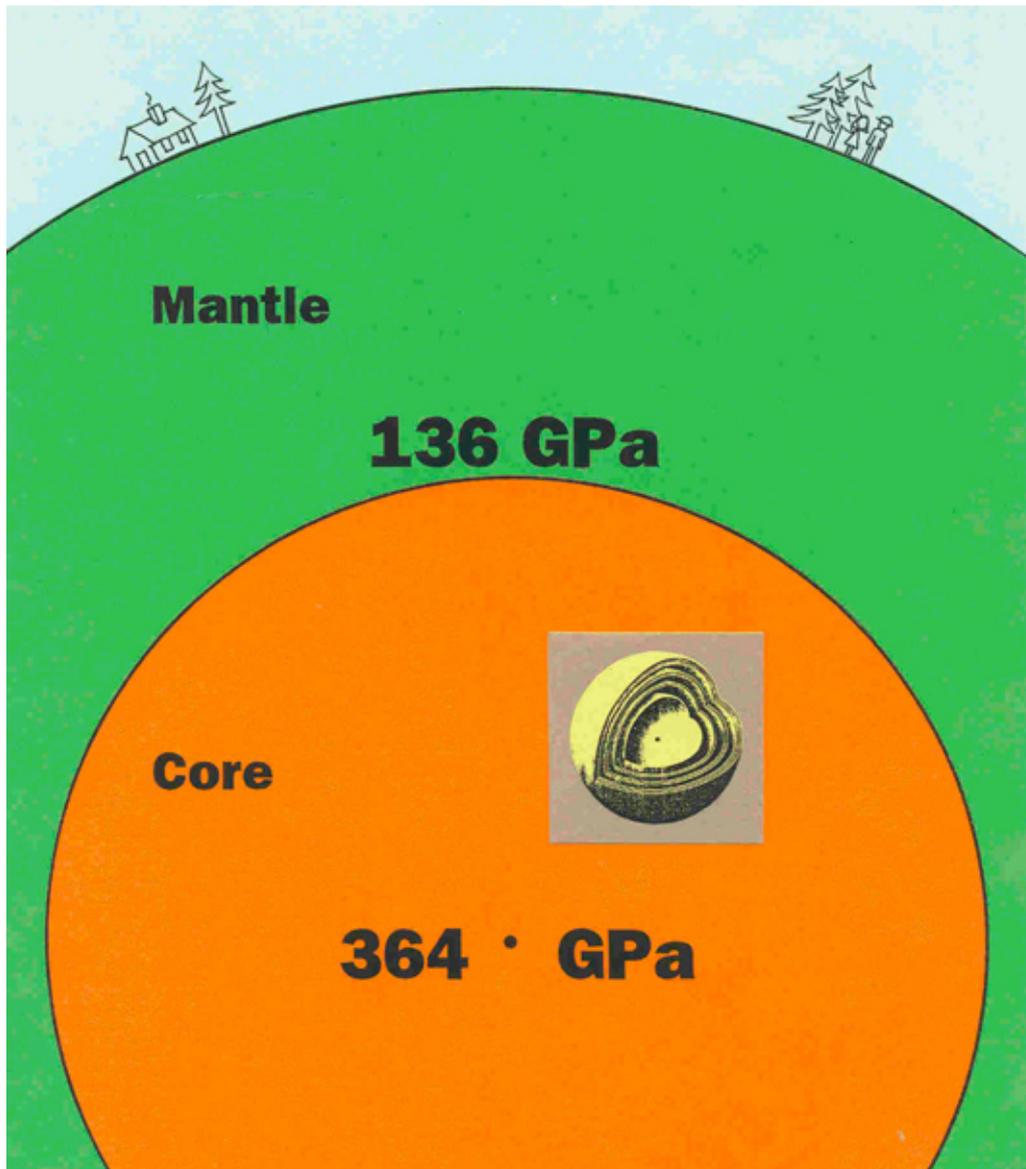
Fig. 9. Expansion of electron shells of new-born elements as a micro-mechanism of the expansion of the Earth

This high ratio is incomparable to that assumed earlier by various authors phase transition, heating or volumetric increment caused by decrease in the gravitational constant. It explains without any problem the well evidenced approximately tenfold increase in the Earth volume in the Phanerozoic.

2. Macro-mechanism of the expansion of the Earth

The macro-mechanism of the expansion of the Earth consists in transmission of new-born elements, mainly Fe, O, Si and Mg from the core to the mantle throughout the D" layer. Particular horizons of lower and upper mantle are uplifted and stretched. In shallow horizons the matter of the upper mantle is transmitted to the oceanic lithosphere by diapirism and the spreading process (Fig. 10).
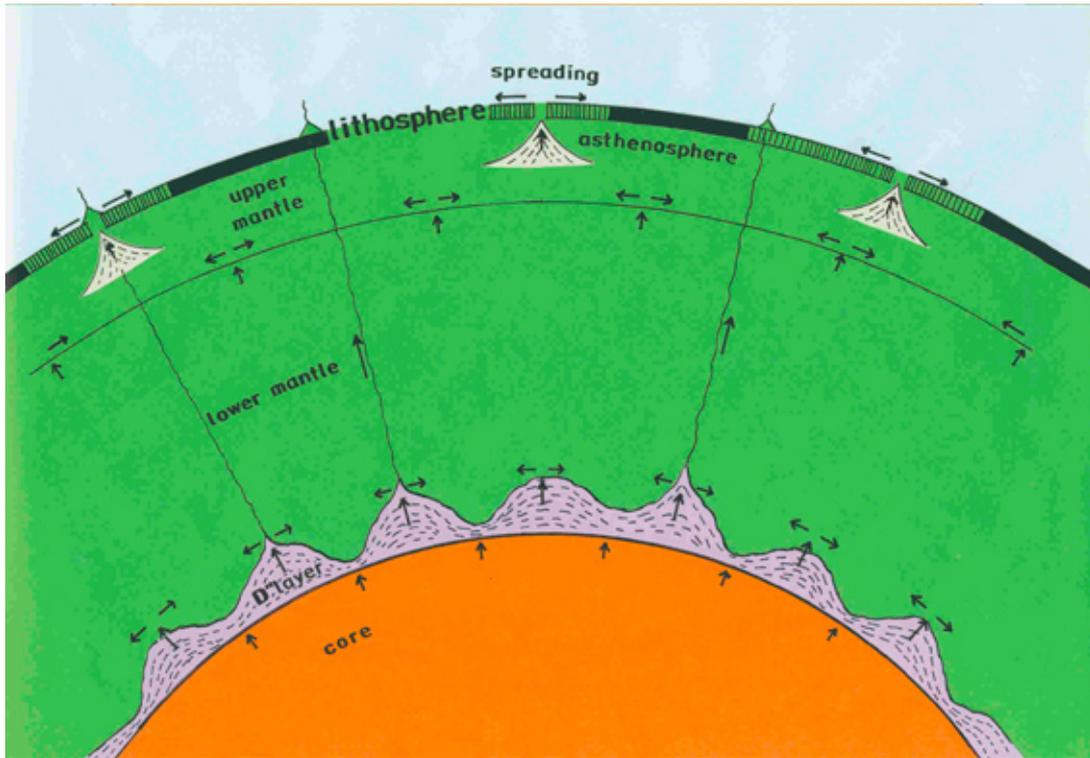
Fig. 10. Outwards migration and concentric stretching of the new and old matter as a macro-mechanism of the expansion of the Earth

V. Energy of the expansion of the Earth

In the reproduced paper there were presented only final results of calculations of the energy of expansion. These were carried out in two ways: by macro-calculation (at geotectonic scale) and micro-calculation (at atomic scale). The first was applied to the whole Earth, the second to the growth of electron shells of atoms at pressure existing in the vicinity of the Earth's centre.

The calculations are here presented in an abbreviated way. A more detailed version will be presented in a planned extended introduction.

1. Macro-calculation of the energy of the expansion of the Earth

Energy of expansion can be calculated from the general formula for potential gravitational energy of a homogenous sphere:

$$U = -\frac{3GM^2}{5R}$$

where: G – gravitational constant, M – mass of the Earth, R – radius of the Earth.

In the reproduced paper more particular and visual method was used which applies to an inhomogeneous (layered) sphere and a tiny annual increment in the Earth's radius. The method consists on calculation of the work of uplifting of a wedge of Earth matter which extends from the Earth's surface to the Earth's center and the top of which has a surface area of only one square centimeter (Fig. 11).
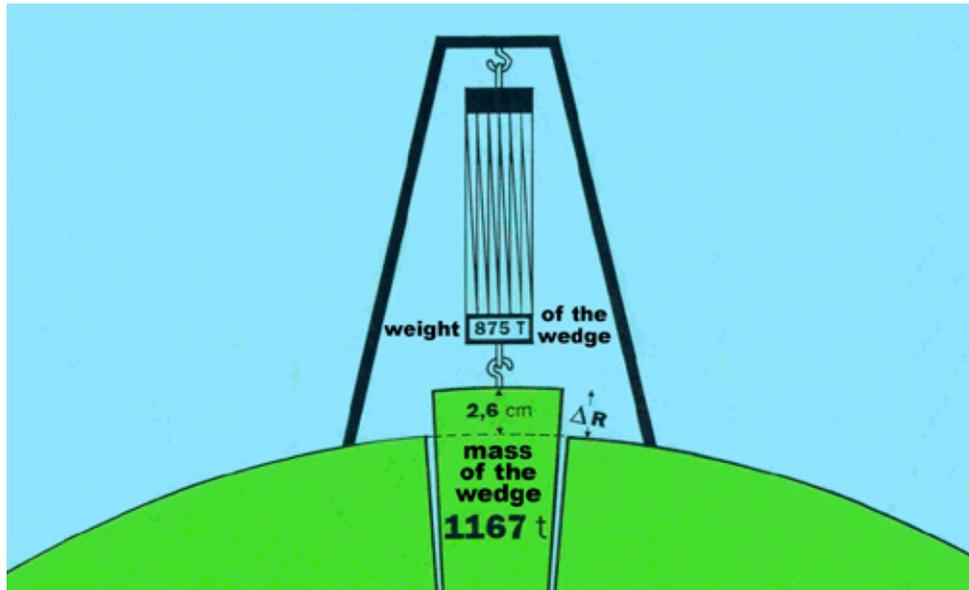
Fig. 11. Uplifting of the wedge of the Earth's matter in order to calculate of the energy of the expansion of the Earth *(explanation in text)*

Because gravity diminishes with depth, the weight of the wedge is less than its mass multiplied by surface gravity acceleration. For homogenous wedge of Earth's mean density the mass is 1167 t (tons of mass) but the weight only 875 T (tons of weight) – Fig. 11.

However the final reported results were obtained by separate calculations for two portions of the wedge: that of mean mantle density 4.2 g/cm³ and that of the of mean core density 12.2 g/cm³ (Fig. 12).
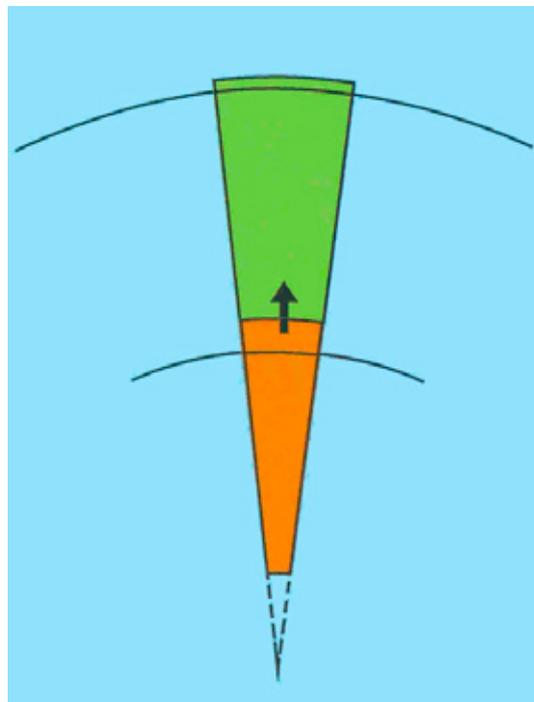

Fig. 12. Uplifting of inhomogeneous wedge of the Earth matter in order to calculate the energy of expansion of the Earth *(explanation in text)*

Uplifting of the top of the whole wedge to the height of 2.6 cm (based on my calculation of the present annual increment of the Earth radius[4]) requires energy of 5.6×10^{12} erg or 5.6×10^{5} J. For the whole Earth this amounts to 2.86×10^{24} J.

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[4] Koziar(1980); www.wrocgeolab.pl/floor.pdf

The annual mass increment calculated in the reproduced paper was 2.82×10^{19} g/year. Thus the calculated energy per 1 g of new-born matter is 24 364 cal (Fig. 13).

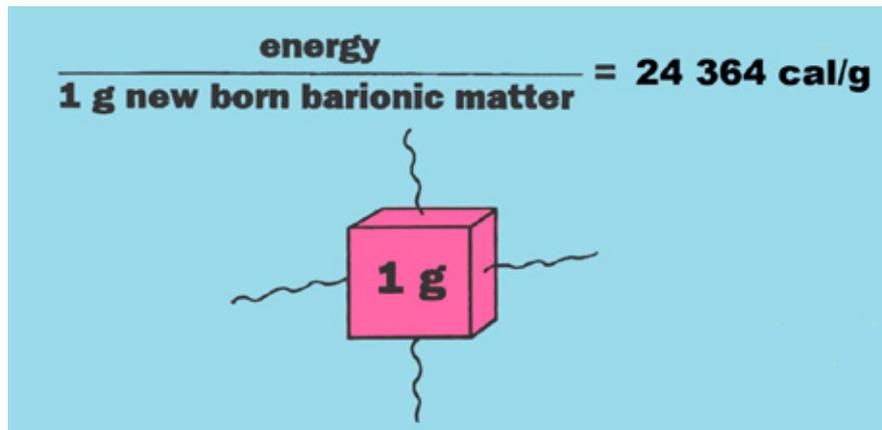$$\frac{energy}{1 \text{ g new born barionic matter}} = 24\ 364 \text{ cal/g}$$

Fig. 13. Energy of the creation of a new mater in a macroscopic scale

This is about 7 times more than in the most effective chemical reaction of oxygen with hydrogen which is only 3 600 cal per 1g of final product that is water.

Davidson (1994) wrote:

> *"If the whole Earth were composed of dynamite its internal energy would be inadequate by an order of magnitude to generate the required expansion from R_{180} = 4000 km to R_0 = 6000 km (Napier, pers. comm.) suggesting chemical energy is inadequate".*

That is right, and the above calculation quantifies this difference.

Burša and Hovorková (1994) made a similar calculation based on a formula for gravitational potential of the homogenous sphere and obtained the result for the whole expansion about 7×10^{31} J. The authors concluded: "*No realistic origin of such energy could be found in the Earth-Moon-Sun system dynamics in the last – 450 x 10^6 y*". Because such an energy is not realistic, the expansion of the Earth should also be considered as not realistic too. The remarks presented in the point (I.1) about causal explanations applies exactly to such reasoning.

Because a definite quantum of matter consists of a definite number of nucleons it is possible to calculate energy of expansion obtained in a macro-scale per a single new-born nucleon or atomic nucleus (consisting of several nucleons). The results are presented in Fig. (14)[5].
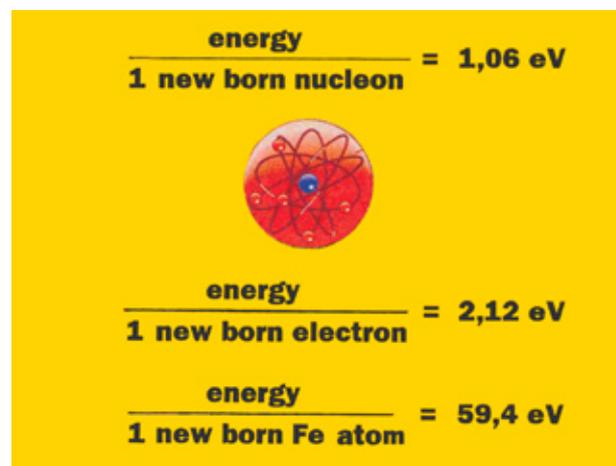

$$\frac{energy}{1 \text{ new born nucleon}} = 1,06 \text{ eV}$$

$$\frac{energy}{1 \text{ new born electron}} = 2,12 \text{ eV}$$

$$\frac{energy}{1 \text{ new born Fe atom}} = 59,4 \text{ eV}$$

Fig. 14. Energy of the creation of a new mater in an atomic scale

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[5] One new-born electron is in average associated with two new-born nucleons – proton and neutron.

2. Micro-calculation of the energy of the expansion of the Earth

Calculation of energy of expansion on an atomic scale was performed in the way presented in Fig. (15), where R is radius of an atom and p is the pressure at the centre of the Earth.
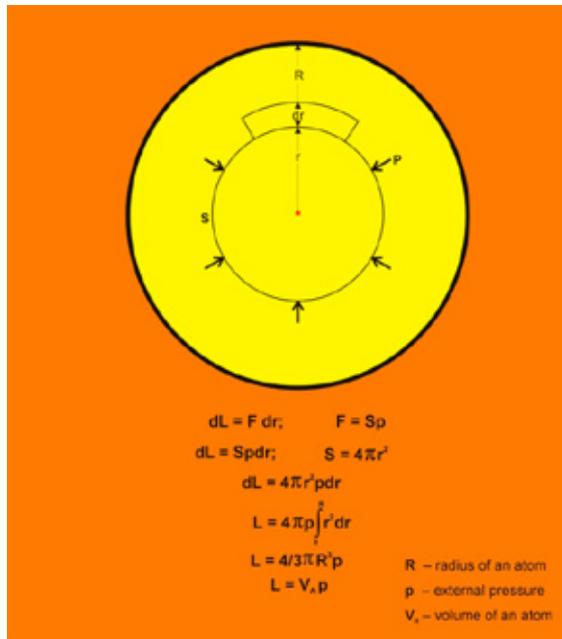

Fig. 15. Work of growth of a newborn atom in the Earth's core

Fig. 16. Work of growth of the dominant newborn atoms in the Earth's core

This yields the following results for particular atoms (Fig. 16). After taking into account also minimal inter-atomic space the inflated volumes are greater (Fig. 17) and the inflating energies are also greater (Fig. 18).

Fig. 17. Volume of the dominant newborn atoms with the minimal interatomic space

Fig. 18. Work of growth of the dominant newborn atoms in the Earth's core with regard to the minimal interatomic space

The two independent ways of calculations give similar results. The energy of creation of a single atom of iron calculated in the macro-scale is 59.4 eV (Fig. 14) and calculated in the micro-scale is 45.2 eV (Fig. 18).

Taking into account Maxlow's (2005) calculation of annual increment of the Earth's mass 6.0×10^9 g/year and annual increment of the Earth radius 2.2 cm/year (both of which are more nearly correct) the first value will be 23.8 eV. The second value is independent of above parameters of expansion of the Earth.

VII. Information about formal improvements of the reproduced paper

The text of the reproduced paper was loosened. A table of contents was added. Subheadings were numbered. Two subheadings were added: "Energy of expansion" and "Importance of magnetic field". Figures were improved and colored. The English language was improved.

Jan Koziar
August 2013

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B. Reproduced paper (1994)

Possible relation between Earth's expansion and dark matter

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Contents

1. Introduction

The theory of Earth expansion has long been developed from several basic observations. Among these are, first of all: the mutual moving apart of all the continents, elongation of the ocean ridges, radial growth of oceanic lithosphere around Africa and Antarctica, extension and splitting of continental margins, the increase of the Pacific Ocean (similar to other oceans), and the deep rooting of plates and ocean ridges which has recently been proved by seismic tomography.

The main objection which has been raised against Earth expansion is the lack of a known cause or causes for such a process. This objection is incorrect because we do not need to know a physical cause of a phenomenon, to be able to prove it as a fact. Nevertheless, recently developed theories of dark matter suggest a possible casual explanation for Earth expansion. What is more, this process of Earth expansion could be just the sort of tangible effect of the existence of dark matter that physicists appear to be seeking.

2. Geometrical range of the Earth's expansion

The approximate magnitude and rate of Earth expansion can be assumed from the extensional development of all oceans in the Meso-Cainozoic. This gives about a doubling of the Earth's radius in the last 200 million years. It was already supposed long ago that the size of the Earth is increasing exponentially (Hilgenberg, 1933). Such a growth was supported by calculations based on paleomagnetic data (Hilgenberg, 1962; Neiman, 1962) and on isochrons of oceanic lithosphere (Koziar, 1980; Osipišin and Blinov, 1987). Furthermore the graph obtained by Koziar (Figure 1) is based on intracontinental reconstruction. It was confirmed by Vogel (1991) and will be used here for further calculations.

The graph is defined by the formula

$$R_1 = R_1 + R_2 e^{rt} \qquad\qquad (1)$$

where: $R_1 = 2800$ km, $R_2 = 3570$ km, $r = 0.00725$ Ma^{-1}.
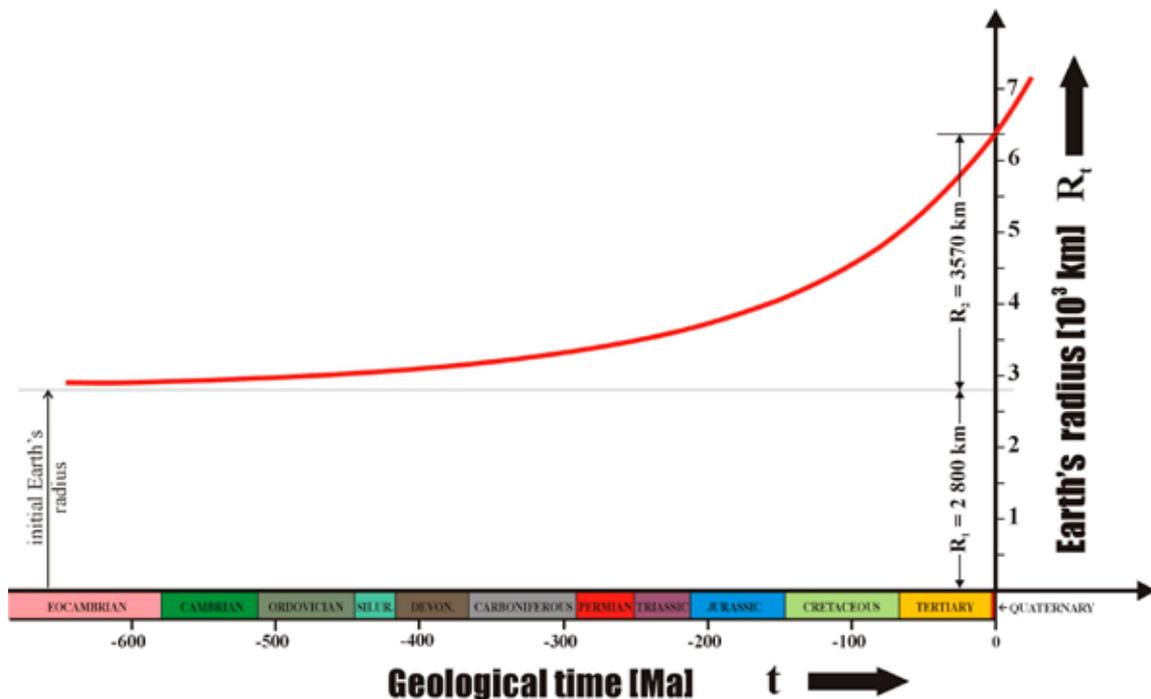

Figure 1. Growth of the Earth's radius

Differentiation of (1) gives the rate of Earth expansion

$$dR/dt = rR_2 e^{rt} \qquad (2)$$

Recent growth rate obtained from (2) is

$$rR_2 = 2.6 \ cm/yr \qquad (3)$$

This value (Koziar, 1980) falls between the results of Blinov (1987) – 2.4 cm/yr and Parkinson – 2.8 ± 0.8 cm/yr (vide Carey, 1988).

3. Growth of the Earth's mass

Growth of the Earth's mass is suggested by many authors (Jarkowski, 1888, 1889; Hilgenberg, 1933, 1974; Kirillov, 1958; Neiman, 1962; Wesson, 1973; Carey, 1976, 1983; Veselov, 1976, 1981; Blinov, 1983; Ivankin, 1990). Such growth may be inferred from two empirical circumstances. First, the recorded increase of the Earth's radius assuming constant Earth mass implies about four times greater gravitational surface acceleration at the turn of the Paleozoic and Mesozoic. This would be too large for the tetrapods living at that time. Second the Earth's growth is accelerated. A simple decrease of mass density, at constant ~~s~~ Earth mass, would rather suggest a slowing down of the expansion rate.

The exponential growth of the Earth's size suggests an exponential growth of the Earth mass (Hilgenberg, 1933, 1974; Carey, 1983; Blinov, 1983).

Recently the Czech geologist Hladil (1991) published the results of his detailed investigations of Upper-Ordovician impact structures made by drop-stones from drifting icebergs. Hladil gives the quantitative conclusion that 450 Ma ago the surface gravitational acceleration was equal to 15 ms^{-2}. Using this value and R = 2900 km – the Upper-Ordovician Earth's radius from (1), G-the gravitational constant, ~~and~~ together with the mass formula $M = gR^2/G$ we obtain 1.89×10^{27}g as the mass of the Earth – i.e. 3.16 times lesser than the recent value (5.89×10^{27}g) – and a mean density of 18.15 g/cm^3 – i.e. 3.3 times greater than the recent value (5.52 g/cm^3). Thus we record both the growth of Earth's mass and the decrease of its density.

The possible hyperbolic decline of gravitational constant G due to expansion of the Universe, as suggested by Dirac (1937), is relatively small over the period of the last 450 Ma, so therefore we assume G as constant in the calculations above.

Now we can try to find an exponential function for Earth mass growth over the whole Phanerozoic. First, we need to find the asymptote of this function. The initial Earth volume defined by (1) is 92×10^9 km^3. Because the Ordovician mean density will have been close to the asymptotical value, we can (avoiding a greater error) multiply by it the above initial volume. We obtain in this way a value for the initial mass of the Earth equal to 1.67×10^{27}g.

Having this value, together with the Ordovician and recent masses, we are able to obtain a complete exponential function

$$M(t) = M_1 + M_2 e^{mt} \qquad (4)$$

where $M_1 = 1.67 \times 10^{27}$g, $M_2 = 4.31 \times 10^{27}$g, m = 0.00652 Ma^{-1}. The function is shown in Figure 2.
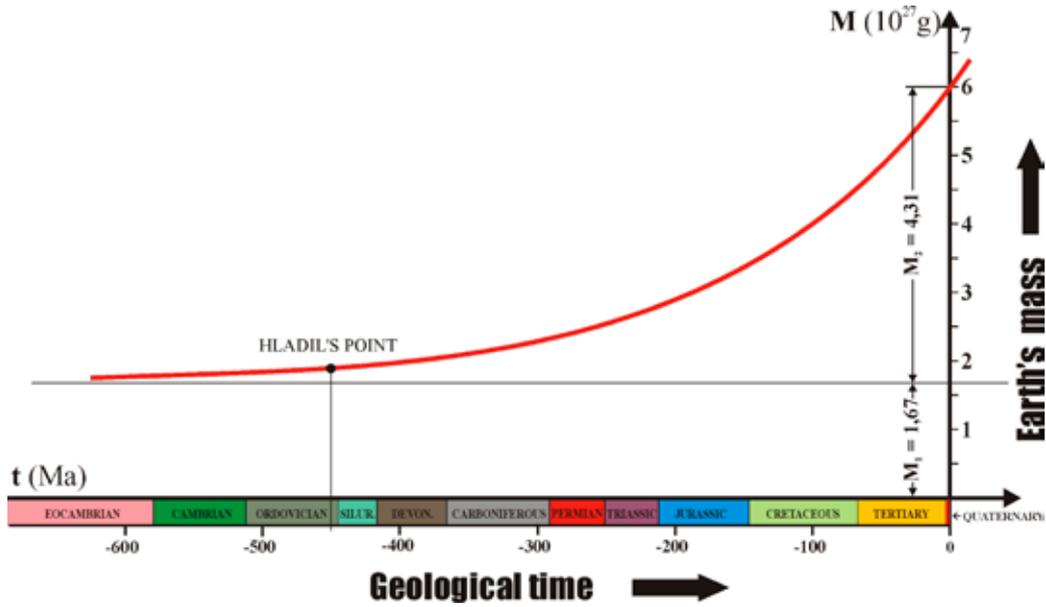
Figure 2. Growth of the Earth's mass

Differentiation of (4) gives a growth rate of Earth's mass

$$dM/dt = m\, M_2 e^{mt} \qquad (5)$$

The recent growth rate of Earth's mass is then

$$m\, M_2 = 2.82 \times 10^{19}\, g/yr \qquad (6)$$

By reducing this value to 1 cm² of Earth surface S, we obtain

$$m\, M_2/S = 5.5\ g/(cm^2\ yr) \qquad (7)$$

The growth of the Earth's mass is possible to be measured by satellite geodesy. Using the SLR method (Satellite Laser Ranging), the geocentric gravitational constant, GM, has already been observed with high accuracy (Smith et al., 1985, 1990). An increase of the GM can be noticed in the data. We find its value corresponding to our results.

4. Dark matter and the expanding Earth

Most authors mentioned above, who are convinced about the Earth's mass growth, have postulated that a substance of a yet unknown kind enters the Earth's interior, and there converts into normal terrestrial matter. Here we shall point out that the recent astrophysics concept of dark matter provides a candidate for this type of substance. Some physicists propose dark matter in the form of highly penetrating neutral particles to explain the well-known problem of the more than 90% deficiency of the Universe mass. Until now, various kinds of object have been considered as possible components of penetrating dark matter. Among others, these include neutrinos and mini black holes with the mass of the order of $10^{12}\,$ kg.

Since 1986, a number of papers suggesting gravitation and collisional capture and accumulation of dark matter inside the cores of the sun and planets have been published. Here we mention only the papers dealing with capture of dark matter by the core of the Earth: Freeze, 1986, Krauss et al., 1986; Gould,

1987, 1988, 1991, 1992a, 1999b; Giudice and Roulet, 1989; Kawasaki et al., 1992. These authors treat iron atoms in the Earth core as the main medium for collision and capture of the so-called WIMPs (Weakly Interacting Massive Particles). The main effect of the dark matter capture is suggested to be annihilation of the WIMPs and emission of neutrinos. However, experimental results so far do not confirm the anticipated emissions (Mori et al., 1992). But conceivably the capture mechanism and its effects could be different than envisioned.

None of the papers mentioned above suggest the possibility of a transition of dark matter into baryonic matter on contact with the latter. None of these consider the Earth expansion theory either. At the same time, the significant increase of the Earth's volume and mass found in geological data could be an empirical effect of an interaction between dark and visible matter such as is being sought by physicists, and another indicator of the existence of the theorized substance.

Assuming a connection between Earth expansion and capture of dark matter in the Earth's core, we have in general two possibilities for the conversion mechanism. First, dark matter directly reacts with Earth's matter. Second, Earth matter only catalyses the change of dark matter into visible matter.

Previously, we presented the global annual amount of new Earth matter (6), and now we shall discuss some qualitative effects. Considering a more-than-threefold growth of the Earth's mass since the Ordovician, we come to conclusion that the main Earth elements Fe, O, Si, Mg must be the products of dark matter conversion.

5. Energy of the Earth's expansion

It is also possible to estimate the energy output due to the conversion process necessary to drive Earth expansion. We consider a radial cone of the Earth with area of 1 cm^2 at the surface. The expanding Earth needs to move the cone up by 2.6 cm every year (2). For the cone of differentiated density (4.2 g cm^{-3} – mean mantle density, and 12.2 g cm^{-3} – mean core density) we find the energy 5.6 x 10^{12} erg (1.34 x 10^5 cal) per 1 cm^2 of the Earth surface per year. This amount of energy is much larger than the geothermic flux (47.3 cal cm^{-2} yr^{-1}) and almost equals the mean flux of solar energy at the Earth's surface (1.32 x 10^5 cal cm^{-2} yr^{-1}).

Since there is 5.5 g mass increase for every square cm of the Earth's surface per year (7), then for each gram of the new matter the energy release should be about 2.45 x 10^4 cal g^{-1}. This is about 7 times more than in the most effective chemical reaction of oxygen with hydrogen (3.6 x 10^3 cal/1g of H_2O). On atomic scale this ratio reads: 1.07 eV per single nucleon or 59.9 eV per single atom of iron.

In these estimates, we have considered only the energy needed to overcome gravity forces, and have neglected the energy needed to overcome the mechanical resistance of Earth matter. We can expect that the energy which drives endogenous geological processes is also of a similar magnitude to the value calculated above.

6. Importance of the Earth's magnetic field

Indirectly, we have evaluated dark matter capture using the magnitude of the Earth mass growth determined by geological methods. However, the resulting amount of dark matter mass is much lager than the theoretical estimates given in the papers cited above. For instance, Gould`s analyses imply an annual global capture of about 30 kg. In these papers, the conjectured capture mechanism resulted from the standard elementary particle interaction combined with the gravitational attraction. Then to explain Earth expansion, we must suppose for the Earth a much more effective capture mechanism, a probably connected with the Earth's magnetic field. This would explain the exceptional behavior of the Earth among other near-Sun planets the expansion of which is insignificant (Venus being a possible exception). All these planets have minute magnetic field compared with the Earth. In this scenario, particles of dark matter must obviously have a tiny magnetic moment.

The proposed capture mechanism determines the optimal conditions for using the recently designed low-temperature particle detectors, e.g. those described in Sadoulet (1988), for detection of dark matter. They should be inserted in traps having strong magnetic field and placed deep underground, in the neighborhood of the Earth's magnetic poles.

Finally, we must point out that the above-described possible connection between dark matter and Earth expansion is not a necessary condition for the latter, which is evidenced independently by geological data.

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