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The Solid, Quantified, Radiating and Growing Earth

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Five propositions in Geology, namely Constant Size Earth, Plate Tectonics, Heat Engine Earth, Elastic Rebound, and the Organic Origin of Hydrocarbons are challenged and in their place the Excess Mass Stress Tectonics — EMST, i.e., the Solid, Quantified, Radiating and Growing Earth claims to be a comprehensive proposition.

In the context of EMST the waving space at 299792458 m/s is the infinite source of all mass. Energy and matter are sine waveforms of local anisotropy in the elastic, large-scale isotropic continuum, which is lossless and has infinite elasticity to any velocity lower than light speed, c, and infinite rigidity at $v \geq c$. Earth's inner core is an equilibrium high tension-frequency location, wherein energy-unpaired standing or travelling waves transform into matter-paired standing waves, so that the conservation principle is not violated. New elements are formed, i.e., 'Excess Mass', which are added, in a solid-state, atom-by-atom around the core. Iron with the highest nuclear binding energy of 8.8 MeV is the most recent and currently forming element; thus the absence of true oceanic crust older than 200 m.y. Upon decompression-oxidation close to the Earth's surface the reduced Fe^{-2} releases its 4—5 'excess' electrons, to become $Fe^{+2,3}$. High temperatures and melting are local and episodic surface phenomena, sourced by radiant heat, i.e., electron resonance in 10^{-6} m micro-cracks at 10^{14} Hz. The dielectric collapse of micro-cracks produces the dynamic stress necessary for the generation of an earthquake. Hydrocarbons are produced abiotically through a process whereby H and C, but also O, N, S and trace elements formed throughout geological history, in the Earth's core, ascended through radial fracture trails in the solid and cold mantle to the Earth's surface. If their rise is blocked compose bigger compounds, e.g., kerogen, that can be transformed by radiant heat and pyrolysis into coal, oil and, gas at temperatures <50, 50—100, and <200 ^{o}C, respectively.

Keywords: constant size earth, plate tectonics, heat engine earth, elastic rebound, organic origin of hydrocarbons, space, isotropy, anisotropy, energy, matter, standing waves, conservation principle, nuclear binding energy, iron, micro-cracks, radiant heat, dielectric collapse, dynamic stress, earthquake, hydrogen, carbon, kerogen, pyrolysis, coal, oil, gas.

Introduction

Although the five challenged propositions of Constant Size Earth, Plate Tectonics, Heat Engine Earth, Elastic Rebound, and Organic Origin of Hydrocarbons are considered by most as non-negotiable facts, upon rigorous examination they show many contradictions and a lack of empirical and experimental verification. Furthermore there is a constant need to resort to ad-hoc hypotheses in order to explain phenomena that cannot be explained by the fundamental arguments of these propositions.

For example according to Hofmeister and Criss *[Hofmeister, Criss 2005]* the half-space cooling (HSC) model, that presumes the ad-hoc contraption of infinite heat flux at zero time, ignores the experimentally verified strong effect of decreasing thermal conductivity with increasing temperature. As a consequence the model over predicts the heat flux measured from mid-ocean ridges in some cases by more than 500%. Thus the model gives a high overall compared to the data, leading to 101 mW.m^{-2} as the mean oceanic value *[Pollack et al. 1993]* whereas the median observed flux is 64.9 mW.m^{-2}. Based on these calculated values, global heat flow maps are constructed that give the false impression that heat flux is higher along mid-ocean ridges and lower along trenches and 'subduction' zones, in direct contradiction with maps that depict the observed values. In the observed values maps, values as low as 20 mW.m^{-2} are common in mid-ocean ridges and values as high as 200 mW.m^{-2} are equally common in trenches, arc and back-arc as well as in continental areas, such as the Japan and Fiji-Tonga trenches and the north-western continental USA. This direct observation is in complete agreement with the global distribution of active volcanoes and hot spots, the great majority of which are concentrated outside mid-ocean ridges in the so-called convergent margins. The contradiction is obvious. Heat released along mid-ocean ridges, where the motion of plates is supposedly fuelled,

falls short, even by an order of magnitude in comparison to the heat released as a by-product of the supposed subduction process. Miraculously we have a heat engine with an efficiency of well over 100%, up to 1000%!

Below many more fundamental contradictions will be exposed showing the need for a serious reconsideration of these five propositions and for an alternative comprehensive proposition.

Constant Size Earth

The formation of a new dome in Mt St Helens in about 20 days (**Fig. 1 A**), from 24 September to 14 October 2004, and of a new dome connected with the Izmit earthquake in less than 35 days (**Fig. 1 B**), from 13 August to 17 September 1999, are two examples of episodic growth of the Earth in association with volcanoes and earthquakes, respectively. It is also known that geoid highs are gravity highs, and positive free-air gravity anomalies (**Fig. 2 A**) coincide with elevation (e.g., Andes, Himalayans, Hawaii, etc.), volcanoes and earthquakes.

Figure 1. (**A**) From Sept 24 through Oct 14, 2004 most of a new dome in Mount St Helens was formed. In Feb 21, 2005 its measured volume was ~4.2×10^7 m^3/~1.3×10^{11} kg, and its growth rate ~2 m^3/s or ~6×10^3 kg/s (Cascades Volcano Observatory, U.S.G.S.). (**B**) New dome 250 km × 60 km × 75 cm, or ~4.4×10^9 m^3/~1.3×10^{13} kg of the 7.4 Izmit earthquake, Aug 17, 1999. ESA's Interferogram Radar acquisitions: Aug 13 and Sept 17, 1999 *[Hanssen et.al., Delft University of Technology 1999]*.

The implication is that, contrary to Airy's isostacy, there is 'Excess Mass' (**Fig. 2 B**), i.e., volume and density increase, below elevation, because if it was only for more mass in the same volume, i.e., greater density, there will be no uplift *[Tassos, 2006b]*. The direct implication is that 'Excess Mass', manifested by the positive gravity and geoidal anomalies, associates with earthquakes and volcanoes (**Fig. 2 C**)

It is quite obvious therefore, that unless there is a physically possible process of eliminating this 'Excess Mass', e.g., the 1.3×10^{11} kg of Mt St Helens volcano and the 1.3×10^{13} kg of the Izmit earthquake; then the Earth has ultimately grown. The question is: Where and how this 'Excess Mass' is formed-transformed without violating the conservation principle? This question will try to answer.

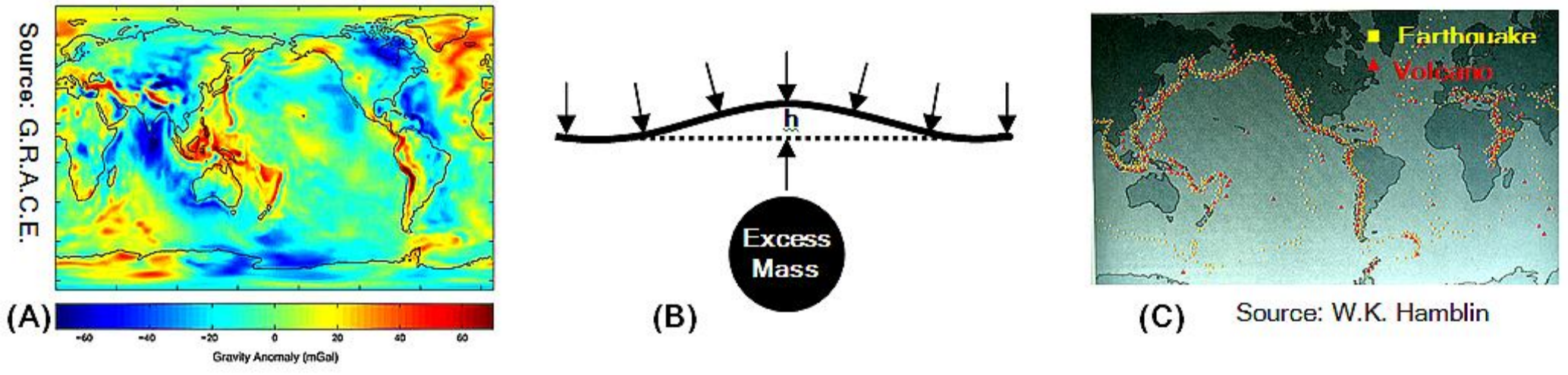
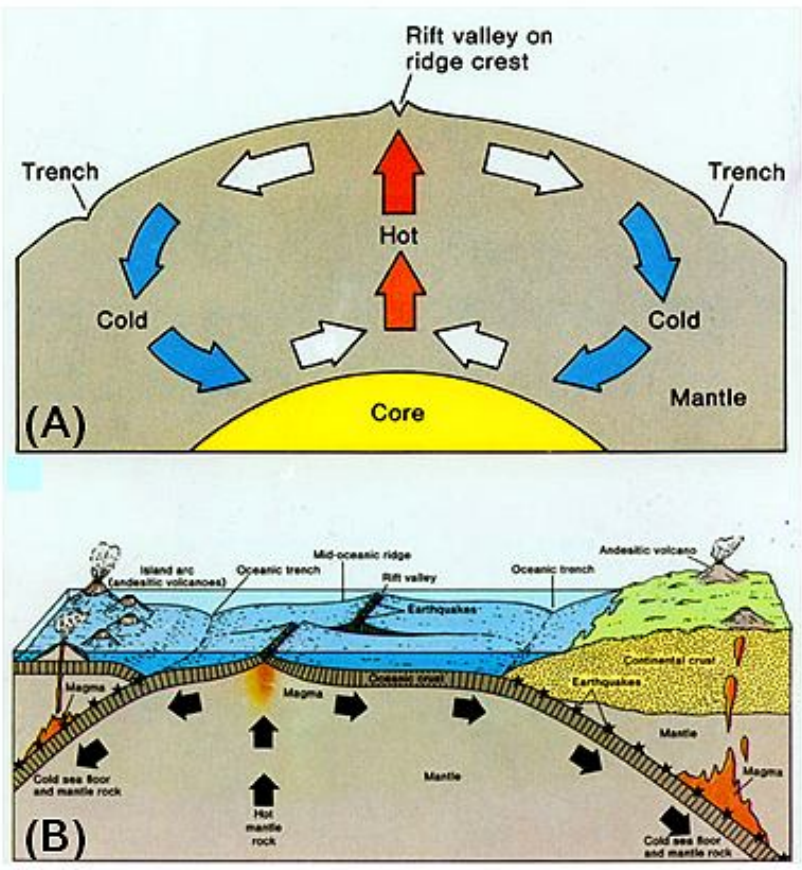


Figure 2. (**A**) The free-air gravity anomalies, which are a measure of total mass under the point of measurement, are between +70 and −70 mGal, and the corresponding geoid heights between +70 and −100 m. (**B**) The geoid surface (dashed line) is the shape a fluid Earth would have if it had exactly the gravity field of the Earth. In that context the vertical coordinate, h (elevation), is referenced to the geoid, and it is attributed to 'Excess Mass'. (**C**) Earthquake and Volcanic zones.

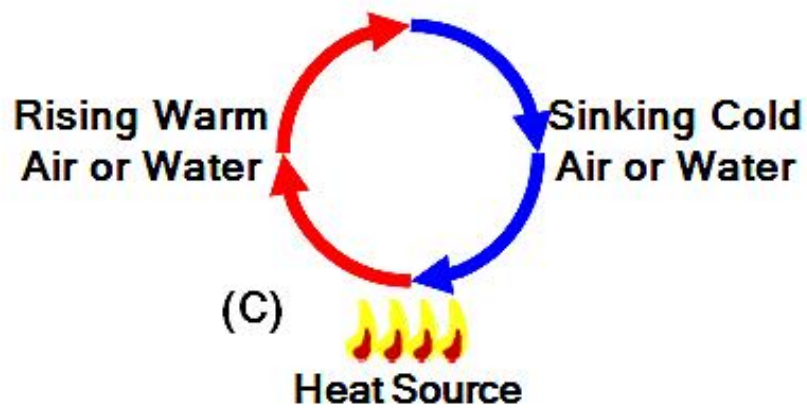
Plate Tectonics

According to plate tectonics the formation of oceanic crust takes place at rift zones located in the Mid-Oceanic Ridges — MORs. Beneath the rift zone convection currents of magma occur in the mantle. The added rock along the MORs, produced from the solidification of magma, pushes previously formed oceanic crust horizontally away from the rift zone like a raft on a

conveyor belt. Ocean crust is returned to the mantle through subduction, caused by the slab pull of the down-going slab. The movement of oceanic crust under the continents is considered as the mechanism responsible for the friction between the oceanic and continental plates that generates earthquakes along the Wadati—Benioff zones, and creates hot plumes of magma which migrate up through the continental mass to form plutonic and extrusive igneous features, like volcanoes (**Fig. 3 A,B**).



Source: McGeary & Plummer: Physical Geology - Earth Revealed, 1992.



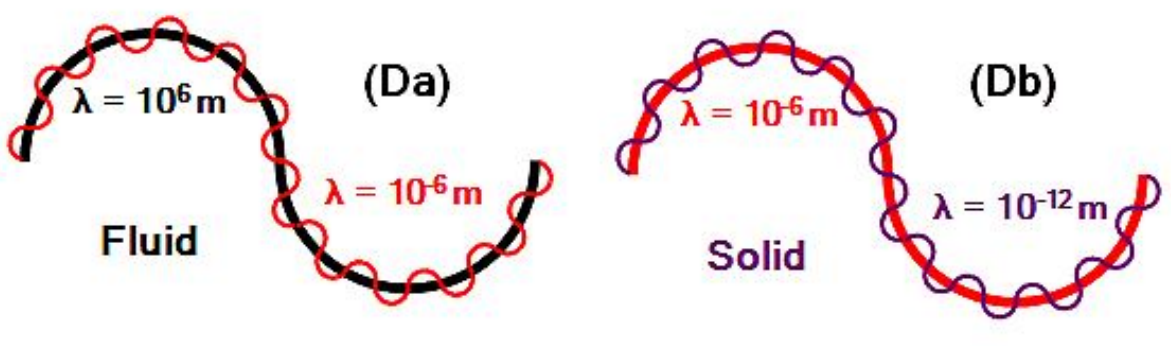


Figure 3. Plate Tectonics: Convection Currents (**A**) and Subduction (**B**). But, the possibility of the chimney or buoyancy effect, i.e., the rise of heated lower density material, and the subsequent descend of cold higher density material, has only been demonstrated in gases and liquids (**C**). In fluids the carrier waves have wavelengths in the order of up to 10^6 m (**Da**), while in solids the carrier waves are the 10^{-6} m heat waves (**Db**).

In order to satisfy the false axiom of constant size Earth, subduction is considered as the process responsible for the elimination of new material added along MORs. Leaving aside the deep continental roots down to 600 km, the fact that new material is not only or even not mainly being added in MORs, and not all MORs are coupled with subduction zones, e.g., Mid-Atlantic Ridge, there is an insuperable mechanical problem. For a solid to penetrate into another solid the binding forces that keep the atoms of a solid in place, have to be surpassed. Gravity is extremely weak. In theory the electrostatic force is about 10^{40} times stronger than gravity.

In practice a simple experiment shows that a nail cannot penetrate into a wooden table only due to the fact that it is several times denser than wood. For this to happen, a hammer strike that will cause a shockwave is required, and the incursion will occur because the penetrating surface area is very small. Otherwise if a rock block strikes the table will cause a shock wave and if the strike is too strong might break the table. More so this is impossible when the down going slab is assumed to be only 2—3% denser relative to the surrounding mantle. Even that though is a false assumption, because it is known that granite is lighter than basalt, and basalt is lighter than peridodite.

Convection currents, meant as transport of bulk matter to long distances, of the order of millions of meters (**Fig. 3 A**), as in the supposed Earth's convection currents, are applicable to fluids (**Fig. 3 C**), not to solids. In real fluids the low resistance is expressed by the very low viscosities, e.g., 10^{-5} for air and 10^{-3} Pa.s for water. If we treat fluids as waves, then their 10^6 m wavelength (**Fig. 3 Da**), is a carrier wave that can almost instantaneously conduct-carry heat, with its 10^{-6} m wavelength. In real solids the 10^{-6} m thermal waves are the carrier waves; any higher frequency-lower wavelength waves, e.g., 10^{-12} m, are carried by them (**Fig. 3 Db**). Thus the dimensions of convection currents in materials in the Earth's interior, with viscosities of the order of 10^{20} Pa.s, is similar to the 10^{-6} m wavelength of thermal radiation. Convection currents of $\lambda=10^6$ m, twelve orders of magnitude higher, could only occur if the Earth's mantle had the elastic properties of an ideal fluid.

Heat Engine Earth

In plate tectonics, but also in alternative theorizations the Earth is a heat engine, i.e., all geologic and geodynamic processes are fuelled by heat. In order for that to occur the temperature of the inner core should be about 5000 K, and the temperature in the mantle should increase with depth to ~3800 K at the mantle-outer core boundary (**Fig. 4 A**). Overall, the temperature of more than 99% of the Earth's interior should be higher than 1000 °C.

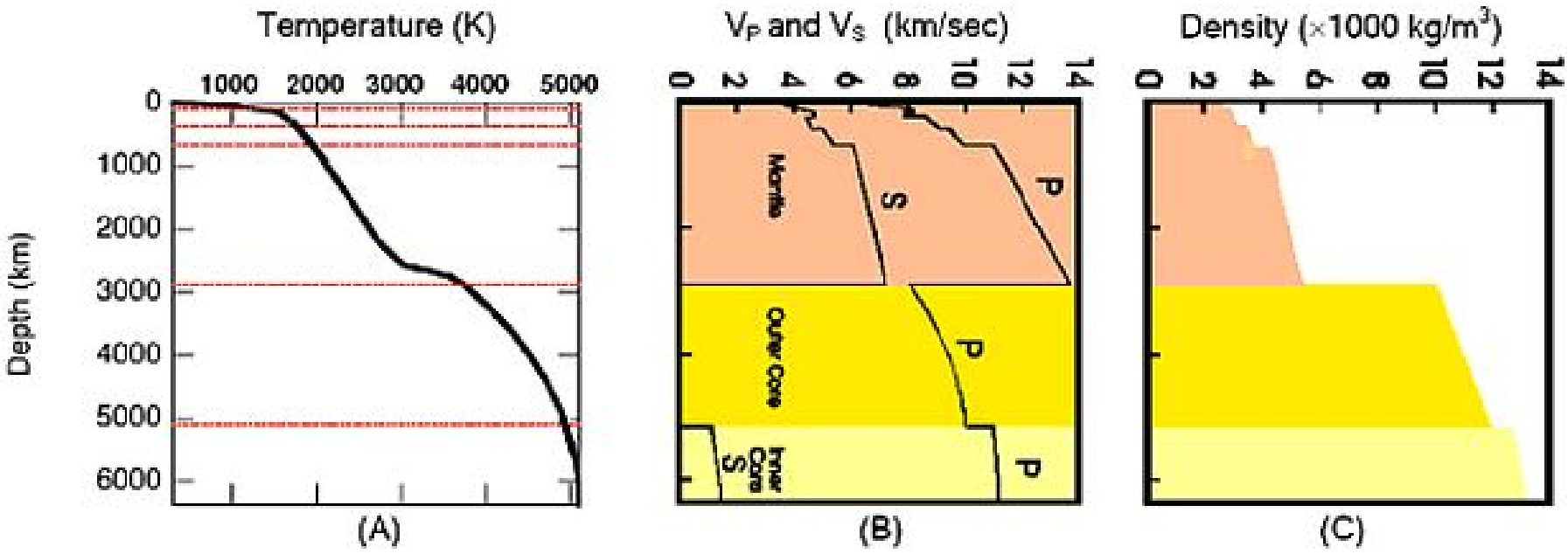


Figure 4. Temperature (**A**), Seismic Wave Velocity (**B**), and Density (**C**) Profiles, in the Earth's Interior.

But, seismology tells us that the velocity of both P and S seismic waves is proportional to incompressibility, K, and rigidity, μ, and inversely proportional to density, ρ, as per (**1**):

$$V_P = \sqrt{\frac{K + \frac{4}{3}\mu}{\rho}} \qquad V_S = \sqrt{\frac{\mu}{\rho}} \tag{1}$$

Then it is well known that the velocity of both P and S waves increases with depth in the mantle (**Fig. 4 B**). Density also increases with depth (**Fig. 4 C**). So, if it was only for density increase, the velocity of seismic waves should decrease with depth. There is no other physically possible way for seismic wave velocity to increase with depth but for the elastic moduli to increase with depth at a faster rate than density. This is impossible though if temperature increases with depth, because the elastic moduli are very sensitive to temperature. Rigidity decreases as temperature increases, and vice versa, and at temperatures above 800 ^{o}C rigidity diminishes rapidly *[Mallock 1924]*.

This decrease cannot in any way be compensated by pressure, because the pressure at any depth is below the rigidity and incompressibility thresholds. For example according to the Preliminary Reference Earth Model — PREM *[Dziewonski and Anderson 1981]* the density of crustal rocks at ~10 km depth, is ~2900 kg.m^{-3}, the pressure ~0.3 GPa, whereas rigidity μ, and incompressibility K, are ~26.6 and ~52 GPa, respectively. At 77 km the density is ~3375 kg.m^{-3}, the static stress ~2.45 GPa, the rigidity ~67.4 GPa, and the incompressibility modulus ~130 GPa. At the depth of 667 km the corresponding values for density ρ, pressure, rigidity μ, and incompressibility K are about 4381 kg.m^{-3}, ~23.8, ~155 and ~300 GPa, and at 2888 km they are ~5566 kg.m^{-3}, ~136, ~294, ~656 GPa.

The implication is quite clear: Depth and therefore static stress-pressure has no effect on elastic moduli. For seismic wave velocity to increase with depth in the mantle rigidity has to increase with depth; as a result temperature cannot increase with depth. Therefore the seismic wave velocity profile is an approximation of the actual, whereas the conventional temperature profile is not.

Associated with the heat engine Earth is the belief that all igneous rocks came from the solidification of magma and their texture depends on the rate of cooling, and therefore depth. The microcrystalline texture is considered indicative of the fast rate of cooling and surface conditions, and the megacrysts of slow rate of cooling, which takes place at greater depth. But, how can this be true if we know from petrology that the cooling rates of rocks inside the Earth are of the order of 50 K per billions years *[Abbott et al. 1994]*, the microcrystalline texture refers to deep mantle rocks like gabbro and peridodite, and the megacrysts to the surface granite?

Also, there is another insurmountable problem. Where all this heat comes from? The conventionally suggested heat sources are: (1) remnant primordial heat trapped in Earth at the time of the Earth's supposed origin, about 4.6 billion years ago, (2) tidal heating, and (3) decay of radioactive elements.

With regard to the first option, the 2×10^{30} J of the supposed primordial heat could have lasted for only the first 50 million years (!), given constant expenditure at the present annual global energy requirements, which are of the order of $\sim4\times10^{22}$ J.yr^{-1}, or $\sim10^{15}$ W, i.e., the seismic moment of a M≈9 earthquake. For the second option, the 10^{12} W of tidal frictional heat induced in rocks by the about 11 cm oscillatory uplift of the mantle due to the moon's gravitational attraction amounts to an insignificant 0.1% of the necessary annual energy requirement for a thermally driven Earth.

Lastly, the radioactive isotopes, such as U^{238}, Th^{232}, and K^{40}, are assumed as the most probable mantle heating energy source. But, the concentrations of Th^{232}, U^{238}, and K^{40} in granite are about 13, 4, and 4 ppm, respectively, a total of 21 ppm; in basalt the total is only 4 ppm, and in peridodite, which is considered to be a typical mantle rock, their total concentration is

the very low 0.1 ppm *[Press and Siever 1978]*. Furthermore, these isotopes are only found within the uppermost level of granitic-continental crust rocks, making up a minor fraction of Earth's outer-most thin skin, and are effectively absent from all known rocks of direct mantle origin, such as peridodite. The annual energy equivalent of 21 ppm radiogenic elements in the crust is ~0.03 $J.kg^{-1}.yr^{-1}$, or ~10^{-9} $W.kg^{-1}$, and of the 0.1 ppm in peridotite, about 3×10^{-12} $W.kg^{-1}$. We have no reason to accept a proposition that the concentration, if any, of radiogenic elements in the mantle and core, i.e., in the about 6×10^{24} kg of Earth's mass, is greater than 0.1 ppm. Thus, the maximum amount of heat all such radiogenic sources could possibly provide **if** concentrated in space and time is a meagre 1.8×10^{13} W; i.e., less than 1.8% of Earth's annual power requirements. In other words, conventional geodynamic models misguidedly presume radioactive isotopes to be an adequate heat source from an essentially non-radioactive mantle.

So, we can with good reason argue that the heat engine Earth, and its implications, such as melting and convection currents, phase changes and degassing due to heating, and the molten origin of igneous rock-molten Earth origin etc., is not verified by observation and experiment.

Elastic Rebound

Conventionally rocks are considered as an elastic medium. Horizontal static stress changes along a potential fault plane (**Fig. 5 A**) produce the accumulation of elastic strain, i.e., rocks bend (**Fig. 5 B**), then frictional sliding, rupture, inelastic slip (**Fig. 5 C**), and finally an earthquake. In other words, a more or less constant horizontal static stress, in the range of 10^4 $Pa.yr^{-1}$ (~3×10^{-4} $Pa.s^{-1}$), slowly, e.g., in ~10,000 to ~10,000,000 years, builds up elastic strain along a fault until it reaches the local strength from 10^8 to 10^{11} Pa, respectively, defined as the critical stress necessary for failure, and then an earthquake occurs with a sudden stress drop. Thus, immediately after the shock the possibility of generation of another strong shock in that region is reduced, and a new earthquake cycle begins; the time between two strong shocks being the seismic gap. But, the estimated average value of stress drop is ~10^6 Pa, and estimates as low as 10^4, or even 10^3 Pa, are not unusual, implying a dramatic reduction of strength, and the release of elastic strain energy due to creep. Let alone the fact that the 10^8 Pa of strength already implies a reduction by three orders of magnitude, again due to microcracking, of the rigidity modulus which has to be of the order of 10^{11} Pa; otherwise a 10^3 to 10^4 $m.s^{-1}$ seismic wave speed cannot be sustained.

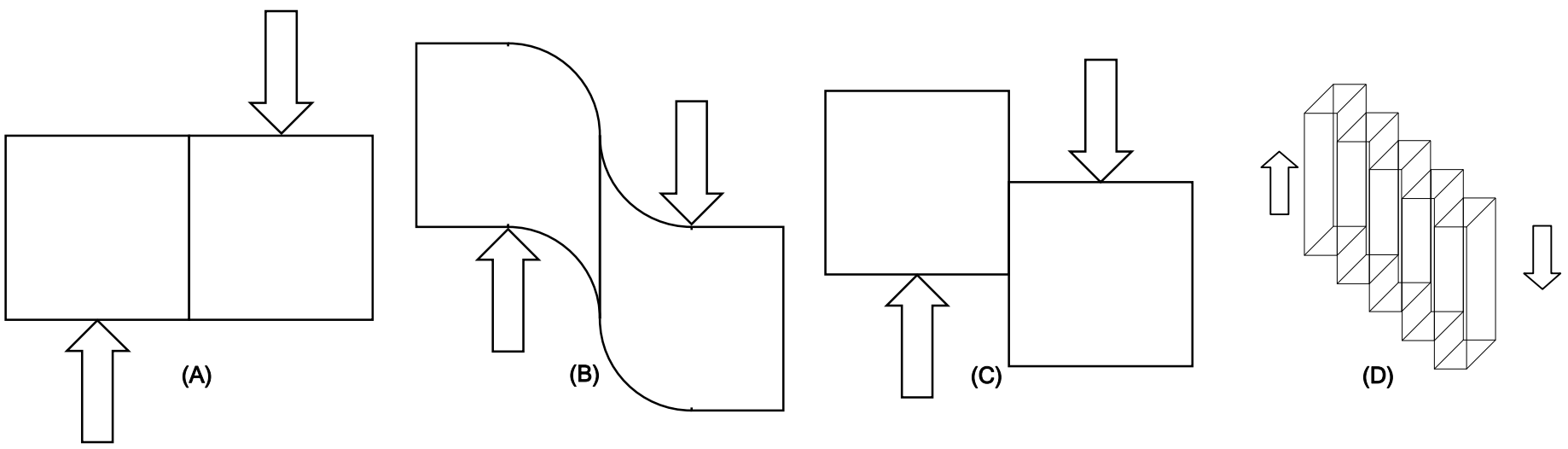


Figure 5. According to the elastic rebound, static stress changes along a potential fault plane (**A**) produce the accumulation of elastic strain, i.e., rocks bend (**B**), then frictional sliding, rupture, inelastic slip (**C**), and finally an earthquake occurs. Actually, and depending on the degree of micro- and macro-cracking, when rocks are under the action of a weak static stress, they do not deform at all, or they deform non-elastically through the slower creep and the faster slip. In effect they act as a series of separate blocks, like a deck of cards that move linearly the one relative to the other, as in (**D**), and remove elastic strain energy from the system.

The question is: can rocks deform elastically when a weak horizontal static stress acts on them, let alone this is an imaginary, so-called regional stress? Or, strain is released through creep (slowly) or slip (faster) due to the coalescence of microcracks (**Fig. 5 D**), and for the transient elastic response of a rock block a real and quantized vertical dynamic stress is required?

In the elastic rebound — seismic gap model the repeating rupture of a single section of a fault is conceived as a 'stuck patch' on the fault's surface, and for the largest earthquakes the whole fault surface should be a huge 'stuck patch' around which strain energy through bending and without creep builds up, i.e., ~10^4 km^2 for a magnitude 8.5 earthquake (**Fig. 5 B**). But, since we refer to the entire fault surface as a stuck patch, if the strength of the rock has been reduced from five to eight orders of magnitude the fault surface area should increase proportionally, for example it should be from 10^9 to 10^{12} km^2 for the 8.5 earthquake, i.e., up to almost four orders of magnitude greater the surface area of the Earth!

When the patch ruptures, the elastic strain is released as seismic waves, slip occurs and the loading process restarts. If the loading rate (plate motion) is constant (static stress), the timing of the earthquakes would be regular; like a saw-tooth waveform. The static stress energy after a strong shock is depleted, so preventing future earthquakes until the stress is restored, i.e., the probability of a strong event to recur increases with time. But, contrary to the seismic gap model, observation indicates that earthquakes cluster in space and time, and immediately after the generation of a strong shock the probability of an equally strong shock in that area greatly increases. Also, estimated stress drop values as low as 10^3 Pa are compatible with slip but incompatible with elastic deformation.

As the slip rate equals stress rate over rigidity, and the co-seismic slip rate in large, but actually, since it refers to the quantized elasticity, in all events regardless of magnitude, is estimated to be in the range of 10^{-4} s^{-1}, there are two opposing solutions:

1. The stress rate remains very low in the range of 10^{-4} $Pa.s^{-1}$, and the rigidity is reduced to 1 Pa, or
2. The stress rate is raised, e.g., to 10^{6} $Pa.s^{-1}$, and the rigidity remains constant, e.g., $>10^{10}$ Pa.

The first solution explains co-seismic slip rates without having to resort on a dramatic stress rate increase, but it requires a reasonable explanation as to how the reduction of rigidity, by at least 10 orders of magnitude, to 1 Pa, is attained. But, this solution cannot be related to earthquakes because the rigidity of 1 Pa can only support a shear wave velocity more than five orders of magnitude lower than that of the 10^{3} $m.s^{-1}$ of seismic waves. Actually, and depending on the degree of micro- and macro-cracking, when rocks are under the action of a weak static stress do not deform at all, or deform non-elastically through the slower creep, from 10^{-9} to 10^{-2} meters per year, and the faster slip, up to centimetres per hour. In effect the rock block acts as a series of separate blocks, like a deck of cards that move linearly the one relative to the other, and remove elastic strain energy from the system (**Fig. 5 D**), and this is why when rock samples are compressed they deform plastically by forming cracks that produce sound, not seismic waves.

The second solution provides the rigidity, $>10^{10}$ Pa, which can support the seismic wave strain rates of $>10^{3}$ $m.s^{-1}$, but it requires a dynamic stress rate in the order of 10^{6} $Pa.s^{-1}$, like a hammer strike, ten orders of magnitude higher than the 10^{-4} $Pa.s^{-1}$ of the supposed horizontal static stress rates. Logically this dynamic stress cannot be horizontal; it can only be vertical, like the sudden 1g collapse of an uplifted volume of rock, the size of which determines the magnitude of an earthquake, since the energy required to disturb the mechanical equilibrium per mass and time unit is constant, $\sim 2\times10^{6}$ $J.kg^{-1}$, or 1 $kg\times(\sim 1.4$ $km.s^{-1})^{2}$. In the case of free-fall then the mass quantum necessary to disturb the mechanical equilibrium of 1 kg of rock could be $\sim 2\times10^{6}$ kg, or ~700 m^{3} of rock that falls from ~5 cm height and hits the ground at an impact velocity of 1 $m.s^{-1}$. In that context various combinations of mass and of free-fall height and subsequent impact speed are possible. For example a 7 km column falling from a height of ~4.5 mm at an impact speed ~0.3 $m.s^{-1}$, whereas at 35 km depth only about 1 mm of uplift and subsequent free-fall and impact speed of ~0.14 $m.s^{-1}$, is sufficient and necessary to provide the 2×10^{6} Joules necessary to negate gravity, and generate a unit magnitude earthquake in MKS.

This solution is in compliance with observation, experiment and logic, and so is considered as the right one. The question is: How this great volume of rock is uplifted and then suddenly collapses; or, how the nucleation process, i.e., the concentration of energy in space and time, occurs? In the following lines we will try to answer these fundamental questions.

In conventional theorizations strain rates, of the order of 10^{-14} s^{-1} are considered, at least partially, as elastic deformation; while a 10^{-4} s^{-1} slip is considered as inelastic deformation (**Fig. 6 A**). But, both creep and slip are inelastic and irreversible deformations, products and explanation of the effect of micro- and macro-cracking, that reduces rigidity and strength, increases the shear compliance, and results to the removal of elastic strain energy from a rock block system (**Fig. 5 D**).

A dynamic stress is represented by an orthogonal triangle, which in the equilibrium maximum potential energy position is an isosceles orthogonal triangle, with a 45^{0} slope (**Fig. 6 B**). The one orthogonal side, parallel to the ideal solid axis, represents compression, the other, parallel to the ideal fluid axis, extension, whereas the hypotenuse is the v_{max} constant for that particular medium, which for rocks is of the order of 10^{3} to 10^{4} $m.s^{-1}$. The terms velocity and its temporal integration displacement, as well as strain rate and stain that are the spatial derivations of velocity and displacement, respectively, are used interchangeably to denote deformation.

In elasticity the displacement per unit mass-rock block is scale invariant, i.e., constant, and what makes the difference in magnitude is the size of the volume which is being displaced-deformed. The physical meaning of that being that at the focal point of an earthquake, and in the absence of any losses, the seismic acceleration should be equal to 1 g, and if there is rupture the displacement should be on the order of 10 meters, which is the displacement in one second of 1 kg of mass once its inertial resistance has been instantly neutralized; in both cases regardless of magnitude.

In analogy to the 100^{o}C of boiling water regardless of quantity, the non-dependence of seismic acceleration on magnitude at the epicentral area is verified by observation, especially for strong earthquakes, where due to the greater active volume-surface area the probability is greater for an accelerometer to be located just above the earthquake focus, so that any attenuation effects are minimized. For example repeated measurements show that the peak ground acceleration — PGA for earthquakes with magnitudes from 6.5 to 8.5 that vary in the released seismic energy by a factor of 1000, is ~0.7g *[Seed and Idriss, 1982]*, in compliance with the fundamental principle that elasticity is scale invariant, and each elastic unit contains a constant quantum of tensional elastic potential.

Similarly the so-called magnitude saturation for earthquakes greater than about 6.5 is indicative of quantization, i.e., energy released per unit mass, and instrumental proximity to an earthquake's location. In random sampling the probability to place a thermometer in a little pot of boiling water is smaller than in a bigger one. But in both cases the temperature of the boiling water is 100^{0} C. With this hard fact at hand we can make the safe assessment that if we could have an accelerometer just above the focus of a magnitude 0 standard earthquake the PGA will be same as that of a M8 shock.

If the Burridge-Knopoff *[Burridge-Knopoff 1967]* spring-block model, whereby a fault can be represented by a network of blocks and springs, is correct then the amount of displacement experienced by a fault block should be the same whether the earthquake involves one block, i.e., magnitude 0 earthquake, or 100,000,000 blocks, i.e., magnitude 8 earthquake *[Winslow,*

1998]. But, observation shows that the tens of meters elastic slip from a M8 earthquake, with a supposed fault area on the order of 10^8 m^2, and from a M0 earthquake with a fault area on the order of 1 m^2, has never been observed *[Kanamori and Brodsky 2001; Sornette 1999]*. So, the primary 'seismic' fault is imaginary, as the regional static stress is, and in all cases it is out of any, even imaginary, consideration for the magnitude 0 earthquake.

Faulting cannot be considered as a free-fall process at 1g acceleration that can cause an earthquake, because the only way for a free-fall inside the Earth to cause an earthquake is through a pre-seismic downward motion of a rock block at the ~10 $m.s^{-2}$ constant 1g acceleration. Aftershock vertical motions of a rock block through normal or reverse faulting, at the very slow rates of 10^{-4} s^{-1}, or even much slower, do not satisfy both the pre-shock and the fast rate requirements. More so horizontal transverse motion cannot be considered as a pre-seismic 1g free-fall. The only way to have a 1g acceleration free-fall is through the sudden drop from a height of a rock block, that takes place in 'void' space, i.e., dynamic stress, since static stress is like standing on the ground, whereby the gravitational acceleration is counteracted by the normal force from the ground, is an examples of an object **not** in free-fall. Otherwise put in a quantized model, as the Burridge-Knopoff model is, in order for the deformation to be lossless, i.e., adiabatic, the strain rate and therefore the stress rate, i.e., gravitational acceleration as in free-fall, has to be equal to the inertial resistance of the rock, expressed by the inertial deceleration. In both cases this is ~10 $m.s^{-2}$.

Also as it was shown experimentally with projectile impacts by Freund *[Freund 2002, 2003]*, at 1.45 $km.s^{-1}$ impact velocity P and S waves propagating at ~6 and 3.4 $km.s^{-1}$, respectively, were generated that soon faded away within 0.2 *m*s after impact. At 4.45 $km.s^{-1}$ impact velocity fissures began to form 2 *m*s after impact, i.e., ten times later in time after the seismic waves faded away, and at 5.64 $km.s^{-1}$ the block ruptured into three segments along the formerly formed fissures. Thus the dynamic stress had two effects; a primary and a secondary. The primary is mandatory and co-seismic, and refers to the transient elastic response of an otherwise non-elastic rock block, and the generation of seismic waves. The secondary is possible and post-seismic, and involves inelastic slip and the generation of a fault, and occurs there and when the rock's strength threshold has been exceeded. In that context there is no cause and effect relationship between faults and earthquakes; no static stress increase or decrease, due to stress transfer, as in **Figure 6 A**. The earthquake mechanics and the rupture mechanics are the mechanics of the continuous i.e., high strength-low shear compliance solid media, and of the discontinuous i.e., low strength-high shear compliance solid media, respectively. In other words earthquakes and faults are two opposite processes, elastic and inelastic, respectively, that can have a common cause, the sufficient dynamic stress, and occasionally can broadly concur in space and time (**Fig. 6 B**), thus giving the false impression of their causal relationship.

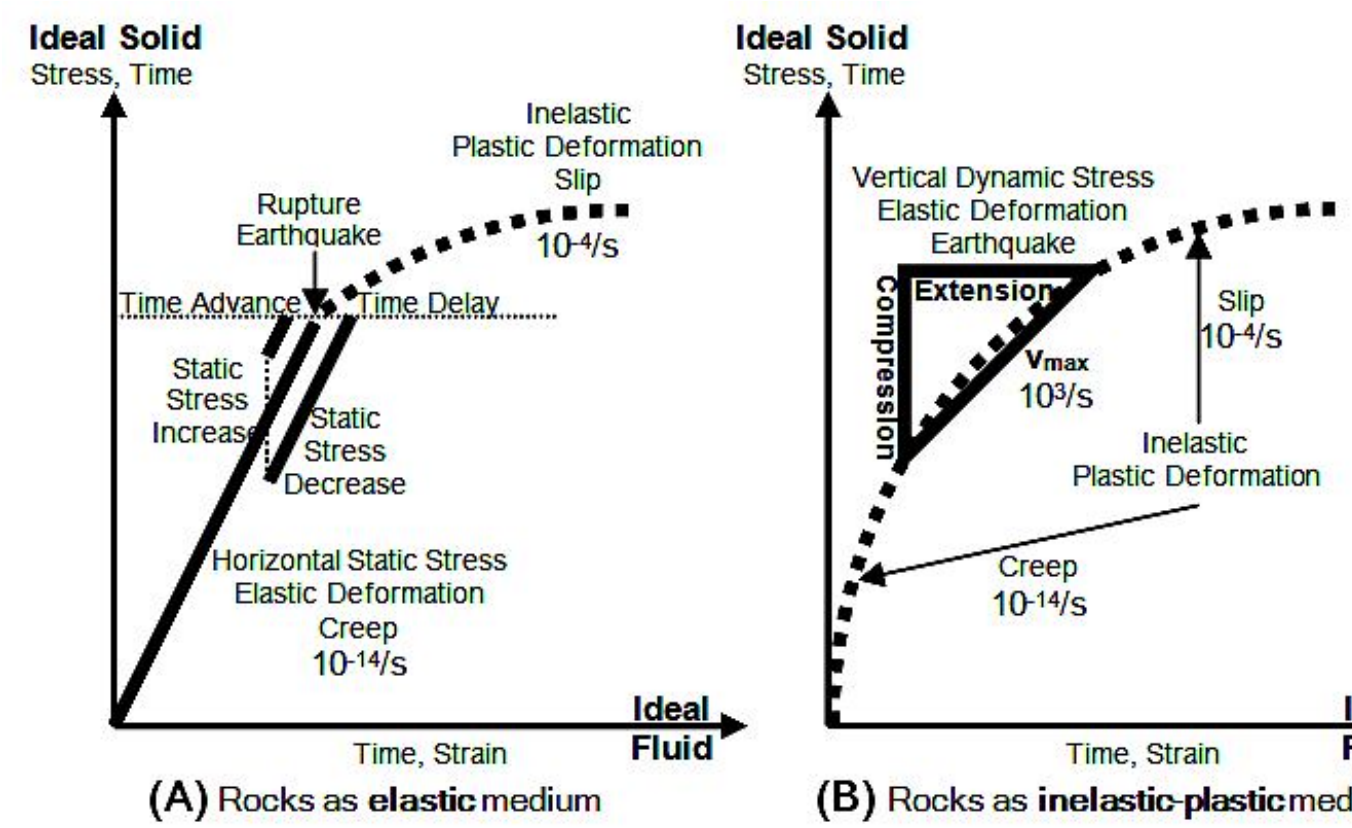


Figure 6. Earthquake generation in an elastic (**A**), or inelastic-plastic medium (**B**).

Thus the transient elastic response during an earthquake is a proved fact, but observation and experiment fail to establish a cause and effect relationship between a fault rupture and the transient elastic response. Consequently the Burridge-Knopoff model and the empirical Gutenberg-Richter relationship $logN = a - bM$, where N the number of earthquakes of magnitude M, and a and b constants, cannot be used to relate the supposed fracture length and the energy released, as well as static stress transfer to trigger earthquakes, because they fail to model elasticity with rupture.

The b-value which is typically equal to 1.0, implying scale invariant linearity and absolute elasticity within the apparently non-linear power-law, but which actually is the expression of linearity in two dimensions, during earthquake swarms can become as high as 2.5 indicating a large number of small earthquakes relative to large ones. A b-value significantly different from 1.0 suggests a problem with the space and time scale of the data set, indicating that the data set does not refer to the space and time scale that corresponds to the b=1 value. In other words the scale invariant $b = 1$ value, or the 45^0 slope of an isosceles right triangle, corresponds to perfect linearity-perfect elasticity, and to the dynamic equilibrium state between com-

pression and extension (**Fig. 6 B**), which is the maximum potential energy state. But this dynamic equilibrium state is also the critical state; it is the state at which when dropping another grain of sand onto a sandpile may cause the entire pile to collapse in a massive slide-avalanche, as in self-organized criticality — SOC *[Bak et.al. 1987]*. Bak et al. argued that when a spatially extended system with many degrees of freedom is driven away from equilibrium by an external force, the stationary state is a state with power law spatial correlation. It will spontaneously evolve to such a 'critical state' that lacks a characteristic length and time. Thus SOC and the 1/f noise power spectrum, is the expression of the wave function.

An ideal solid can be considered as an absolutely rigid medium with infinite mass-amplitude, or as an absolutely elastic medium with infinite energy-frequency, tending due to extension to zero amplitude-zero mass. In a waving medium these two opposite states must co-exist, but the infinite mass state as an actuality and the zero mass state as a potentiality. A zero mass state cannot actually exist, because waves and energy without inertia-mass cannot exist. On the other hand an ideal fluid is perceived as a medium without inertial resistance-mass. But, in actuality the 'massless' state is the equilibrium state between the inertial and the elasticity forces in a material continuum. Any continuous medium the inertial resistance of which has been balanced can wave, i.e., behave both as an ideal fluid and an ideal solid for as long as the force that neutralizes its mass-inertia acts on it.

The viscosities and the relaxation times of real solids, like rocks, are of the order of 10^{20} Pa.s and 10^{10} s and higher, respectively, implying a rigidity in the time unit of $\geq 10^{20}$ Pa, and a dynamic density of the order of 10^{12} kg.m^{-3}. In a primarily plastic medium, that is a medium which is much closer to an ideal solid, the elastic response and the generation of an earthquake requires a force capable to exceeding the resistance of its mass to move from its rest equilibrium position. A rock block will respond as an elastic medium for as long as this force acts upon it. If this is a non-recurring dynamic stress this lossless elastic response is limited to the first cycle, and is observed in many seismograms, implying an implosive stress rate in the range of seconds.

In a quantized Earth this fundamental requirement of exceeding the inertial resistance is expressed by the seismic moment, a measure of total energy involved in an earthquake, which unless is provided concentrated in space and time, an earthquake cannot occur; the same way unless the latent heat is provided concentrated in space and time boiling cannot occur. On the average the conventional estimate of this energy is about 2×10^4 times greater than the elastic energy released as seismic waves. In actuality, and taking into consideration the $\sim2\times10^6$ J.kg^{-1} of latent energy it should be $\sim2\times10^6$ times greater, but this is not the real issue. In all cases, even if we take the conventional 2×10^4, the present annual global energy-power requirements are orders of magnitude greater than the $\sim2\times10^{18}$ J of seismic energy released annually that amounts to a magnitude 9 earthquake; they are at least $\sim4\times10^{22}$ J.yr^{-1}, or $\sim10^{15}$ W.

Finally if the elastic rebound proposition was correct, then most, if not all seismic energy should be released along a fault. But, observation shows that almost always the maximum intensity area does not coincide with the fractured area, if any, and there are numerous examples of buildings along both sides of the San Andreas and the North Anatolian Faults that suffered no damage. Also the thousand of kilometres long faults in the Pacific basin are almost earthquake free. Moreover it was not the movement along the fault produced by the underground thermonuclear test on January 19, 1968, in Central Nevada, the cause of seismic waves; it was the nuclear explosion itself *[Bolt 1976]*. The above explain why a 'seismic' fault has never been observed *[Kanamori and Brodsky 2001; Sornette 1999]* and earthquakes, especially the big ones, do not spatially relate to faults.

The Organic Origin of Hydrocarbons

Chemically, coal, oil, and gas are a complex mixture of hydrocarbons, mostly alkanes of various lengths, with no two deposits chemically identical. Naturally occurring methane gas, CH_4, represents the simplest possible alkane and parent molecule. Longer chains, in the range of C_5H_{12} to $C_{18}H_{38}$, are the liquid petroleum form, and the longest, but hydrogen deficient form is the solid coal or anthracite. Hydrocarbons frequently contain other elements such as sulfur, oxygen, and nitrogen. The sulfur content in some cases can reach very high concentrations.

Traditionally coal, oil and gas, are considered to be biogenic in their origin. Coal and gas are thought to originate from the organic matter of dead plants (ferns, trees, grasses and phytoplankton), and oil from dead animal matter (mainly zooplankton). In this context the plants and animals from which fossil fuels were formed, lived and died 300-400 m.y.a. in primordial swamps for coal and gas, and oceans for oil, where stagnant water prevented the oxidation and total decomposition of organic matter. Assuming prevailing anoxic conditions and a depositional basin setting it is then thought that continual deposition and subsequent burial provided pressure and exposed the confined organic matter to high temperatures. The theorization is that terrestrial plant material on the bottom of swamps was compacted into peat, and finally into anthracite by compaction to 10% of the original volume of the peat, and heating to $\sim200^oC$. Bacteria attacked the cellulose in the plant and phytoplankton cell walls leading to significant biodegradation and producing methane gas. Finally many seas are thought to have receded and left dry land with coal, oil and gas buried underneath it.

This section of the publication describes the contradictions of the organic origin of hydrocarbons. In a later section we will show how an inorganic origin of coal, petroleum and gas in the context of a solid, quantified, radiating and growing earth may be explained.

- ***The accumulation, preservation and transformation of organic matter:*** In conventional terms, abundant supply of organic matter, rapid accumulation of both coarse grained and fine grained sediments to reserve oil and gas

and block their escape, and anoxic conditions to prevent the oxidation of organic matter are the four fundamental requirements that favor the accumulation and preservation of organic matter and its transformation into oil and gas. But the abundant supply of organic matter as well as the supply of sand require near shore and well oxygenated turbulent waters. In turn, the fine grained sediments and the anoxic conditions required to prevent decomposition are typical of stagnant and/or deep waters that exclude abundant life.

- ***The sedimentary sequence and tectonic setting:*** Conventionally the sediment and tectonic setting sequence is the following: first, fine-grained material into which organic matter is adsorbed in a shallow setting, i.e., lagoon, or swamp, to form the source rock. Second, coarse grained sediments to serve as the pressure load for coal and as the reservoir for oil and gas, in a sufficiently deep but near shore environment, and, finally on the top of the source and reservoir rock and in an offshore setting, clay material lithified to shale to serve as sealant. There is nothing that can be confidently said about the sediment source and tectonic associations in all three stages, but it is the last stage that presents the greatest degree of uncertainty. The formation of shale requires high temperatures and/or pressures; but these conditions are incompatible with it being offshore and on the top.
- ***Pressure:*** In the conventional context for the formation of anthracite a temperature of the order of 200°C, ten times higher than the estimated temperature for the formation of peat, and a pressure of $>10^8$ Pa are required. Physically, pressures of this magnitude require more than 7 km of overlying sediment. Given that the volume of the compressed peat to form anthracite is 10% of the volume of uncompressed peat if the temperature is kept at 20°C, the required pressure then has to be one order of magnitude higher, i.e., $>10^9$ Pa, or >70 km of overlying rock. In both cases, but more so in the 70 km case, the sediment source needs to be identified.
- ***Temperature:*** The incompressibility of the crustal basement rock, e.g., granite, is of the order of 10^{10} to 10^{11} Pa and that of sandstone $\sim10^{10}$ Pa. Thus the 10^8 to 10^9 Pa of the overburden weight cannot result to a yield and subsidence of the loaded basement and to a subsequent burial and exposure to higher temperatures of the compressed peat. Provided a sediment source and the proper tectonic setting exist i.e. fault throw of >10 km, adding sediments on the surface of the Earth increases altitude and decreases depths of the loaded areas. But, the relative position, and therefore the temperature of the sediment–basement rock interface is the same as before the emplacement of the sediment, since this interface did not sink to a greater depth relative to proximal unloaded areas. Moreover it is thought that periods of mass volcanism existed after the initial dispersal of Pangaea. This mass volcanism would destroy any reserved organic matter at the continental margins.
- ***Sulfur:*** Petroleum is a complex mixture of many hydrocarbons, primary of the alkane group, the general composition of which is C 83-87%, H 11-15%, and traces of Oxygen, Nitrogen, and Sulfur *[Levorsen 1967]*. The Sulfur content, either as free S, and/or H_2S, and/or as S compounds, like thiols/mercaptans, in petroleum is on the average ~1.5 (0.1—5.5) wt%, and it can be more than 31%. In coal is higher, av. ~1.7 wt%, and in the Illinois coal is >3 wt%. In natural gases is usually lower, traces to 0.2 wt%, and gas is considered sour if the H_2S content exceeds 5.7 milligrams per m^3 of natural gas (~0.0007 wt%), but in some cases, e.g., Texas, Arkansas, and Wyoming, the H_2S content of gases can be as high as 42.4%. On the other hand the composition of organic matter is: C 52—71%, H 5—10%, O 5—20%, N 4—6%, and no Sulfur *[Levorsen 1967]*. Also the total C content in the C-rich shales of Central India is up to 6.44%, whereas that of S is 16.5% *[Banerjee et. al. 2006]*. Thus the Sulfur found in oil and which is thought to originate in the Earth's core *[Murthy and Hall 1970]*, cannot be of organic origin.
- ***Helium and Trace elements:*** The inert gas He as well as metals like Ni and V and trace-elements like Zn, Pb, Cu, Cd, Cr, Co, As, Sb, Te, Hg, Au, Ag that are found to associate with oil cannot be of organic origin. Furthermore the metals and trace elements are typical of mantle rocks, like dunite/peridotite and serpentinites *[Gold 1993; Szatmari et. al. 2005]*.
- ***Carbonaceous chondrites:*** Carbonaceous chondrites, thought to be a type of meteorites that never melted or even heated above 50 °C, are mostly small, black, friable, very low density and high porosity rocks. Visually they are almost indistinguishable from kerogen or coal. They contain amino acids and polycyclic aromatic hydrocarbons, a class of very stable hydrocarbon compounds with multiple benzene rings, typical of asphalts, fuels, oils, and greases.
- ***Bitumen nodules in Archean rocks:*** Bitumen nodules preserved, for example in sandstones from the ~3.5 Ga old Pilbara Craton, Australia, are thought to have formed in situ around uraninite from kerogenous sediments, due to radiogenic heating *[Buick et al. 1998]*. But, the lack of oxygen and the absence of extensive sedimentation during the Archean do not favour the production of organic matter, and its burial and preservation, and give merit to the inorganic origin of these nodules.
- ***Depth of oil and gas discoveries:*** Almost all oil giants are found between 1 and 2 km; shallower than the ~3 km of the gas giants. If the force is from above and given the greater mobility of gas, the order should be opposite. Oil should be found at greater depths and gas closer to the surface. The greater depth gas is found is a consequence of higher temperatures at depths where microcracks-resonant cavities and electrons radiating at thermal frequencies coexist.
- ***Dissolved to particulate Carbon ratio:*** In mangrove and seagrass systems in Gazi Bay, Kenya, the ratio of dissolved organic carbon (DOC) to particulate organic carbon (POC) is between 3 and 15, i.e., the DOC is 65 to 95% of

total organic carbon *[Bouillon et.al. 2007]*. The direct implication is that the carbon dissolved in water could very well be of inorganic origin, and if it is of organic origin is excluded from the oil transformation process.

- ***Lack of biodegradation:*** Despite all expectations, oil found in Barents Sea in a depth as shallow as ~1000 m was not biodegraded. Since biodegradation, the process by which organic matter is broken down, aerobically or anaerobically, by micro-organisms is not observed in the Barents Sea, the great gas reserves in the area cannot be attributed to the action of methanogenic bacteria. Therefore, we can with good reason argue that the generating mechanism for oil and gas is common, and biodegradation does not play any major role in their formation processes.

Z ∞ Space

Z ∞ Space *[Tassos and Ford 2005a—c]* re-examines cosmology, astronomy, relativity, quantum mechanics, particle physics and geology upon the fundamental principle that infinity is the ultimate material actuality. In that context zero, vacuum, or empty space are nonexistent as physical entities. Space is the infinite source of all mass, accounts for the repelling 'dark-energy' and the contracting 'dark-matter', and becomes measurable as 'energy'— traveling, actually unpaired standing waves, and 'matter'— paired standing waves, i.e., waving space itself at the scale invariant constant of 299792458 $m.s^{-1}$. A zero mass state cannot physically exist, because waves and energy without inertia-mass cannot exist. The 'massless' state is the scalar equilibrium state between the inertial and the elasticity forces in a waving material infinite continuum. Due to its uninterrupted continuity the inertial resistance of Z ∞ space is constantly balanced by its extension and oscillates constantly at light speed, c. All other media included in, and made of Z ∞ space wave for as long as the force that counteracts their mass-inertia acts on them and at v_{max} speeds lower than c.

Energy and matter are sine waveforms of local anisotropy in the elastic, large-scale isotropic continuum, which is lossless and has infinite elasticity to any energy input up to any velocity lower than light speed, c, and infinite rigidity at velocities equal or greater than c. Gravity is tension and its inverse quantity is 'mass'-space density. All wave-particles contain a constant quantum of tensional elastic potential, irrespective of wavelength, as per $E = hf$ (**Fig. 7**). The implication is that a frequency increase due to tension will result, proportionally to the frequency increase, to more waves in the same absolute space; thus greater mass and energy density with time. In that context a 10^{25} m wave can be analyzed, for example into 10^{40} waves of 10^{-15} m wavelength and appear to be 10^{40} times further away, or to travel 10^{40} times faster; thus the apparent greater than c, or even infinite speed since each wave, in compliance with the Fourier analysis, can be analysed into an infinite number of higher frequency sine waves.

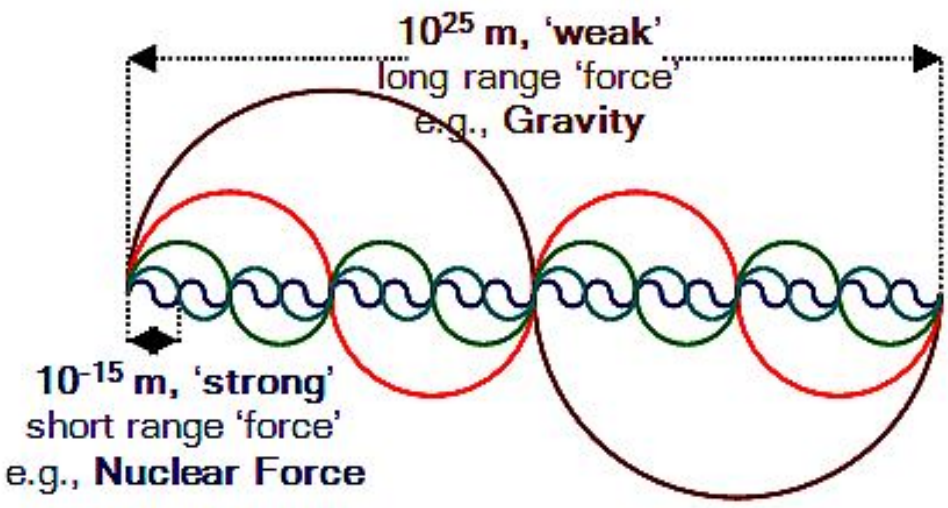


Figure 7. A simple sinusoidal wave of cosmic dimensions, e.g., 10^{25} m, gravity, and a simple sinusoidal wave of nuclear dimensions, e.g., 10^{-15} m, nuclear force, have exactly the same quantum of matter and energy, i.e., carry the same information. Gravity is tension and its inverse quantity is 'mass'-space density, i.e., in the same absolute space there are proportionally to the frequency increase more waves. In that context a 10^{25} m wave can be analyzed into 10^{40} waves of 10^{-15} m wavelength and appear to be 10^{40} times further away, or to travel 10^{40} times faster.

In material infinity the circular motion is the synthesis, a scalar quantity that represents the unity of linear motion, in opposite directions and at right angles, of the vector quantities of extension and compaction. It is produced when a standing wave-quantum of matter is reflected without loss between two absolutely rigid surfaces of a layer, the thickness of which gets smaller with time, but it is always greater than zero (**Fig. 8**). This is a self-sustained process because the cyclic (extension-compaction) component is coupled with a unidirectional extension component, which results to higher frequency over time, and it means that the 1 is divided into smaller parts the size of which is inversely proportional to the number of parts in which is divided, i.e., the two variables are related in a linear manner, so that there is a constant ratio between the two quantities; the light speed, c.

Constant speed and absolute elasticity that is coupled with absolute rigidity can be represented, in the context of the Snell's Law, by two parallel interfaces that never join in one, and separate in three parts a medium, so that the 'internal' space has the same speed and refraction index, $v_1 = v_2 = 1$, $n_1 = n_2 = 1$, and $v_1/v_2 = n_2/n_1 = 1$, with that of the 'external' space. The physical meaning is that in an isotropic medium when its deformation rate reaches its maximum possible value in any direction, it is like it is separated by two parallel and absolutely rigid interfaces, so that in the in between 'internal' space, the physical properties of which, i.e., speed and refraction index, are the same with them of the 'external' space, you get 'total internal reflection and refraction'. So, a ray, and hence a wave, does not cross the interface, as shown by the three small yellow arrows in **Figure 8 A**.

This means that the three yellow arrows represent 'total internal reflection', or change in the direction of motion by 180^0, and 'total internal refraction', or change in the direction of motion by $+90^0$ and -90^0, which is equivalent to the 180^0 straight

angle of 'total internal reflection'. The interfaces, and any point between them, interchangeably act as a source and as a receiver, or, as an absolutely elastic and as an absolutely rigid surface, respectively, so that a ray-wave emitted half way between the interfaces and travelling normal to them, when it 'hits' at v_{max} the interfaces will undergo 'total internal reflection' and 'total internal refraction'. The physical implication of this is that a ray-wave can travel in between and along, but not across them. In 'total internal reflection' the sine of the 0^0 angle of incidence equals that of the 180^0 angle of lossless reflection, and in 'total internal refraction' the critical angle, the arc of sine 1, is 90^0, and so is the sum of incidence and refraction angles measured from the normal to the interface (**Fig. 8 A**).

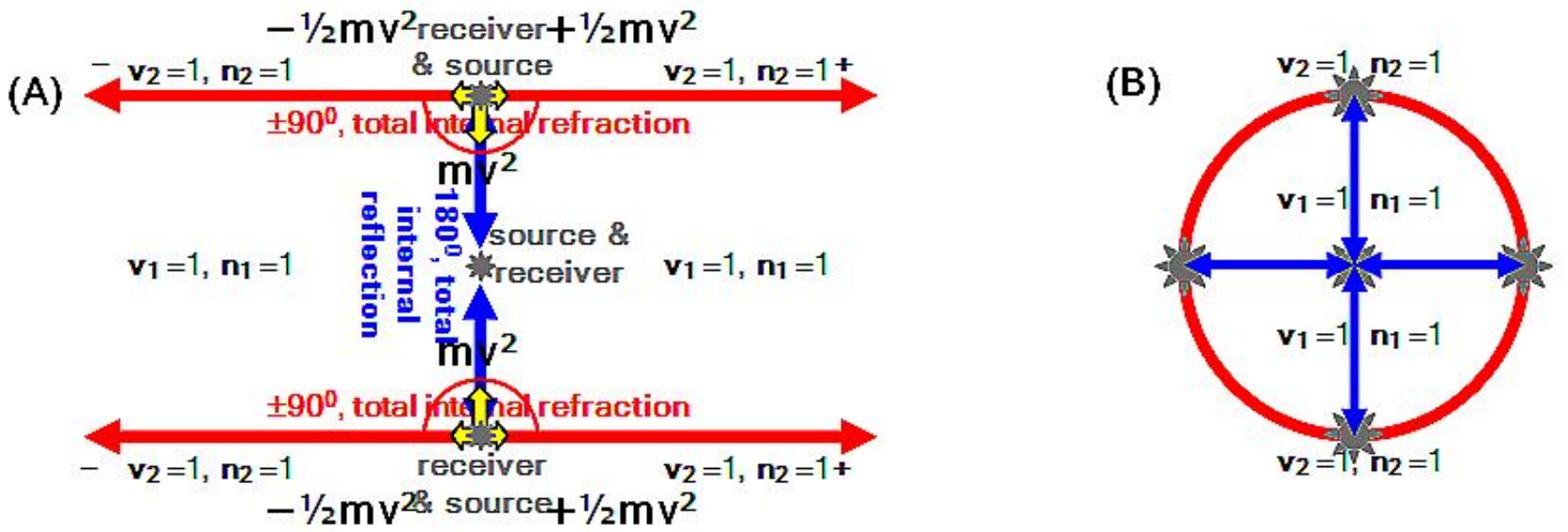


Figure 8. Absolute elasticity that is coupled with absolute rigidity can be represented in any direction by two parallel interfaces that separate in three parts (above, in between, and below the two parallels) an isotropic medium so that $v_1/v_2 = n_2/n_1 = 1$. A ray-wave originating from any point half way between the interfaces, acting as a source and receiver and travelling normal to them, when it hits the interface, now acting as an absolutely rigid surface, but also as a receiver and source will undergo 'total internal reflection' by changing direction of motion by 180^0. At the same time, as shown by the three small yellow arrows, it will undergo 'total internal refraction' by changing direction of motion by $+90^0$ and -90^0, which is equivalent to the 180^0 straight angle of 'total internal reflection', so that it will act as a source emitting rays-waves travelling in opposite directions along the interfaces and in a direction normal to it (**A**). Since we are referring to any direction the limit is the circle, and the source and receiver is its centre and any point on its circumference (**B**).

Since we are referring to any direction the limit is the circle, the source and receiver is its centre and any point on its circumference (**Fig. 8 B**), whereas the plus and the minus refer to opposite directions and the 'halving' process of 'total internal refraction', so that the absolute value sum of $|+½mv^2|$ and $|-½mv^2|$, or $|+1|$ and $|-1|$, is mv^2 and not zero. In that context the 'total' refers to the lossless, the zero is non-existent as a physical quantity, and it refers to the change in the direction of motion point of the 'total internal reflection', that conventionally represents the 'excited' state, whereby the scalar potential energy mv^2 has its maximum of 2. The potential energy at the equilibrium point has the second higher, but critical value of $2^{0.5}$, and the 'low' energy state is that of 1. In fact, this is true for anyone of the two of a pair of observers, at 180^0 or 90^0 relative to each other. For the pair of the observers though acting as one entity the $2^{0.5}$ equilibrium state, is the root mean square (rms) average most probable and stable, but at the same time critical state between the interchangeable maximum 2 and the minimum 1. In fact it is the oscillation between the $|+1|$ and $|-1|$around the 'zero' (0) equilibrium point, i.e., the extra energy to go from $2^{0.5}$ to 2 is 'absorbed' in the one direction and then released in the opposite direction at the equilibrium point, and then the same happens in the opposite direction to the minimum 1, which actually is the same quantity, but in the opposite direction. In other words the supposed $(+1) + (-1) = 0$ of conventional thinking actually is 2, as per $|+1|+|-1|=2$.

In conventional terms the $½mv^2$ quantity is considered as kinetic energy and the Bh as potential energy, but in the free-fall condition are quantitatively equal, which means that $mv^2 = 2Bh$. Thus this 1:2 relationship-equivalence is due to the fact that the equilibrium state involving a quantum, i.e., 1, is together multiplicative and additive. In other words the 'total internal reflection' and 'total internal refraction' being simultaneously multiplicative (1×1) and additive $(1 + 1)$, require actual continuity and apparent discreteness, the product 1 representing the 'total internal reflection', a paired standing wave and matter, as per the $2^{0.5}$ long semi-axis, and $2^{0.5}/2$ short semi-axis ellipse, which in absolute scale invariant elasticity is mandatory, and develops due to compression or extension. The area of the 2:1 ellipse is the sum of the areas of the 2 smaller with $2^{0.5}/2$ radius circles, and is also equal to the area of a radius 1 circle. Thus the sum 2 of the additive process $(1 + 1)$ is the mathematical expression of the 'total internal refraction', of a couple of unpaired standing waves and of energy, which is quantitatively equal to the 'total internal reflection' (1×1), of a paired standing wave and of matter; thus and the absolute equivalence of matter and energy.

This equivalence, at the equilibrium average state, can be expressed either as the waving of half of the mass at a constant speed, e.g.,

$$mv^2 = |+(½m)v^2| + |-(½m)v^2|$$

or, of the same amount of mass waving at $1/2^{0.5}$ speed, e.g.,

$$mv^2 = |+m(v/2^{0.5})^2| + |-m(v/2^{0.5})^2|.$$

The first solution could be possible if mass existed in discrete entities-particles, whereas the second one is obligatory if space-mass is a continuum. Observation appears to confirm both, but actually only continuity. In relativity, or in 'free' space, or in our $Z\infty$ space, the discreteness option appears to occur, since all waves regardless of mass-wavelength wave at the light speed constant of $c = 299792458\ m.s^{-1}$. This happens because space being a material continuum, i.e., with mass-inertia, otherwise it could not wave, is at the same time quantized, and the quantum could be characterized as the quantification of quality, and the physical expression of an absolutely closed, or strictly defined, for an external observer, and at the same time of an absolutely open, within its boundaries (internal observer), system. Thus the apparently discrete particles when the stress is recurrent, i.e., the inertial resistance-compression is constantly balanced by the gravitational acceleration-extension, which is only possible if space-mass exhibits continuity and absolute elasticity for speeds lower than c, and absolute rigidity for speeds equal or greater than c.

In the case of a non-recurrent stress as in an earthquake the unity and the apparent discreteness appear at the epicentral point, in the vertical component, the P waves and the 'total internal reflection' the former, in the horizontal components, the S waves and the 'total internal refraction' the latter. In all cases the 6 $km.s^{-1}$ of P waves, the ~4.2 $km.s^{-1}$ of S waves, and the 3 $km.s^{-1}$ for the surface waves, confirm continuity and the $1/2^{0.5}$ reduction. Continuity also explains dispersion, attenuation, the clockwise and the anti-clockwise spiraling at an ever decreasing step, which tends but never becomes zero, i.e., no motion, but fades away into the space's background noise. Movement in any direction being a wave, is equivalent to two normal to each other coordinates, the one representing compression and the other extension, thus and the necessity and sufficiency of the 2D Euclidean space in an of infinite dimensions-directions space, which at each successive analysis step satisfies the

$$mv^2 = |+m[(sin\ \theta)v]^2| + |-m[(cos\ \theta)v]^2|$$

relationship, which at the equilibrium state is

$$mv^2 = |+m[(sin\ 45^0)v]^2| + |-m[(cos\ 45^0)v]^2| = |+m[(1/2^{0.5})v]^2| + |-m[(1/2^{0.5})v]^2|,$$

the plus and the minus always implying the movement of mass in opposite directions.

A line segment on a plane, an arc of a great circle on the surface of a sphere, and a fractional turn of a helix on a cylinder, is the shortest path connecting two points; in the helix the one point is not directly above the other. Similarly the triangle is the shorter path connecting three non-collinear points on a plane, and the orthogonal triangle is the shortest. The sine and cosine functions, the values of which vary between the +1 and −1 limits, the plus and the minus implying motion in opposite directions, and 0 the equilibrium as well as the change in the direction of motion point whereby the 1 limit is fully implemented, qualitatively and quantitatively describe the wave function. This means that in material infinity the wave function $sin^2\theta + cos^2\theta = 1$, whereby the square represents a scalar quantity and 2D space, is unlimited and limited at the same time, since it can have an infinite number of solutions, but up to the scalar quantity-quantum of 1, a limit which is a constant, and which is fully materialized in every pair, of infinite number, of values. In other words the wave function is a chaotic, but not an arbitrary function. The physical meaning of this is that on an infinite continuum, expressed by the tangent of 90^0, a local perturbation is transmitted with a limited and scale invariant speed, the light speed constant, expressed by the $sin\ 90^0$ or the $cos\ 0^0$, trigonometrically equal to the quantum quantity of 1, i.e., the radius of any circle-wave.

In the Cartesian coordinate system the most probable and therefore the most stable state, but at the same time the critical state, is the equilibrium and maximum tension point at 45^0 relative to the x and y axis, because the sine and the cosine of 45^0 are equal to $2^{0.5}/2$, and their sum is the greatest than the sum of the sine and cosine of any other angle. This explains why in a medium with the properties of $Z\infty$ space, i.e., waving material infinity, the circle in 2D and the sphere in 3D space is the obligatory most stable and at the same time critical state.

An object can oscillate $\pm 45^0$ around this point and externally to appear to be stable and stationary, but if the necessary energy input is provided, so that the width of the oscillation around the equilibrium point becomes $\pm 45^0+$, the apparent collapse of this state will be accompanied by a change in polarity. This is what is happening every quarter of a cycle in a waving continuum, which externally appears stable and stationary. This is also the physical meaning of the so-called self organized criticality — SOC and of the 1/f noise power spectrum *[Bak et. al. 1987]*, which is the expression of the wave function that never collapses, of continuity and of the scale invariant elasticity, which is absolutely deterministic up to the critical point $v <= v_{max}$, and uncountable beyond the critical point $v => v_{max}$, which results to higher frequency, and not to the surpass of v_{max}.

Therefore the fact that the sum of angles of any triangle always is 180^0 is nothing else than the geometrical representation of the lossless reflection, in which an object will take twice the time and travel twice the distance to return to its start point, the straight line being the shortest path. Thus a triangle inscribed in a semi-circle connecting two antipodal points, so that the circle's diameter is its hypotenuse, and any point on its half-circumference is an orthogonal triangle. The orthogonal triangle with the diameter of a semi-circle as its hypotenuse is nothing else than the expression of 'total internal reflection' and half cycle, whereas the orthogonal isosceles triangle in which the two orthogonal sides, the $sin\ 90^0$ and $cos\ 0^0$, trigonometrically equal to the scale invariant R=1 radius, represents the 'total internal refraction', and one quarter of a cycle. This is nothing else than the time and distance it will take for a ray-wave of any wavelength to be transmitted in any direction at v_{max}. This anisotropy will reach an observer as waves that propagate radially as the Rayleigh waves on the surface of water, and in concentric circles moving away from the 'source', e.g., a pebble's implosion site, which represents the 180^0 reflected ray. So the

two orthogonal sides of a triangle represent the rarefaction and compaction deformations, and the speed limit with which they are transmitted, and which, as infinity, is materialized in every single cycle, is the 299792458 $m.s^{-1}$ scale invariant constant. This is why any wave can be analyzed into an infinite number of higher frequency waves, and infinity is present in any wave as an actual physical quantity and not as a concept, as zero is.

In other words in each Fourier transformation of the power law, in which the actual value, but also the probability of measuring a particular value of some quantity varies inversely as a power of that value, e.g., sine and cosine, there is a cyclic-periodic scale-invariant frequency band over a given frequency, and a linear non-periodic transformation that refers to how frequency changes with time, as per 1/f noise, which is nothing else than the process of multiplication by division and in which the range of frequencies is unlimited. This means that unless there is a constant stretching of the space continuum and the resulting frequency increases with time, any waveform cannot be the sum of infinitely many sinusoids, nor a Fourier transformation of a power law is again a power law.

A traveling, or, unpaired standing wave (**Fig. 9 A**), refers to the vector quantities of extension and compaction, i.e., linear motion and momentum, as per $p = mc = @f = \sim 5.34 \times 10^{-28}$ $kg.m.s^{-1}$, where $f = \sim 2.418 \times 10^{14}$ and $@ = \sim 2.21 \times 10^{-42}$ kg.m, a new matter constant introduced by David Ford. It can be represented by two semi-circles displaced by one diameter, or two orthogonal triangles, which in the maximum amplitude state are isosceles. The two orthogonal sides interchangeably represent extension and compaction of time-space, whereas motion-maximum speed is represented by the hypotenuse, always equal to 2R (R is the radius of the circle, the maximum amplitude, and λ/4). The moving object actually is an oscillating quantum of matter-standing wave in an absolutely elastic continuum that accelerates from 'zero' to its maximum speed. In a traveling wave the 'zero' velocity is at 90^0 and 270^0, and occurs at the point the moving matter quantum changes direction of motion by 90^0, implying 'total internal refraction', and a polarity change by 180^0, implying 'total internal reflection'. The zero physically represents the impact points, where a change in the direction of the endless motion occurs. The v_{max} is at points 0^0, 180^0 and 360^0. In other words for all angles from 0 to 360^0 the sum of the squares of the orthogonal sides is equal to the square of the constant hypotenuse, as per $a^2 + b^2 = c^2$, or $\sin\theta^2 + \cos\theta^2 = 1$, where the 1 is the light speed constant.

A particle is a standing wave embedded in space, thus the wave-particle duality is resolved. A circle is a standing wave, and the circle's periphery can be considered as a concave mirror with an infinite number of reflective surfaces, which at the same time can act as free surfaces, whereby a ray emitted from its center once in contact with its periphery, acting as an absolutely rigid reflective surface, will undergo a lossless reflection on it and change direction by 180^0, form a pair and emit at a higher by $1 \times 2^{0.5}$ frequency, and at the same time cause two waves of lower by $1/2^{0.5}$ frequency, moving in opposite directions on the plane tangential to the circle, which is now acting as a free absolutely elastic surface (**Fig. 9 B**). This is nothing else than the pair production and photoelectric effect with the upper limit frequency, i.e., energy 'gain', and the Compton scattering with energy 'loss'-lower limit frequency, which are 90^0 out of phase, so that an observer at 45^0 to both will observe the equilibrium composite surface wave like average and equilibrium waveform with the same frequency as the 'absorbed' radiation, so that energy and momentum are conserved.

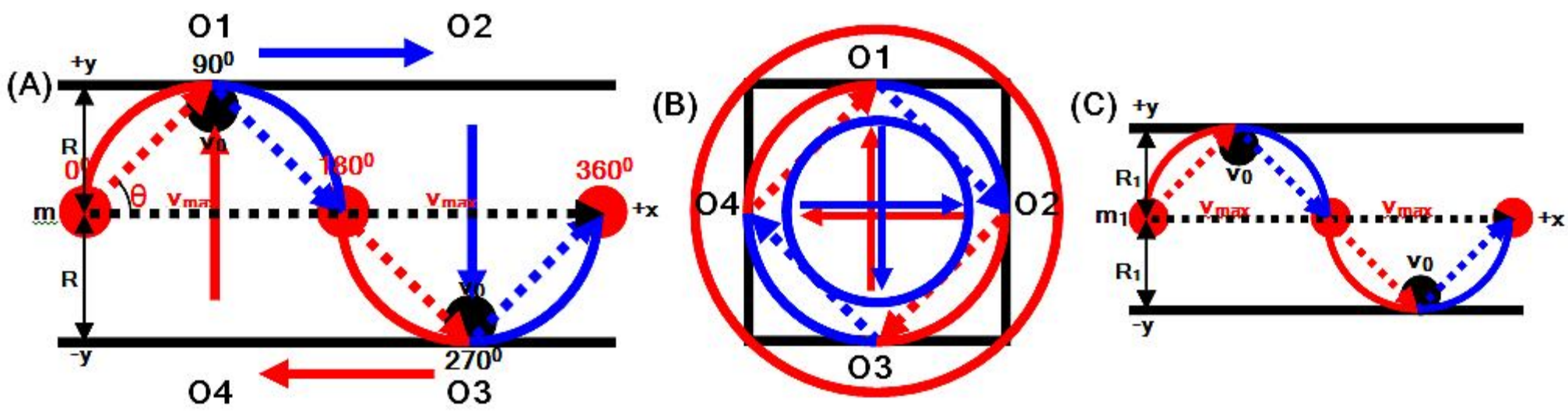


Figure 9. The ad infinitum extension constantly accelerates, as per v = a*t, the matter quantum (red and black full circles). But, due to the inability of space to wave faster than c, lossless reflection occurs and an unpaired standing or traveling wave (**A**), is formed. Any three of the four O1, O2, O3, O4 observers if taken by the two, e.g., O1—O2, and O2—O3, thus forming a right isosceles triangle, will actually observe the same relative motion, that manifests the absolute equivalence of 180^0 and 90^0, of the 'internal' dynamics of 'total internal reflection' and of the 'external' dynamics of 'total internal refraction'. The dotted line represents the direction of motion. In a traveling wave the motion appears to be linear, and in a standing wave is circular, thus the spin of apparently discrete particles. A 'particle' actually is a standing wave, an oscillating matter quantum, embedded in an absolutely elastic continuum at speeds less than v_{max}, and absolutely rigid at speeds equal or greater than v_{max}. The circle's circumference and centre represent both the v_0 or maximum potential energy equilibrium, and the v_{max} location, thus and the absolute equivalence between stationary and moving at constant speed. Any excess energy input results to the permanent formation of a pair of standing waves-matter (**B**), and to the release of an unpaired standing or traveling wave-energy (**C**), both with higher by $2^{0.5}$ frequencies, whereas v_{max} is always the c constant.

The distance traveled in the unit of time from v_0 to v_{max} is the radius of the R=1 red-blue circle, or $\sin 90^0 = 1$, which is the product and the most probable equilibrium state between $1/2^{0.5}$ (compaction) and $1 \times 2^{0.5}$ (rarefaction). At v_{max} the ray will undergo 'to-

tal internal refraction' on the concave surface of the bigger $(2^{0.5})$R red circle which is now acting as an absolutely rigid surface, and change direction of motion by 90^0 and so on ad-infinitum, forcing the ray to describe a cyclic trajectory. Thus and the coexistence of the paired standing wave, representing 'total internal reflection', the photoelectric effect, and higher by $2^{0.5}$ frequency, i.e., energy 'gain', geometrically represented by the small $(1/2^{0.5})$R blue circle, with the unpaired standing or traveling wave, representing 'total internal refraction', Compton scattering, and lower by $2^{0.5}$ frequency, i.e., energy 'loss', geometrically represented by the big $(1\times2^{0.5})$R red circle. These two states are also equivalent to compaction and rarefaction, to matter and energy, to magnetism and electricity, to P and S waves, to multiplication and division, to integration and derivation, respectively.

So, in a pure sine wave the $(2^{0.5})$R red circle represents the maximum tension and equilibrium location, since $sin\,45^0 + cos\,45^0 = 2^{0.5}$, of a quantity in one direction, or extension, whereas the $R/2^{0.5}$ blue circle the maximum tension and equilibrium value in the opposite direction, or contraction, thus and the +1 and −1 spin values, whereas the R=1 red-blue circle is the observed 'union' of the two. In other words there is a constant and interchangeable halving (1/2) and duplication (1×2) process, so that their product is always 1, and the R=1 red-blue circle, in between the big-red and the small-blue circle (**Fig. 9 B**) is nothing else than the root mean square 'effective' value.

In a material medium which is absolutely elastic for speeds lower than its maximum deformation rate v_{max}, absolutely rigid for speeds equal or greater than v_{max}, and under a constant extension rate-acceleration, i.e., $Z\infty$ space, the cyclic trajectory is obligatory at v_{max}. Otherwise if the trajectory is not cyclic it could accelerate to infinite speed. This is the only logical physical implication of the fact that in cyclic motion the constant acceleration is used not to constantly change the speed of motion, but to constantly change the direction of motion at constant speed, and this can only occur in a medium with the above mentioned properties.

Let us now take four observers in **Figure 9**; observer 1 (O1), observer 2 (O2), observer 3 (O3), and observer 4 (O4). Observer 1 (O1) from 0^0 to 90^0 will see movement towards him/her and the convex side, which now appears as 'external' of the wave surface. The same O1 from 90^0 to 180^0 will see movement away from him/her but the same 'external' convex side of the wave surface. On the contrary, and at the same time, O4 will observe the 'internal' concave surface moving in the opposite direction; away from him/her. Observer 2 (O2) located 180^0 relative to O1 will observe what it appears to him/her as the concave 'internal' surface moving away from him/her from 180^0 to 270^0, and moving towards him/her from 270^0 to 360^0. Exactly the opposite will observe the O3 observer. At 0^0, 180^0 and 360^0 all four observers will observe linear motion, whereas at 90^0 O1 and O4 will observe no motion, the same as O2 and O3 at 270^0, which are actually the points where a change in the direction of motion, or a polarity change occurs.

Thus, the fact is that the 'internal' dynamics of matter-paired standing waves, and the 'external' dynamics of energy-unpaired standing waves, the convex and the concave surface, motion towards (+) and away (−) from an observer, are absolutely equivalent, coexisting, and take place at the constant speed of 299792458 $m.s^{-1}$. Also any two pairs O1—O2 and O2—O3, and/or O2—O3 and O3—O4, and/or O3—O4 and O4—O1, located at 180^0 among themselves and at 90^0 relative to each other, as per 'total internal reflection' and 'total internal refraction', respectively, will observe the same relative motion. The direct implication of this is the absolute equivalence of 180^0 and 90^0, of 'total internal reflection' and 'total internal refraction'; of the whole and of the half. In other words this is the actual physical meaning of relativity and of the quantum; of deterministic uncertainty, i.e., the linear motion in one direction and its opposite in the local anisotropy (determinism), and of the lack of preferred direction of the cyclic motion in the infinite isotropy (uncertainty); of the constancy of the maximum deformation rate regardless of wavelength-size, expressed by the light speed and acceleration of gravity constants, the free-fall feather and elephant example.

It is self evident therefore that in 2D space a traveling, or unpaired standing wave can be considered as a closed half-space in the direction normal to the interfaces, and open in the direction parallel to them, whereas a paired standing wave as a closed half-space in both directions. A standing wave refers to rest position and circular motion. In that context the famous Einstein's and Planck's equations $E = mc^2 = hf = \sim1.6\times10^{-19}$ J, where $h = \sim6.626\times10^{-34}$ Js is Planck's constant, refer to a pair of standing waves. Thus the conventionally thought as kinetic energy, $½mv^2$, is the potential energy of an unpaired standing, or travelling wave since in 'total internal reflection and refraction', or multiplication and division, or integration and derivation, the 1 is multiplied and divided by two in both cases without violating the conservation principle, since the product of space tension and density is always 1.

In a standing wave it is not only the hypotenuse, but also the two orthogonal sides of the two smaller, with $(2^{0.5})$R hypotenuse, isosceles orthogonal triangles for each 2R hypotenuse triangle of a traveling wave, that represent motion and 'total internal reflection and refraction'. The steady-state is the continuous interchange of the cause, gravity, represented by the one orthogonal side, and the effect, inertia or anti-gravity, represented by the other orthogonal side, whereas the hypotenuse represents motion at constant speed. So the synthesis of the two opposite and equal forces results to the perpetual cyclic motion, like the dog chasing its tale. In other words motion is both the cause and the effect, so that the two equal orthogonal sides, which are $2^{0.5}/2$ if the hypotenuse is 1, also represent motion, and each becomes the hypotenuse of a smaller isosceles triangle. The process of quantized minimization represents evolution.

Every point on the circle's circumference is a v_{max} and v=0, and so is the circle's center since they interchangeably represent the start-source, and the end point-receiver of a lossless reflection path; thus and the absolute equivalence of stationary and motion at constant speed. The center of the circle actually is the maximum tension equilibrium point, a Lagrangian point. Without violating the conservation principle we have a duplication process at a higher, by $2^{0.5}$, frequency-energy, which in

constant acceleration is transient. Any excess energy input will result to an irreversible duplication, and the amplitude of the emitted traveling wave, i.e., the radius R_1 of the matching circle, to be smaller, not by any number, but by $2^{0.5}$, or $1/2^{0.5}$ = ~0.707 (**Fig. 9 C**); thus and the quantization of continuity.

Any traveling-unpaired standing wave can be considered as a composite waveform that can be analyzed in infinitely many waves of higher frequency, but also as the product of two simple sinusoidal waves, 90^0 out of phase, the one representing rarefaction and the other compaction, i.e., motion in opposite directions. The steady-state is expressed by the circle on the Euclidean plane, i.e., the relationships among distances and angles, the radius of which decreases with time, so that evolution is also expressed, is sufficient and necessary to describe this waveform. In the 3D space the sphere represents steady-state, whereas the helix with ever decreasing amplitude is the expression of the synthesis of steady-state and evolution.

Likewise the result of the interference of two similar waves in phase will be an alternating redshift-moving away from, and blueshift-moving towards an observer, which is coupled with a general shift towards the blue, i.e., towards higher frequencies, thus and the blue sky. In the 180^0 out of phase the 'destructive' interference results to the illusion of no wave emitted and of a 'black hole'. The implication is that the 2D space is sufficient and necessary to describe the wave function of any wave, be that light or seismic wave. This wave will follow a radial and normal to it path, whereas the 2D surface can act as a free surface, and/or a reflective surface, and/or a polarization plane.

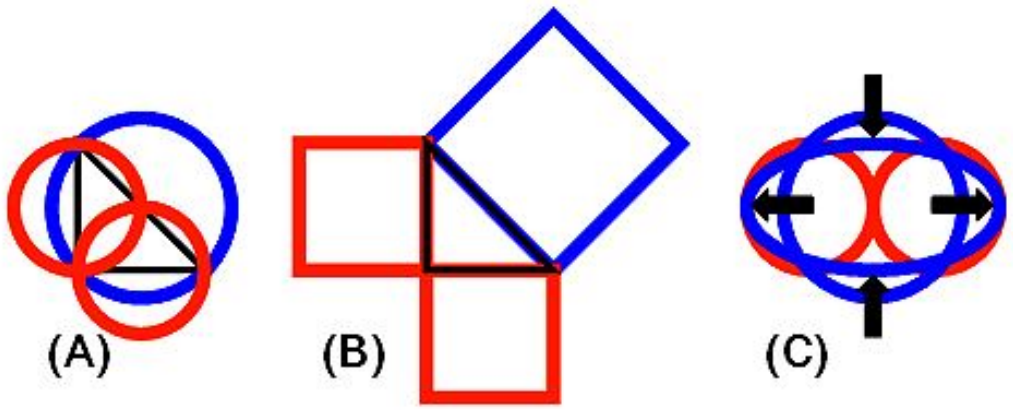


Figure 10. In perfect elasticity and equilibrium (**A**, **B**, **C**) the areas of the big blue shapes are equal to the sum of the areas of the two smaller red shapes. Under extension or compression (**C**) the R=1 circle becomes an ellipse with $2^{0.5}$ long and $1/2^{0.5} = 2^{0.5}/2$ short semi-axis, the area of which is equal to the area of the R = 1 circle, and the sum of the areas of the two $R_1 = 2^{0.5}/2$ circles. The equilibrium is at 45^0, where $\sin 45^0 = \cos 45^0 = 1/2^{0.5} = 2^{0.5}/2$ = ~0.707.

The physical meaning of the geometrical representation of absolute elasticity-rigidity at the equilibrium-'zero' state (**Fig. 10**), is that in this maximum tension state the scalar quantity of 1 is transiently and internally 'duplicated' by 'halving', as does the orthogonal parallelogram-square-isosceles triangle by its diagonal, into two equal quantities-areas that are aligned and move in opposite directions. If space is extended, e.g., by $2^{0.5}$, its mass density is reduced proportionally in the direction of extension, and in the direction normal to its extension space is compacted and its mass density is proportionally increased, by $2^{0.5}$. Thus the R = 1 circle, which also represents a traveling-unpaired standing wave, becomes a $2^{0.5}$ long semi-axis and $1/2^{0.5} = 2^{0.5}/2$ short semi-axis ellipse. The area of this 2:1 ellipse is equal to the area of the R=1 circle, and the sum of the areas of the two $2^{0.5}/2$ radius circles. The two equal masses-areas, or paired standing waves, attract each other with a force (inertial acceleration) which is exactly equal and opposite to the force (gravitational acceleration) the infinite space-mass is attracting each one forcing them to repel. As the binding energy per nucleon curve shows, if and when the excess energy to extend space to a higher frequency-energy quantum level is provided the duplication is irreversible, but after that each one of the two products appears as a 'discrete' entity, but actually is a new smaller quantum embedded in the space continuum.

In a wave absolute elasticity and absolute rigidity, rarefaction and compaction co-exist as one, the same way as in $Z\infty$ space the no-change and change states co-exist as one. Steady-state means the absolute proportionality of two quantities that represent rarefaction and compaction of space, e.g., energy and matter, or electricity and magnetism, that vary linearly so that one of the quantities is a constant multiple of the other, or equivalently they have a constant ratio, which represents the scale invariant constant speed of light, c. Evolution is change of size-scale with time, i.e., frequency increase, and the constant transformation of energy-unpaired standing waves, with apparent linear motion, into matter-paired standing waves, apparently at rest but actually in circular motion, thus and maximum potential energy state, and the magnetic moment or spin that can take either the value +1 or -1. Both steady-state and evolution are manifestations of waving material infinity. Our cosmos remains unchanged, due to its proportionality, and changes and appears to grow, by becoming smaller and more energetic and massive with time, due to its linear extension.

Following that logic there are some important and instructive implications.

1. Any ray originating from a circle's centre is reflected back without loss and returns to it.
2. Any point other than the circle's centre can become the centre of a smaller radius circle.
3. The fact that the sum of the angles of a triangle and also its hypotenuse is the straight angle of 180^0 means that the triangle is the geometrical representation of 'total internal reflection'.
4. The 90^0, or the two orthogonal sides of a triangle, represent 'total internal refraction'.
5. Any radius of a circle represents the maximum speed constant.
6. An orthogonal triangle represents a standing wave; a rectangular parallelogram union of two.
7. The right isosceles triangle, the square, the circle, and the 2:1 ellipse represent equilibrium.

8. Any right isosceles triangle can be divided into two equal right isosceles triangles the hypotenuses of which are the two orthogonal sides of the twice as big triangle.

In other words motion represented by the hypotenuse of the bigger triangle, is the cause, and extension and compression represented by its two orthogonal sides is the double and opposite effect, each of which every quarter of a cycle becomes the cause, thus and the hypotenuse in each of the two ½ triangles, then the two triangles unite in one, and the cause becomes the effect, and so on ad-infinitum. Thus the 2D circle and the 3D sphere, i.e., the waving material continuum, for an 'internal observer', by position since we cannot go out of infinity, is the manifestation of the linear 'total internal reflection and refraction', of perfect elasticity and of linear acceleration from v_0 to less than v_{max}, which is coupled with the 2D power law whereby as space dilates time contracts and vice versa, so that the sum of their squares is always 1, which 1 is the scale invariant light speed limit, c. On the contrary an 'external observer', using logic to transcend experience, sees the absolute rigidity and the cyclic motion at $v_{max} \Rightarrow c$, which is also the mean critical point equilibrium state, as well as the 'external' unidirectional and linear reciprocity in which if 1 is multiplied by *n* times distance and divided by *n* times time, i.e., a proportionally greater number of waves in the same absolute space, the product is 1, or c. So, what an observer, which is the union of the 'internal' and the 'external' observer, sees is the isotropic and quantized material infinity waving at c.

Every wave-particle can be considered as a rational number, which is a number that can be expressed as the ratio, c, of two prime number integers, a and b, and can be written in infinitely many forms, the simplest form being when a and b have no common divisors except 1, i.e., a = b = c = 1. It is therefore this common divisor and positive real number integer 1 that can be analyzed into infinitely many prime numbers-quanta that form an uncountable set of values, since a wave can be analyzed into infinitely many waves of higher frequency, and there is not an algorithm that can yield infinitely many digits. The infinitely many prime numbers-quanta are the infinite harmonic waves of higher frequency, each contributing the power spectrum of the actual wave. Thus the actual mass of the wave-particle is the integration of the infinitely many prime number-harmonic frequency modes. So decimal fractions representing rational numbers are approximations to infinity, and since infinity is the final actuality, to an actual underlying real number such as 1.

The physical meaning is that a and b are extension and compression, or the sine and cosine functions, or the two normal sides of a triangle, respectively, 1 being their materialized limit, or the radius of any circle, so and their ratio at equilibrium is again 1, the scale invariant speed of light, or the rate with which both the perfectly linear extension and compression of space are completed, and the power law is the expression of linearity in the 2D Euclidean space. Each particle-wave quantum is connected with other quanta that comprise the material space continuum, the continuity of which is never broken, and there is no 'empty' space in between. Motion is imparted from one oscillating matter quantum-standing wave to another, thus forming a traveling wave. The amplitude of a wave is a measure of its mass. Thus the amplitude of a wave with infinite mass will be infinite. In turn infinite mass also implies infinite rigidity, i.e., flatness. Reversely infinite energy requires infinite frequency which implies a state that tends to be, but never becomes, zero amplitude, i.e., zero mass.

Of the two opposite states the infinite mass expressed by the **1** is an actuality whereas the infinite energy-zero mass a potentiality, which acts as the perpetual force, that drives the process of continual linear extension of $Z\infty$ space. So, due to its infinity the space continuum is under constant linear extension, and the total tensional elastic energy (E)-potentiality of the cosmos increases proportionally counteracting entropic dissipation, whilst local space density (m)-actuality, proportionally increases, as one, due to the frequency increase, implying proportionally more waves in the same absolute space. Thus the square root of energy over mass (**2**), or rigidity over density (**3**), or tension-gravity over space density (**4**) is a constant for a particular medium.

$$c = \sqrt{\frac{Energy(E)}{Mass(m)}} = \sqrt{\frac{hf}{m}} = \sqrt{\frac{Force \times Distance}{Mass}} = \sqrt{\frac{M \times LT^{-2} \times L}{M}} = \sqrt{\frac{MLT^{-2}}{ML^{-1}}} = \sqrt{\frac{L^2}{T^2}} = \frac{L}{T} \qquad (2)$$

$$v = \sqrt{\frac{Rigidity(\mu)}{Density(\rho)}} = \sqrt{\frac{Force/Area}{Mass/Volume}} = \sqrt{\frac{M \times LT^{-2} \times L^{-2}}{M \times L^{-3}}} = \sqrt{\frac{MLT^{-2}}{ML^{-1}}} = \sqrt{\frac{L^2}{T^2}} = \frac{L}{T} \qquad (3)$$

$$v = \sqrt{\frac{Tension - Gravity}{SpaceDensity}} = \sqrt{\frac{Force}{Mass/Distance}} = \sqrt{\frac{M \times LT^{-2}}{M \times L^{-1}}} = \sqrt{\frac{L^2}{T^2}} = \frac{L}{T} \qquad (4)$$

The maximum extension a wave-matter quantum can undergo is π/2, or ~1.57, to become a straight line, and within 90^0 or $\lambda/4$ from rest (v_0) to reach v_{max}. In other words the wavelength, λ, of an R=1 circle is 4, and upon extension to become a straight line and to reach v_{max} it becomes ~6.28, i.e., 4×(π/2). Beyond this length increase there can be no wave-photon emitted, no information reaching an observer. Any further extension will result to a wave but of higher frequency. Thus the total volume of the potentially observable cosmos is limited by the constant speed of light and extension rate, conventionally in the range of 10^{-18} s^{-1}. This observable volume is the 'Optical Bubble' *[Tassos and Ford 2005c]*. Doppler redshifts within $Z\infty$ space never exceed z = ~0.57, and all higher components, e.g., the conventional 6.56, are non-Doppler, attributed to continuous linear rise in frequency of emitted photons-unpaired standing or traveling waves, from a pair of standing waves. Non-Doppler

components can be instrumentally measured and differentiated from Doppler components, via amplitude/wavelength ratios (A/W) of all photons. Thus the actual extension rate is about 11.5 times slower, of the order of 10^{-19} s^{-1}, implying an 'age' of our cosmos at least one order of magnitude greater than the supposed 13.6 billion years of the big-bang.

Hence extension is perfectly linear, and the waving material infinity is perfectly Euclidean, so that the points (a,b) satisfying $a^2 + b^2 < c^2$ located within the circle's area and outside its periphery make up an open set, or an open half space, which physically corresponds to absolute elasticity. The points (a, b) satisfying $a^2 + b^2 = c^2$, or $sin^2\theta + cos^2\theta = 1$, are located on the periphery of the circle, representing a line-hyperplane and absolute rigidity, but also the v_{max} and the v_0 locations for an object that accelerates from the circle's centre equilibrium stationary point, reaches v_{max} when it hits the circumference, where, due to the lossless reflection and change in the direction of motion by 180^0 momentarily acquires zero speed, and then accelerates again to v_{max} when it reaches the circle's centre. The 1 is the radius of any circle, or a quantum, or one of an infinite number of prime numbers, and which is a materialized physical quantity, not a concept. Hence the circle, and therefore the wave function, represents the limited and the unlimited, the chaotic but not the arbitrary, the ultimately uncertain, i.e., all directions of infinite isotropy, and the ultimately deterministic, the one direction and its opposite of local anisotropy. In that context the circle's centre represents the equilibrium second higher potential energy state, whereas its periphery its maximum potential energy state. Both can appear stationary due to equilibrium and/or change in the direction of motion point, and move at the v_{max} constant, so and the absolute equivalence of stationary and moving at constant speed, of 'internal' and 'external' dynamics. Consequently the union of the circle's area and of its periphery line represents a closed set-half space, i.e., $Z\infty$ space, or the waving at light speed infinite quantized material continuum. So the circle which is the representation of any wave is actually the manifestation and materialization of infinity, since any circle can include an infinite number of smaller radius circles, and the closed refers to the lossless motion, or to any trajectory that starts and ends at the same point, ad infinitum; the cyclic being the result of inertia, i.e., non-zero.

Excess Mass Stress Tectonics — EMST

In the context of Excess Mass Stress Tectonics — EMST *[Tassos 2003, 2007b,c; Tassos and Ford 2005a,b]* Earth is a quantified solid body, the size of which appears to increase with time at an exponential rate. About 200 m.y.a. Earth's diameter was about 60% its present size, and its whole surface was covered with granitic continental crust, representing Pangaea, with narrow and shallow epicontinental seas. The Fe-rich mantle, the also mafic oceanic crust, and the deep and wide oceans formed during the last 200 m.y. or so.

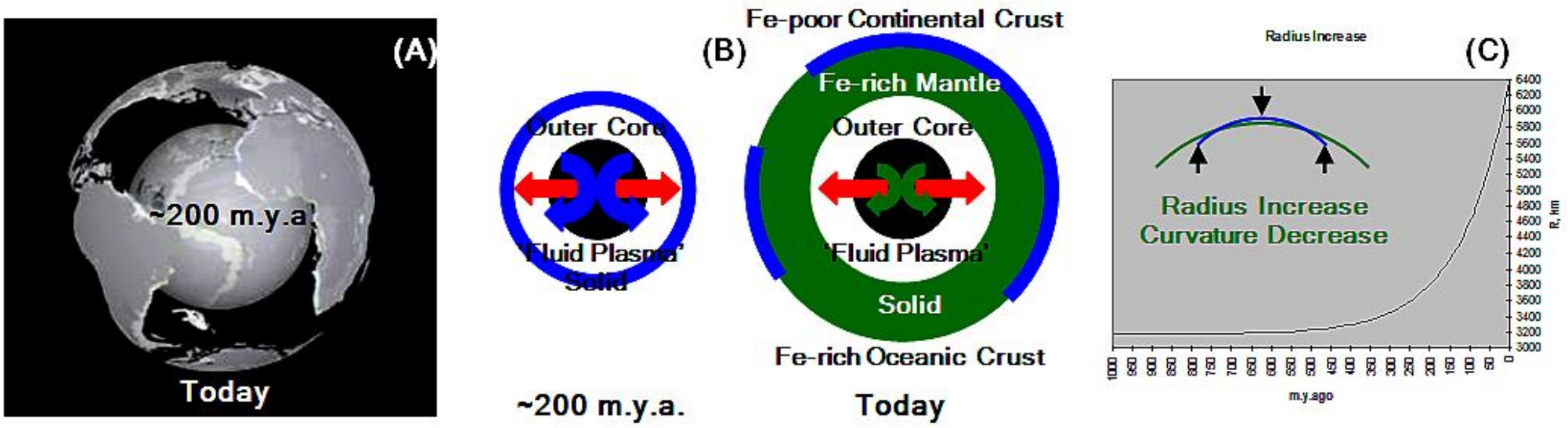


Figure 11. Based on the observable Earth's surface increase during the last 200 m.y. due to the formation of the oceanic crust-floor the Earth's cumulative radius increase is given by $R_t = R_1 + R_2e^{-rt}$, where $R_1 = 3170$ km, $R_2 = 3200$ km, t = time in m.y.a., and r = 0.0081 $(m.y.)^{-1}$ (**A**, **B**, **C**). The blue represents the pre-200 m.y.a. felsic crust, and the green the meta-200 m.y.a. mafic mantle (**B**). The rate of radius increase is $dR/dt = rR_2e^{rt}$, and is associated with a proportional curvature decrease (**C**).

As shown in **Figure 11** based on the observable Earth's surface increase during the last 200 m.y., due to the formation of the oceanic crust-floor, the Earth's cumulative radius increase is given by $R_t = R_1 + R_2e^{-rt}$, and its extension rate by $(R_{to}-R_1)/R_{to}\times t_0 = 3.46\times10^{-18}$ s^{-1}. Where $R_{to} = 6370$ km, the present radius of the Earth, $R_1 = 3170$ km, a realistic estimate of the radius of an all encompassing granitic crust Earth after all the iron rich crust has been removed, $R_2 = 3200$ km, t = m.y. ago, $t_0 = 4.6$ billion years, the conventional estimate of the Earth's age, and r = 0.0081 $(m.y.)^{-1}$. Thus the radius increase rate is $dR/dt = rR_2e^{rt}$, which means ~2.59 cm/year present rate, and is associated with a proportional curvature decrease that renders the vertical component undetectable from satellite interferometry, since ideally the relative uplift at the edges is balanced by the relative subsidence in the middle of an arc. Furthermore this radius increase and curvature decrease with time results to an apparent horizontal displacement in the very long baseline interferometry (VLBI) and satellite lazer ranging (SLR) measuraments *[Mundy 1988]*, compression and uplift at the edges, and middle arc extension, relaxation, and subsidence. The 'Excess Mass' — E.M. apparent addition rate, since there is not mass generation but the transformation of mass from energy, unpaired standing waves, into matter, paired standing waves, is $d(E.M.)/dt = mM_me^{mt}$, where $m = 0.0158$ $(m.y.)^{-1}$, and M_m the 4.08×10^{24} kg of mantle, i.e., 6.45×10^{16} $kg.yr^{-1}$ present rate of transformation of mass from energy-unpaired into matter-paired standing waves.

The binding energies of atomic electrons are in the range of eV, while of nucleons in the range of MeV, i.e., ~10^6 times greater. Thus the proton-neutron pair of the nucleus of an atom represents the maximum possible tension of space, the equilibrium state, and magnetism. The electron cloud represents the looser 'plasma' state of space where electrons accelerate from rest to light speed, and electricity. On the 'fusion' side to the left of the Fe peak of ~8.8 MeV per nucleon, smaller nuclei appear to join together to form a larger and more stable ones, i.e., with higher nuclear binding energy than the original nuclei. To the right of the Fe peak, processes such as radioactive decay and 'fission' again of a less stable nucleus, form a smaller but more stable nucleus with higher binding energy per nucleon. Actually, what appears as 'fusion', or 'fission' is more waves in the same absolute space. Thus, both 'fusion' and 'fission' are on the overall non-entropic, i.e., their products have higher energy-frequency as per E = hf. They involve a reversible cyclic and an irreversible linear extension component that increases frequency with time, and any 'excess' energy input forms a pair of standing waves of higher frequency to stay permanently, and emit unpaired standing or travelling waves of similarly higher frequency.

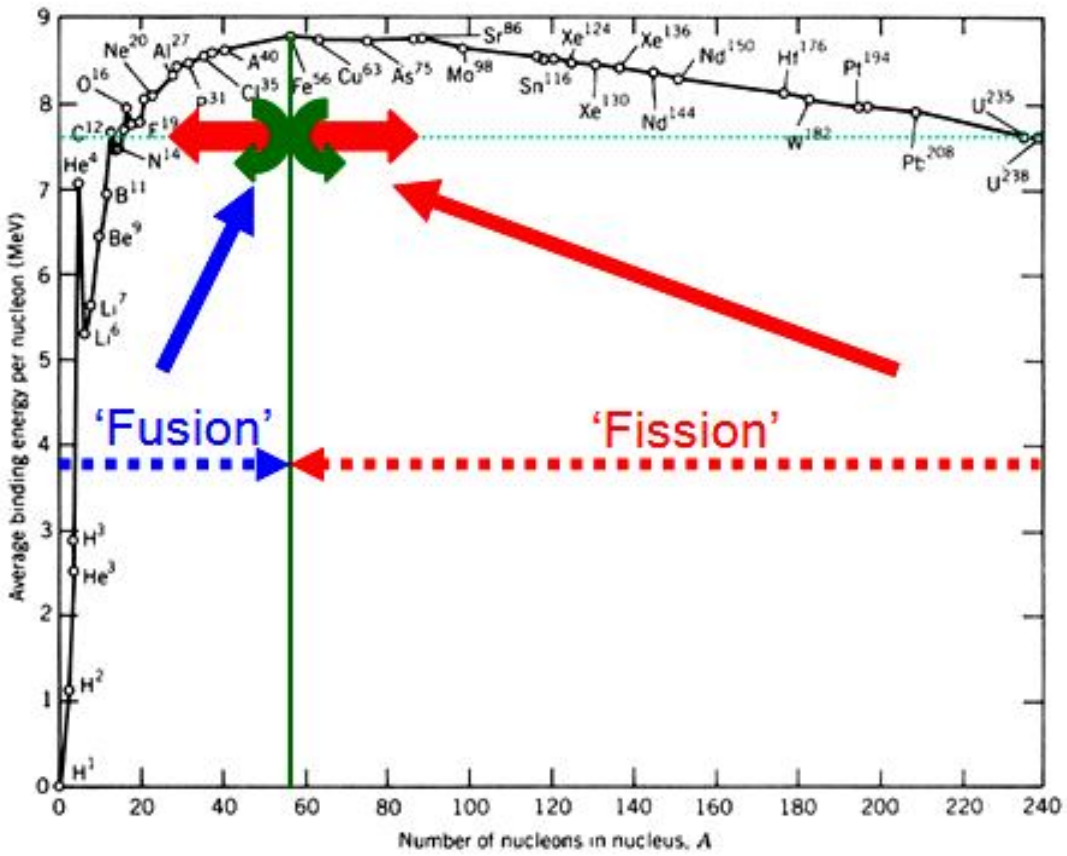


Figure 12. Through the 'fusion' process to the left of the Fe peak of ~8.8 MeV per nucleon, smaller nuclei join together to form a larger and more stable nucleus, i.e., with higher nuclear binding energy. To the right of the Fe peak, the 'fission' process involves the decay of a bigger but lower binding energy nucleus to a smaller but more stable and higher binding energy per nucleon, as per E = hf. Thus all spontaneously occurring processes are on the overall non-entropic. They involve a cyclic (extension and compaction) and a linear extension component (red arrows) that increases frequency with time. Any excess energy input will result to the formation of a higher frequency pair of standing waves-matter (green semi-circles), and to the emission of energy-travelling waves of equally higher frequency-energy.

Earth's inner core is considered as a Lagrangian point, i.e., an equilibrium high-tension, and therefore high frequency location, wherein energy-unpaired standing waves transform into paired standing waves-matter, so that the conservation principle is not violated, and form new elements, i.e., Excess Mass. Earth's outer core, being 'looser' space than that of the inner core, in correspondence to the electron cloud of an atom, has the characteristics of a plasma state, in which the newly formed elements accelerate from stationary to v_{max}. The order which elements form depends on their nuclear binding energy. Hydrogen with the lowest nuclear binding energy of ~1.1 MeV per nucleon should be the first element to form, and Fe, with its ~8.8 MeV, the last and most stable (**Fig. 12**). Thus, the absence of Fe rich rocks and oceanic crust older than about 200 m.y. finds its physical explanation, and so do the Archean greenstone belts: Fe was emplaced during the last 200 m.y. in the crystalline structure of existing Fe-poor rocks. So, three phases in the Earth's growth are recognized:

1. The first pre-Fe (pre-U) phase when H^1 (0 MeV), H^2 (~1.1 MeV), He^3 (~2.5 MeV), H^3 (~2.9 MeV), Li^6 (~5.3 MeV), Li^7 (~5.7 MeV), Be^9 (~6.5 MeV), B^{11} (~6.9 MeV), He^4 (~7.1 MeV), and N^{14} (~7.5 MeV) were formed.
2. The second pre-Fe, or meta-U, phase starts and sets the radioactive decay clock with the ~7.6 MeV of U^{238} on the 'fission' side, and the ~7.7 MeV of C^{12} (the ~7.6 MeV correspond to ~13 atomic mass) on the 'fusion' side. The two lines converge to the Fe^{56} peak of ~8.8 MeV, and involve division-derivation by ~4.25 in 'fission', and an equivalent multiplication-integration in 'fusion' of the atomic mass, i.e., more than two halving or duplication periods. Considering the from 0 to ~7.6 MeV of the pre-U phase, the actual age of the Earth is much higher, maybe by an order of magnitude, than the 4.6 billion years, and similarly the Earth's extension rate is of the order of 10^{-19} s^{-1}.
3. The meta-Fe phase started ~200 m.y.a. with the formation of Fe^{56}, and still goes on today.

All 'instant genesis' or 'cosmic dust' accretion models are excluded, because the former require a start point and the negation of the conservation principle. The later because they assume 'discrete' particles, and furthermore have to explain how gravity, the weakest of all forces, can bring them together and overcome the electrostatic repulsion which is many orders of magnitude stronger. In the context of EMST all elements, i.e., Excess Mass — E.M., form in the Earth's inner core; accelerate from stationary to v_{max} in the Earth's 'plasma' state outer core, and then are emplaced atom-by-atom and in solid state around it concentrically. A small fraction, ~7% of the total 6.45×10^{16} kg of E.M. added every year, or ~4.5×10^{15} $kg.yr^{-1}$, that correspond to the mass of ~10^{12} m^3 'active volume' (seismic moment over rigidity) of a M≈9 earthquake, ascends to the surface through microfracture trails, and 'fuels' geodynamic and geochemical phenomena at or close to the Earth's surface. Depending on structural

constraints E.M. can form compounds, crystals, minerals and rocks that can escape as a gas to the atmosphere, and/or stay as a liquid and/or solid on the Earth's surface, and/or form inside the Earth gas, and/or liquid, and/or solid deposits.

The first rocks to form on the Earth's surface were the Li, Be, B rich proto-pegmatites, mostly as big mono-crystals. Later as C^{12} started to form, almost concurrently with U^{238}, and to enter into the crystalline structure of proto-pegmatites, the proto-kerogen, the source rock of the nearly H-free anthracite was formed. Carbon upon its association with H gave CH_4, the parent molecule of hydrocarbons. In the absence of blocking CH_4 was and is released in the atmosphere *[Houweling 2000]*, the same way as it is released from Titan's surface today. As the constant extension of space and the consequent frequency increase provided the higher binding energies per nucleon, elements like O, Na, Mg, Al, Si, S, K, and Ca, through 'fusion', and Th and Cs through 'fission' formed and entered into the crystalline structure of proto-pegmatites. Minerals like spodumene, feldspar and quartz were formed, and the proto-pegmatites gradually transformed into pegmatites and finally into granites, and the proto-kerogen into kerogen. At the end of the pre-Fe phase an all encompassing pegmatitic-granitic crust covered a smaller, ~0.6 its present radius, Earth (**Fig. 13 a**).

Finally, in the meta-Fe era during the last 200 m.y. of the Earth's history, with the initiation of production of Fe and its emplacement into the crystalline structure of the preexisting felsic minerals, new Fe-rich minerals, such as the platy micas and the granular and more mafic olivine and pyroxene, and rocks like gabbro and basalt, started to form. Splitting the all encompassing granitic continental crust, filling the space beneath it and in between the split, like a solid wedge, thus forming the mantle and the oceanic crust, and resulting to the Earth's exponential growth to its present size (**Fig. 13**). The emplacement of Fe into the crystalline structure of minerals of granitic rocks led to their 'oceanization', the formation of the intracratonic greenstone belts, BIFs and komatites, e.g., the Jack Hills belt in W Australia. The emplacement of Fe was associated with a rise in temperature and the initiation of the pyrolysis process of kerogen into coal, oil and gas, at temperature windows from 0 to ~50, ~50 to ~100, and ~100 to~200 °C, respectively, the enrichment of kaolinite with iron and its 'baking' into shale, and the formation of various types of coal. At temperatures above 200 °C porphyrins are destroyed, and kerogen is fully oxidized to CO_2 and H_2O. Thus oil and gas cannot exist at temperatures higher than about 200 °C, but the almost hydrogen free anthracite requires such temperatures.

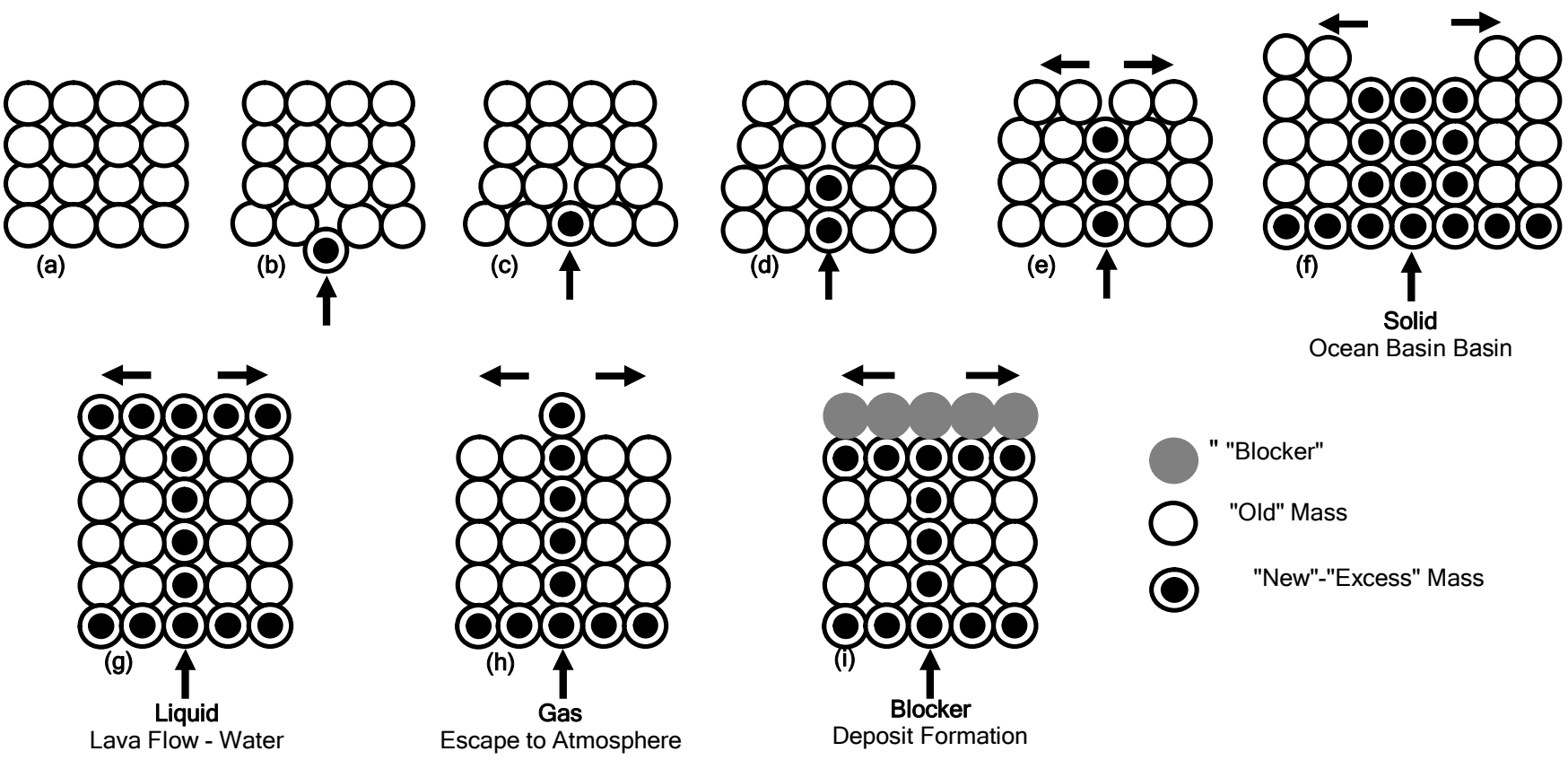


Figure 13. The atom-by-atom emplacement in solid state of 'New'-'Excess' Fe-rich Mass during the last 200 m.y. oceanized, rifted and up-lifted the pre-existing Fe-poor granitic continental crust, (**a**) through (**f**), and resulted to the formation of deep (av. ~3.8 km) and wide ocean basins. Melting temperatures and lava flows is a surface phenomenon and lava floods the surface, the same way as water fills the ocean basins (**g**). So if the rising mass is in a liquid or gas state it will stay on or escape from the Earth's surface (**h**), unless stopped by a 'blocker' (**i**).

In the presence of micro- and/or macro-cracks that associate with and manifest high seismic and tectonic activity, positive gravity and heat flow anomalies, and in the absence of the impermeable cap rocks oil, and especially CH_4, is released from the Earth's surface and cannot be reserved. The emplacement of iron during the last 200 million years resulted to the oceanization, rifting and up-lift of the pre-existing Fe-poor granitic continental crust, as shown in **Figure 13 a** through **13 f**, and to the formation of deep (average depth ~3.8 km) and wide ocean basins, which were filled with the exhaled juvenile water during that period of time.

Also during the last 200 m.y. the tectonic activity intensified, and along with the formation of deep and wide oceans a complex pattern of uplifts and near shore sedimentary basins developed, thus providing the coarse grained reservoir sediments, the necessary heat, and the structural and/or stratigraphic traps for the formation and preservation of oil and gas. These temperature and geodynamic prerequisites explain why oil and gas deposits are found in basins adjacent to deformed precambri-

an shields and platforms, and associate with moderate seismic and volcanic activity, free-air gravity, geoidal, and heat flow anomalies, and large igneous provinces (LIPs), i.e., Excess Mass. Melting temperatures and lava flows is a surface phenomenon and lava floods the surface, the same way as water fills the ocean basins (**Fig. 13 g**). So if the rising mass is in a liquid or gas state it will stay on or escape from the Earth's surface (**Fig. 13 h**), unless stopped by a 'blocker' (**Fig. 13 i**).

Heat in the Context of Z ∞ Space and EMST

An important property of Fe under high pressure-tension is the coincidence of the s- and d-orbital electronic states. Thus the reduced Fe^{2-} anion is formed, which upon decompression acquires its oxidized low pressure configuration of $Fe^{2,3+}$, and releases its 4—5 'excess' electrons. It is these 'new' electrons that enter and resonate into microcracks-resonant cavities at thermal frequencies of $\sim 10^{14}$ Hz that provide the heat capable to cause the pyrolysis of kerogen into coal, oil and gas, but also volcanism and lava flows. In that context rocks like shale and limestone originate from the primordial pegmatites. They were formed during the last 200 m.y. when the emplacement of Fe and the associated increased heat flow 'baked' and transformed in-situ the looser kaolinite and chalk into shale and limestone-marble, respectively. The released 'excess' or 'new' electrons can travel as 'free' electrons and following the least resistance path enter into the tiniest microcracks and when the concentration of electrons exceeds the threshold of $>10^{18}$ electrons.m^{-2} their internal pressure balances gravitational attraction. If and when the concentration of the self-repulsive electrons increases, microcracks enlarge, their cumulative internal pressure builds up, and a great mass of rock is uplifted over time, resulting to and explaining the observed doming and dilatancy of the seismogenic volume prior to and after an earthquake. Part of this doming is transient due to the collapse of microcracks, and another part is permanent and it is due to the emplacement of 'Excess Mass', mostly as iron during the last 200 m.y., causing the positive gravity and geoidal anomalies.

The solid, quantified, growing and radiating Earth is a body in which the thermal frequencies $\sim 10^{14}$ Hz can only develop in resonant cavities–microcracks of $\sim 10^{-6}$ m, the thermal radiation wavelength, that lower the bulk rigidity by 2 to 3 orders of magnitude to 'thermally proper' rigidities (**Fig. 14 a,b**). Within resonant cavities lossless reflection of resonating electrons at the thermal frequencies of $\sim 10^{14}$ Hz occurs and when the resonance seizes the free surface of an object quickly cools. So the only source of heat inside the Earth is thermal radiation, and except for some minor radiogenic heating is due to the resonance of 'new' electrons inside $\sim 10^{-6}$ m microcracks at $\sim 10^{14}$ Hz. At higher (X-rays and higher) and lower (radio waves and lower) frequencies the amount of thermal radiation decreases rapidly. In that context radiative cooling, at rates of $^{o}C.sec^{-1}$ to $^{o}C.day^{-1}$, is the most efficient way of heat transfer from the 'free' surface to the very low rigidity atmosphere. In high rigidity media unfavorable for thermal frequencies, heat is conducted at rates of the order of ^{o}C per billion years, i.e., 10 to 15 orders of magnitude slower than the cooling rates of the free surface of lava. Thus if a heat source is sandwiched between two high rigidity layers (**Fig. 14 c**) an upward 'normal' and a downward 'reversed' temperature gradient will develop. In that context, whatever high temperatures might develop in the plasma state outer core, are confined there due to the very high rigidity of the overlying mantle and the underlying inner core.

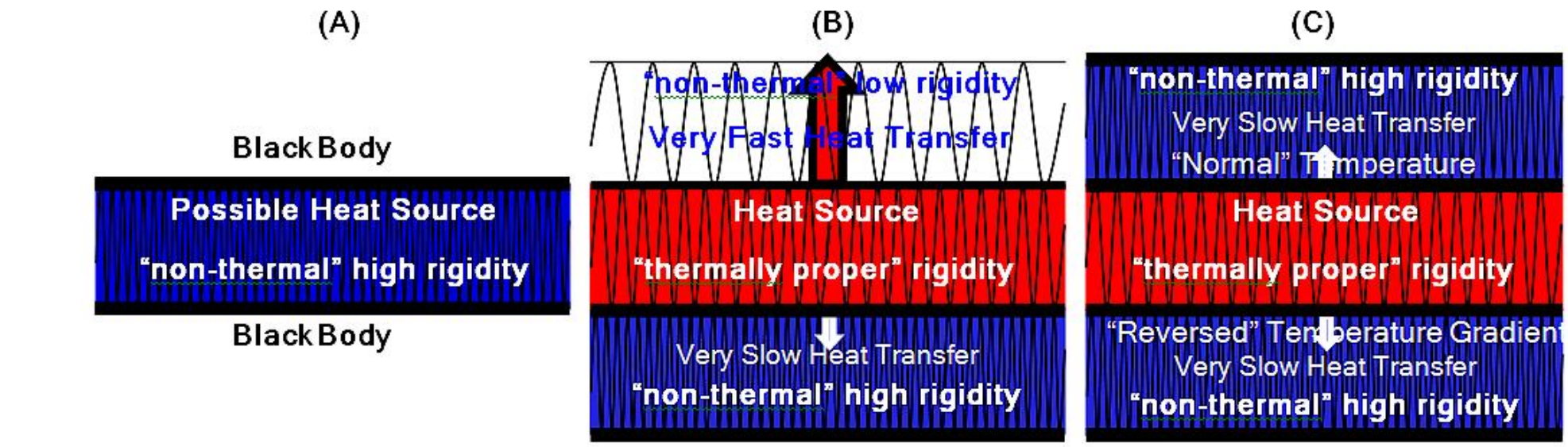


Figure 14. In the context of a solid, quantified, radiating and growing Earth (EMST) a black body is an object in which the thermal frequencies $\sim 10^{14}$ Hz do not develop (**A**). Thermal radiation, i.e., resonance of electrons inside $\sim 10^{-6}$ m microcracks-resonant cavities at $\sim 10^{14}$ Hz frequencies, is the source of heat inside the Earth at 'thermally proper' rigidities. Thermal frequencies cannot develop when the rigidities/frequencies are either too high, e.g., solid rock, or too low, e.g., air. Radiative cooling, from a 'free' surface to the very low rigidity atmosphere, is very fast, at rates of the order of ^{o}C/sec to ^{o}C/day. In the high rigidity rocks, the cooling rates are extremely low, of the order of ^{o}C/billion years (**B**). If a heat source is sandwiched between two high rigidity layers an upward 'normal' and a downward 'reversed' temperature gradient will develop (**C**).

There is experimental evidence that complete closure of microcracks is expected at a depth greater than 5 km *[Kern, 2005]*. The EMST explanation is that at depths lower than ~5 km, microcracks form at the interface between the rising Excess Mass and the overlying layers of rock and can remain permanently open, thus acting as 'resonant cavities' for 'old' and 'new' electrons liberated from the reduced Fe, i.e., Excess Mass. As a result of electron resonance at $\sim 10^{14}$ Hz in these microcracks radiant heat is released.

As for the locally high temperatures in these upper 5 km or so of the Earth's interior, direct borehole measurements and indirect infrared method estimates indicate temperatures not exceeding 300—340^{o}C *[Fytikas and Marinelli 1978; Jonsson 1978;*

Vaughan et. al. 2005]. Also contrary to common belief, temperatures do not always increase with depth down to 5 km, where in principle the maximum concentration of microcracks — resonant cavities should result to the release of greater amounts of radiant heat, and therefore to higher temperatures. For example in Santorini the highest sites in altitude register the highest temperature values of fumarolic gasses that have temperatures ranging from 60°C to 97°C *[Vougioukalakis et. al. 2007]*. Moreover the extrapolation of direct measurements at shallow depths used to estimate the temperature at 1 km depth to determine the temperature gradient can often give not only unreal but also absurd values. As Fytikas and Marinelli, *[Fytikas and Marinelli 1978]* note it seems entirely useless to use an extrapolation line, because extrapolating the measured temperature at the #58 and #63 boreholes in Milos island to 1 km depth would give 95°C, and an absurd 1400°C, respectively. Actually both values are unreal, because this is a 'virtual' temperature gradient; the locally actual high temperatures are very close to a radiant heat source.

The 'hot lenses' usually are found at depths shallower than 5 km *[Canales et. al. 2006; Singh et. al. 2006; Tolstoy et. al. 1997]*, thus supporting the notion of cold and rigid Earth's interior, and of high temperatures and melting being near surface and/or surface phenomena. Melting temperatures require a 'free' surface, so they can only occur at the Earth's surface in lava flows, or near the surface in cracks and fissures. Thus the Earth's average heat flux of ~60 *m*W.m^{-2} should be attributed to a concentration of microcracks that can generate radiant heat and a temperature of ~150°C at 5 km depth, which gives a 'virtual' temperature gradient of ~30°C.km^{-1}, which with an average thermal conductivity of ~2 W.m^{-1}.K(°C)$^{-1}$ gives the ~60 *m*W.m^{2} of heat flow. Obviously a heat source with a temperature of ~30°C at 1 km depth would give the same heat flow value. This is the only realistic approach for the observed Earth's heat flow, because if we go by the Stefan—Boltzmann's law for a black body, Heat Flow = $\sigma\varepsilon T^4$, where $\sigma = 5.67\times10^{-8}$ W.K^{-4}.m^{-2}, ε the average emissivity equal to 0.91, and T is temperature in Kelvin, the heat flow of ~60 *m*W.m^{-2} corresponds to a temperature of ~33 K, i.e., –240°C, and the heat flow that corresponds to the supposed above 1000° C Earth's interior temperature should be about 150,000 W.m^{-2}! In other words the Earth is almost a perfect black-body, the physical meaning of it being that due to micro-cracks high temperatures is a near surface, local and episodic phenomenon and heat is trapped into the micro-cracks.

Note that the 33 K of the Earth's temperature is about an order of magnitude higher than the 2.725 K of the so called 'cosmic microwave background radiation' (CMBR), which is observed coming from every direction and is thought to be the afterglow of the big bang, and one of the stronger proofs of the hot origin of the universe. But as it was shown heat can only be radiant, it concerns a very small part of the wave spectrum, and as far as the Earth is concerned all evidence indicate that it never went through a hot, molten stage. In the context of Z∞ space and EMST the CMBR is nothing else than a measure of the amplitude, and therefore of mass, of the background 'noise' of the waving space continuum, in which every higher amplitude wave fades away.

Earthquakes in the context of Z ∞ Space and EMST

Crustal deformation due to the dilatancy, the intensity of which is absolutely compatible with the Excess Mass Stress Tectonics - EMST predictions, i.e., 10^{-5} m to few decades of millimeters, is widely known to associate with an earthquake's preparatory stage. For example uplift from 20 to >50 mm, measured with the use of the Differential Global Positioning System (DGPS) and Differential Interferometric Synthetic Aperture Radar (DInSAR), in the Ionian Islands of Cephallonia, Zakynthos, and Lefkas (Greece), which in Lefkas island occurred from March to September 2003, is attributed to dilatancy and is used as a promising earthquake prediction method *[Lagios et. al. 2007]*. As mentioned before in the context of EMST the dilatancy is caused by the widening of microcracks when the concentration of mutually repellent electron in them exceeds the important geodynamic quantum of ~2×10^{18} electrons per square meter, which is necessary to balance the gravitational attraction with the electrostatic repulsion of electrons (see Appendix). Any concentration of electrons greater than that will cause a proportional dilatancy of the microcracks and the subsequent uplift and doming of the overlying rock volume, which in order to be 'observable' it requires very shallow focal depths, in the order of less than a few kilometres, since, for example, at a 35km depth the required uplift is only 1 millimetre. This process also explains the various electromagnetic phenomena that have been observed many times to associate with the preparatory stage and the generation of an earthquake, and some, as the Seismic Electric Signals — SES, are also used in earthquake prediction efforts *[Varotsos et. al. 2008]*.

If and when the concentration of electrons in the microcavities surpasses the electrical impedance to electron flow a dielectric breakdown occurs, i.e., the transient discharging of electrons very rapidly empties the network of cavities, causing their implosive free-fall 1g collapse. This sudden electron flooding should also have a sudden conductivity increase, a phenomenon that has been observed to concur with earthquakes; the Tangshan earthquake of 28 July 1976 being the most characteristic case *[Noritomi 1978]*. This high energy implosion coerces the otherwise plastic, i.e., non-elastic underlying rock block, to respond instantaneously elastically, and thus an earthquake is generated. The magnitude of an earthquake depends on the size of the active volume of almost in tandem discharging microcavities, since the energy required and released per mass unit is constant, thus and the power law that relates proportionally the size of an earthquake with the size of the deformed volume of rock. Except for this transient doming, which is the manifestation of energy, i.e., electrons, concentration in space and time, there is a permanent doming due to the spatial and temporal concentration of matter, or Excess Mass, i.e., mostly iron, that associates with earthquakes, and is manifested by the positive free-air gravity, geoidal, and magnetic anomalies.

For the Gutenberg-Richter magnitude and number of earthquakes relationship in order to exhibit its linearity and satisfy the $b = 1$ value, which means that the number of earthquakes decreases proportionally to the magnitude increase, should be cor-

related with the proper space and time scale. Indicatively the magnitude 8 and higher earthquakes to the whole Earth's surface area and one year of time period, the M=7 to 10% of the Earth's surface area and about 1.2 months, the magnitude 6 to 1% of the Earth's surface area and about 3.6 days, and so on. So any data set that refers to a smaller space and time scale is skewed towards the small earthquakes, the *b*-value will be greater than 1 and up to 2.5 in swarms of small earthquakes, whereas if the space and time scale is larger and/or the instrumental coverage poor the *b*-value will be smaller than 1, and the data set skewed towards the big shocks.

Thus the power-law and the self-organized criticality–SOC *[Bak et. al. 1987]*, that tries to explain how the scale invariant avalanche conditions develop in multiple interactive systems, in actuality is the mathematical expression of the linear quantized waving material infinity. The mechanical equilibrium of rocks which is the maximum potential energy state will be disturbed and an earthquake will be generated if a sufficient dynamic stress is provided. When and where that will occur depends on a threshold value-quantum of electron concentration in micro-cracks, greater than 2×10^{18} electrons per square meter, which unless is provided, like the extra grain of sand onto a sandpile, the dielectric collapse will not occur and the dynamic stress necessary to disturb the mechanical equilibrium and generate an earthquake will not be supplied. This means that the nucleation process, i.e., the concentration of energy in space and time, once started could be completed within seconds in the one extreme end, which is and the most usually observed case, or never be completed in the other. A direct implication of this is the inherent deterministic non-predictability of earthquakes, regardless of magnitude. Simply small earthquakes are more frequent, and so more statistically predictable, because they refer to a smaller space and time scale.

It follows that in the EMST context whereby earthquakes can be generated only through free-fall, the $½mv^2$ quantity, which in conventional terms is considered as kinetic energy and the Bh quantity which is considered as potential energy are quantitatively and qualitatively equal, which means that $mv^2 = 2Bh$, and physically corresponds to the lossless reflection of the collapsed rock mass. Higher free-fall elevation means higher impact speed, and therefore higher than the 2×10^6 Joules which are sufficient and necessary to cause an earthquake. So if this extra energy input is sufficiently high it might also cause the rupture of the rock block, and generate the secondary inelastic effect of a fault that follows in time an earthquake.

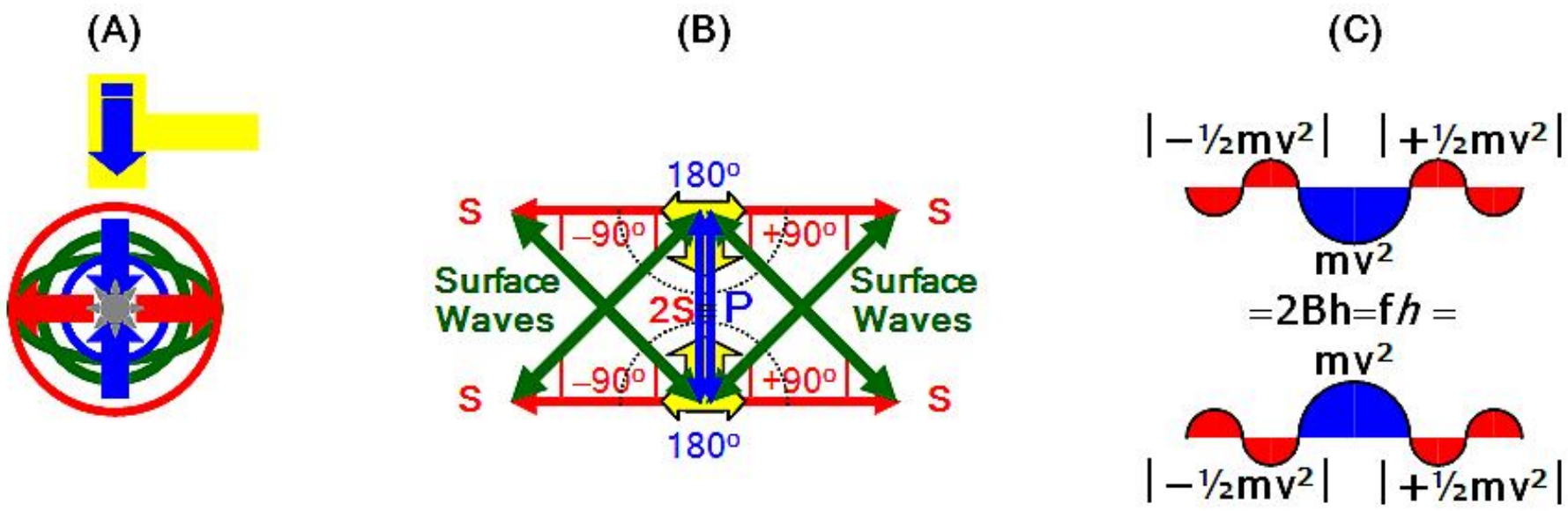


Figure 15. (**A**) A hammer blow will cause the compression (blue arrows-circle) of the green circle, and its extension (red arrows-circle) in the direction normal to the direction of strike, to become a 1:2 green ellipse. (**B**) 2S ≡ P-wave (2 blue arrows) represent 'total internal reflection 180^0 out-of-phase', and S-waves (diverging red arrows) as per $|+90^0| + |-90^0| = 180^0$, or 'total internal reflection 90^0 out-of-phase'. Surface waves (green arrows) are at 45^0 to both. (**C**) At the epicenter the vertical component is dominant, because it represents a pair of standing waves (blue semi-circles), while the horizontal component represents two unpaired standing, or travelling waves (red semi-circles), as per, $E = 2Bh = hf = mv^2 = 2(½mv^2)$.

A hammer strike, i.e., a dynamic compressive stress acting as the elastic force, will cause the compression of the green circle, and its extension in the direction normal to the direction of strike, so that it becomes a 2:1 green ellipse (**Fig. 15 A**). Alternatively this deformation can be represented by the lossless reflection of a mass between two absolutely rigid surfaces in a direction parallel to the direction of strike. A ray, but actually a wave, does not cross the interfaces, as shown by the three small yellow arrows, that represent two equivalent critical states:

A) *Excited, or, total internal reflection 180^0 out-of-phase*, conventionally the particle-matter, or, equivalently a dipole, but in fact a pair of standing waves, as per $|+1| + |+1| = |-1| + |-1| = 2$ and $|+1|\times|+1| = |-1|\times|-1| = 1$.

B) *At rest, or, total internal reflection 90^0 out-of-phase*; conventionally this is the massless wave-energy, or, photon, or, two monopoles, but actually this is two unpaired standing waves, as per $|+90^0| + |-90^0| = 180^0$, and therefore quantitatively equal to the excited or total internal reflection state.

Thus potential energy is the conserved physical quantity manifested as paired standing waves-matter and unpaired standing waves-energy; the two sides of a coin. The short axis of the ellipse corresponds to compression and a pair of standing waves, the longitudinal (**P**) waves (blue arrows) propagating parallel, and two unpaired standing or traveling waves, the transverse (**S**) waves (red arrows), propagating in opposite directions ($+90^0$ and -90^0) normal to the direction of strike, whereas the surface waves (green arrows) are at 45^0 to both (**Fig. 15 B**).

Since amplitude is a measure of mass, and frequency, f, a measure of energy, twofold amplitude or frequency means twice

as much mass and potential energy, respectively and equivalently. At the epicenter the frequencies are higher, and the vertical component is dominant, because it represents a pair of standing waves-matter, as per $E = 2Bh = hf = mv^2$, where B weight, h height, and *h* Planck's constant. The diverging from the 'source' S-waves are two 'single' standing waves, conventionally travelling waves with kinetic energy, as per, $½mv^2 = hf/2 = Bh = E/2$ (**Fig. 15 C**).

If there is no damping, i.e., the elasticity forces act infinitely long, as in the isotropic $Z\infty$ space, the vibrations can be maintained also infinitely long. In the case of a non-recurrent force only the first cycle will be lossless. In other words the earthquake producing deformation in a non-elastic medium, like a rock, can only occur with the action of a vertical dynamic load, because the horizontal static stress is too weak to overcome the inertial resistance of a rock block, and whatever linear movement through creep and slip removes elastic strain energy. If this transient dynamic stress that caused the earthquake exceeds the rock's strength can also produce a fault rupture, as a secondary non-elastic effect.

Thus in the context of Excess Mass Stress Tectonics — EMST an earthquake is an electromagnetically induced mechanical process, whereby the dielectric collapse in microcracks causes the abrupt vertical displacement of the rock column, thus providing the dynamic stress that disturbs the mechanical equilibrium of an underlying rock block. The same process can also cause a tsunami as the collapse of the ocean bottom will cause the downward displacement of the water column *[Tassos, 2005, 2006a, 2007c]*. Thus in both cases the downward first motion is explained. In an earthquake, as in a tsunami, the 'source' P waves are a pair of standing waves oscillating parallel to the direction of stress, and the diverging from the 'source' S waves are unpaired standing or traveling waves propagating normal to the direction of stress. In the case of the non-recurrent vertical dynamic stress in the direction parallel to the strike the green $R = 1$ circle that represents the most probable equilibrium and stable state, and for that matter the surface waves, in compliance with the conservation principle will be deformed to the same area green ellipse the long semi-axis of which, normal to the direction of strike, is $2^{0.5}$ and its short semi-axis $2^{0.5}/2$.

Another way of representing the same process will be that the equilibrium $R = 1$ green circle is contracted to the $R_2 = 1/2^{0.5}$ blue circle with ½ the area and 2 times the space density of the green circle. Then the moving mass will be reflected without loss, change polarity and direction of motion by 180^0 pass again through the $R = 1$ equilibrium green circle, and then extend to the $R_1 = 2^{0.5}$ red circle, 2 times the area and ½ the space density of the black circle. In the case of the non-recurrent dynamic stress only this first cycle will be lossless, and the wave can be characterized as a soliton, a linear perfect sinusoidal wave. From the second cycle and on, inertia takes over. The sinusoidal waveform is altered, due to the interference with other waves, and attenuated, due to both absorption and scattering loss, thus acting as a dispersive long or coda wave *[Aki 1980]*. In some cases though, when the interference gains balance the absorption and scattering losses the wave keeps its soliton waveform. Eventually the mechanical equilibrium of the rock volume is restored, and it returns to its maximum potential energy state, or otherwise put, its self-organized criticality.

In other words the effect of the interference of two waves in phase, and 180^0 out of phase is the same, and refers to two quanta of mass oscillating in the same absolute space, if the waves have the same wavelength-frequency, or, in the case of different wavelengths, with the longer wavelength-shorter frequency, which is acting as a carrier wave, and with amplitude the sum of the amplitudes of the component waves. The difference is that in the in phase case the resultant waveform will appear as a traveling, or actually as an unpaired standing wave, whereas in the 180^0 out of phase as a pair of standing waves oscillating in tandem. In effect, in a seismic as in any wave what we perceive as matter is a paired, and as energy an unpaired standing wave, respectively. In both cases though what we have is mass in motion, i.e., momentum, since there is no such an entity like a discrete and much more a mass-less particle, and what makes the difference is the coupled-matter or uncoupled-energy state of it.

The vertical component is the only one in the epicentral point *[Carydis 2007]*, and dominates at a distance from the epicenter equal with the earthquakes' focal depth. In the epicentral point and in absence of any dispersion should be equal to 1 g regardless of magnitude. It may be interpreted as a paired standing wave, or, as the echo effect produced by the 1g free-fall of the overlying rock column and its lossless reflection, so and the upward 1 g, in the first lossless cycle (**Fig. 15 B**).

In an isotropic and homogeneous medium perfect elasticity is coupled with absolute rigidity. The wave function is perfectly linear and all waves can be characterized as solitons, i.e., waves that maintain their perfect sinusoidal shape and travel at constant speed, and from the first cycle they exhibit their composite Rayleigh like wave waveform, since there is no differentiation according to wavelength. Also in perfect elasticity the 'total reflection and refraction angles' 180^0 and 90^0, respectively, is described by the circle. Since perfect elasticity-rigidity is coupled with infinity, i.e., infinite number of waves, there is constant local intensifying interference, which fades away into the background 'noise' at a distance which is proportional to the degree of intensification.

In transient elasticity, which is coupled with anisotropy and inhomogeneity, i.e., media with different densities-refractive indexes, as in earthquakes, waves are dispersed, i.e., they are shorted according to wavelength. So soon after the first lossless cycle, caused by the transient dynamic stress, the opposing intensifying and attenuating effects are accompanied with the temporal and spatial differentiation of P, S, and surface waves, thus resulting to distinctive waveforms that eventually fade away into the background 'noise'. If and for as long the opposed effects balance and the waveform keeps its shape and speed constant, they can appear as a soliton.

Thus the result of the interference of P and S body waves is the surface waves, on the horizontal plane the Love, and on the vertical plane the Rayleigh waves. The fact that the surface waves are the result of interplay of the body waves is evident in the Rayleigh waves that clearly contain both longitudinal and transverse motion, as the sea waves, and move in elliptical orbits, with their major axis at 45^0 to the interface (green ellipses in **Fig. 15 A**) so they appear to either prograde or retrograde. In effect are a

composite waveform that represents the most stable and highest possible potential energy equilibrium state. The surface waves propagate along interfaces between media with different densities and compositions, i.e., different refractive indexes, which interfaces except for the first lossless cycle that act as absolutely rigid, act as partially reflective and refractive interfaces, so that waves partially cross them, and partially are trapped between them. Oppositely in an isotropic medium, as in Z∞ space, interfaces constantly act as a totally reflective and refractive, or as absolutely rigid and absolutely elastic, so that waves never cross them.

In all cases the equilibrium position, which in the Cartesian coordinate system is at 45^0, is the maximum tension, and so maximum frequency-maximum potential energy position, as per E = hf, since $sin\ 45^0 = cos\ 45^0 = 2^{0.5}/2 = \sim 0.707$, and their sum $2^{0.5}$ is greater than the sum of sine and cosine of any other angle. This also explains why the Rayleigh waves are the most destructive waves. The Love surface waves appear as horizontally polarized transverse waves, SH, and manifest the periodic dynamic absolute elasticity and rigidity of the x—y surface. As follows the electromagnetic-light waves are surface waves in an isotropic medium.

In summary the seismic waves, as any wave, is a chaotic but not an arbitrary function, or the interchangeable compaction and rarefaction in perpendicular directions, or two simple sinusoidal waves 90^0 out of phase, seen from different angles. The P waves from 0^o, the S waves from 90^o, whereas the surface waves from 45^o relative to the direction of the stress that produced them. In mathematical terms compaction and rarefaction represent the integration and the derivation processes, respectively. The P waves express the one pole of the antithesis and compression, the S waves are normal to the P waves, thus expressing the other pole and extension, whereas the surface waves at 45^o relative to P- and S waves axis, is the synthesis, and at 45^o the equilibrium position between P- and S waves, or compaction and rarefaction, or, rigidity and elasticity, and for that matter between magnetism and electricity, if we refer to the scale of light and thermal radiation waves, i.e., $\sim 10^{-6}$ m wavelength and $\sim 10^{14}$ Hz frequency. In a homogeneous and isotropic medium there is no change with depth, but in an inhomogeneous and anisotropic medium, the rigidity, i.e., the refractive index, of which increases with depth, as inside the Earth, the amplitude of both body and surface waves decreases proportionally to the rigidity, and/or frequency, and/or density increase with depth.

Hydrocarbons in the Context of Z∞ Space and EMST

In the Z∞ space and EMST model of hydrocarbon formation the 'force' that includes the 'source' rock, the sealant, pressure, heat and time, comes from below (**Fig. 16 A**). The source rock is the inorganically formed kerogen, from the time of the Earth's origin up to ~200 m.y.a. During the last 200 m.y. of the Earth's history kerogen was heated from >20 to <200°C to transform into coal, oil, gas, and anthracite. The heat source is located in micro-fractured locations in the upper 5 km or so of the Earth's interior and it is due to thermal radiation at $\sim 10^{14}$ Hz produced in microcracks-resonant cavities of 10^{-6} m dimensions. As for the sealant, it is mostly due to the in-situ 'baking' of loose rocks like kaolinite into shale. That way there is no need for clay sediment source and transport and for overburden pressure and heat for its lithification after deposition to form the impermeable sealant rock. The same applies to the coal formation, which is formed in-situ at temperatures below 50^oC for peat and lignite, and about 200°C for anthracite.

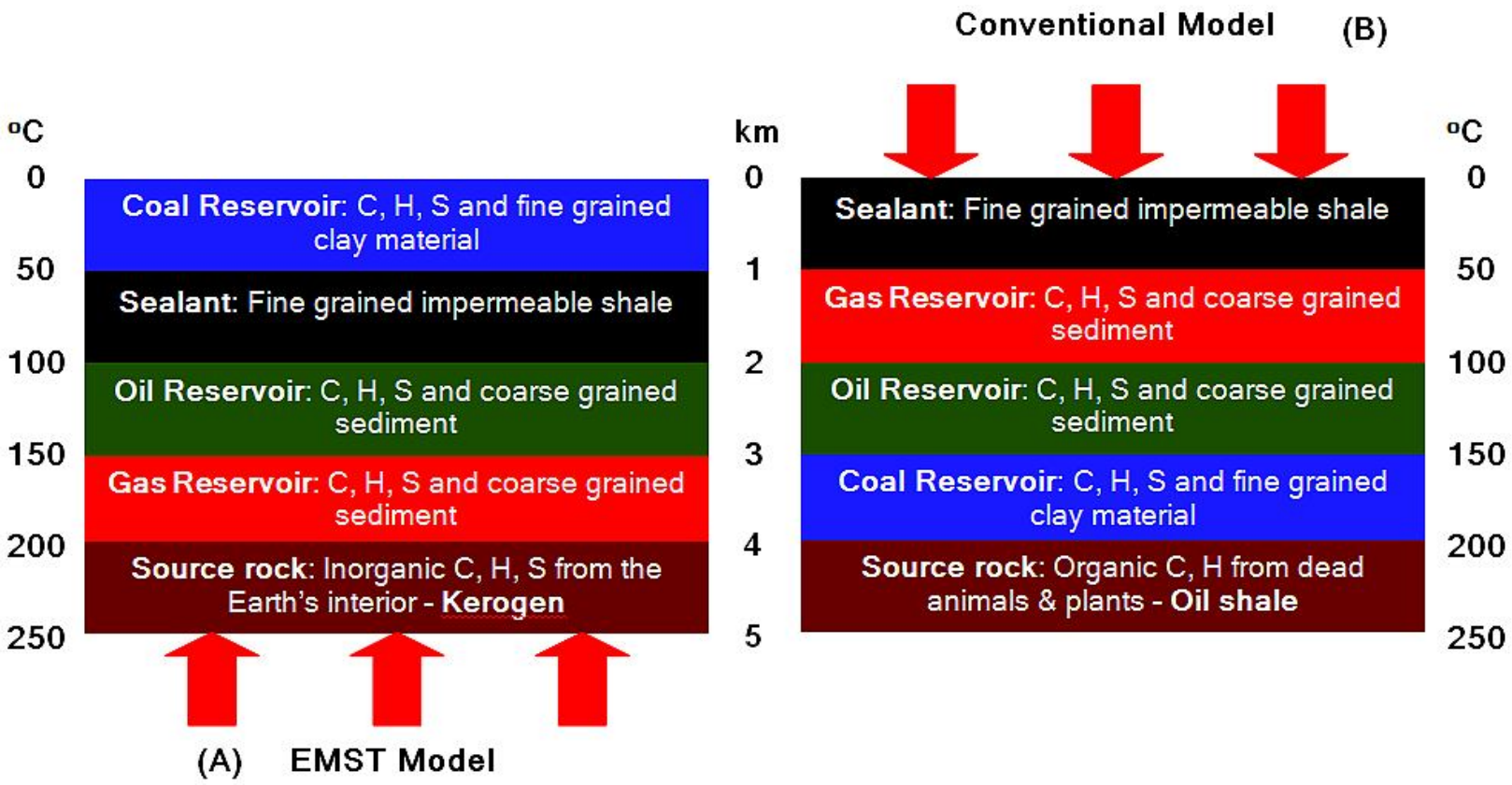


Figure 16. (**A**) In the Excess Mass Stress Tectonics – **EMST** model of **abiotic** hydrocarbon generation the **force** is **from below**. (**B**) In the **conventional** model of **organic** hydrocarbon generation the **force** is **from above**.

It also directly explains the association of oil with sulfur, helium, and trace elements, without the need to resort to some exotic sources, or leave their source problem practically unanswered. They, as all elements, are formed in the core, rise to the surface, and depending on structural constraints occupy any 'empty' space in the structure of preexisting minerals and rocks. As the size of elements gets smaller, due to the frequency increase-wavelength decrease with time, while their nuclear binding energy per nucleon increases, there is a density increase with time too.

In the context of EMST and the inorganic and deep seated origin of kerogen and its associations, the transformation of which into hydrocarbons takes place in the upper 5 km or so of the Earth's interior, the dominance of dissolved carbon relative to particulate carbon, as well as the lack of biodegradation in the Barents Sea oil find their explanation. Similarly the presence of bitumen nodules around uraninite, preserved in Archean sandstones from the ~3.5 Ga old Pilbara Craton, Australia, but also the lack of oxygen and the absence of extensive sedimentation during the Archean, indicate on the one hand that these conditions do not favour the production of organic matter, its burial and preservation, and on the other when a heat source, like uraninite, is available the inorganic kerogen can be transformed into hydrocarbons.

In contrast in the conventional model the 'force' is from above (**Fig. 16 B**). This 'force' includes organic matter, pressure and heat, and requires an identifiable and sufficient source of the organic matter, of the coarse- and fine-grained sediment; of the necessary load and/or heat for the transformation of the oil shale into coal, oil and gas, and the lithification of clay into shale to serve as a sealant.

Provided all other conditions that designate the relationship of hydrocarbons with 'excess mass' are met, in the context of EMST and in compliance with direct measurements and indirect estimates, locations with a 'virtual' temperature gradient of ~50°C.km^{-1}, i.e., ~200°C at 4 km depth, and surface heat flow values of ~100 *m*W.m^{-2} are the most preferable ones to look for oil and gas. So, in the case of 'normal' temperature gradient the low temperature peat and lignite should be found at or close to the Earth's surface, oil at 1—3 km, and gas at 3—4 km depths. Whereas in the case of 'reversed' temperature gradient (**Fig. 14 c**), and given that the kerogen source rock is there to be heated and transformed into hydrocarbons, gas should be found on the top of the sequence, oil in between, and coal in the bottom.

Conclusions

- Five propositions, namely Constant Size Earth, Plate Tectonics, Heat Engine Earth, Elastic Rebound, and Organic Origin of Hydrocarbons are challenged because a close examination of them shows a lot of contradictions and the lack of empirical and experimental verification. Furthermore there is a constant need of ad-hoc hypotheses in order to explain phenomena that cannot be explained by the fundamental arguments of these propositions.
- Z∞ Space re-examines cosmology, astronomy, relativity, quantum mechanics, particle physics and geology upon the fundamental principle that infinity is the ultimate material actuality. In that context zero, vacuum, or empty space are nonexistent as physical entities. Space is the infinite source of all mass, accounts for the repelling 'dark-energy' and the contracting 'dark-matter', and becomes measurable as 'energy' — traveling, actually unpaired standing waves, and 'matter' — paired standing waves, i.e., waving space itself at the scale invariant constant of 299792458 m.s^{-1}.
- In the context of Z∞ Space and Excess Mass Stress Tectonics — EMST, there no 'instant genesis' or primordial accretion of 'cosmic dust', but in compliance with the conservation principle, constant transformation of energy (unpaired standing or traveling waves) into matter (paired standing waves) which takes place in the Earth's maximum tension-equilibrium point inner core, thus forming the Excess Mass — E.M., which accelerates from stationary to v_{max} in the Earth's outer 'plasma' liquid-like core.
- The E.M. is then deposited atom-by-atom around the core concentrically, thus resulting to an observable growth and evolution of the Earth, within a waving material and infinite cosmos, which due to its infinity is in a steady state. A small fraction, ~7%, of total E.M. added every year ascends to the surface through micro-fracture trails, and 'fuels' geodynamic and geochemical phenomena at or close to the Earth's surface.
- All wave-particles contain a constant quantum of tensional elastic potential, irrespective of wavelength-scale, as per E = hf.
- Earth evolution is divided into **a**) the Pre-Iron >> ~200 m.y.a., when all other elements except Fe, depending on their nuclear binding energies were formed, clustered into minerals and rocks, and covered the whole surface of a smaller Earth, ~60% its present radius, with an all encompassing granitic crust, and **b**) the Meta-Iron < ~200 m.y.a. phase when Fe, the element with the highest 8.8 MeV nuclear binding energy, was formed and emplaced into the crystalline structure of granitic rocks, resulting to their oceanization, to the formation of the mafic mantle and oceanic crust, of deep oceans, and to the exponential growth of the Earth to its present size.
- Earth's mantle is cold. The speed of seismic waves increases with depth in the mantle. In order for that to occur its rigidity-stiffness should increase with depth at a faster rate than density. If the mantle was a melt and the temperatures more than 1000°C this could not happen.
- Temperatures that occasionally reach the melting point of rocks only occur within the upper 5 km or so of the Earth's crust.
- Heat is radiant produced by the resonance, in ~10^{-6} m microcracks/resonant cavities at the thermal frequencies of ~10^{14} Hz, of the 'excess' 4—5 electrons released from each high pressure/ tension reduced Fe^{-2} that is oxidized/decompressed into $Fe^{+2,3}$.
- In the EMST model of hydrocarbon formation the 'force' is from below resulting, during the last 200 m.y., to the pyrolysis of the inorganic previously formed kerogen into coal, oil and gas.
- If and when the concentration of 'excess' electrons in the same microcracks well exceeds the 10^{18} electrons.m^{-2} the microcracks enlarge and finally collapse, and thus a vertical dynamic stress is produced and an earthquake is generated. Thus we are referring to a scale invariant electromagnetic self-organized criticality.
- The surface seismic waves, as the electromagnetic waves, are a composite waveform that represents the highest possible potential energy equilibrium state. The surface waves are the result of the interference of two simple sinusoidal waves, 90^0

out of phase, the one representing compaction or the P-waves, and the other rarefaction or the S-waves. In the electromagnetic waves compaction represents magnetism, and extension electricity.

- Therefore Excess Mass Stress Tectonics — EMST or the solid, quantified, radiating and growing Earth, is a comprehensive proposition, because its fundamental arguments explain the various phenomena, there is no need to resort to ad-hoc hypotheses in order to explain any of them, and it is supported by observation and experiment.

APPENDIX

The attractive gravitational force, Fg, between two masses m_0 and m_1, separated by a distance r, is equal to

$$F_g = Gm_1m_0/r^2,$$

where $G \cong 6.67\times10^{-11}$ Nm^2kg^{-2}, the gravitational constant.
The number of electrons that can produce an equal repulsive force can be found by using the formula

$$F_e = q_1q_0/4\pi\varepsilon_0r^2,$$

where $\varepsilon_0 \cong 8.854\times10^{-12}$ $C^2m^{-2}N^{-1}$, or the electromagnetic permittivity of 'vacuum'.
For separation to occur, the gravitational attraction and electrostatic repulsion have to be equal,

$$F_g = F_e = Gm_1m_0/r^2 = q_1q_0/4\pi\varepsilon_0r^2,$$
$$\text{then } Gm_1m_0 = q_1q_0/4\pi\varepsilon_0 \text{ and } q_1q_0 = Gm_1m_04\pi\varepsilon_0.$$

It is important to note that the distance factor r is eliminated. For our computations we will take the unit surface area of 1 m^2, at the depth of ~33 km, the average continental crust and mantle boundary. Taking a density of about 3000 $kg.m^{-3}$, a column of 1m×1m×33km, has a mass, m_1, of ~10^8 kg, while the mass, m_0, of a column 1m×1m×6340km, with an average density of ~5500 $kg.m^{-3}$, is ~3.5×10^{10} kg. Considering that $q_1 = q_0$, it follows that $q_1 = q_0 =$ ~0.16 C. Since the electron charge is ~1.6×10^{-19} C, the required amount of 'excess' harmonically resonant electrons is in the range of 2×10^{18} per m^2. Therefore, in the presence of more than 2×10^{18} of 'new' or 'excess' electrons per m^2, the rock column at a depth of ~33 km will be separated from its underlying column. Any electron concentration greater than 2×10^{18} per m^2 will result to the proportional uplift of the overlying rock column, and a concentration -quantum, in all cases greater than the 2×10^{18} per m^2, will result to the dielectric collapse and to the subsequent collapse of the overlying rock column.

REFERENCES

1. Abbott, D., L. Burgess, and J. Longhi. (1994). An empirical thermal history of the Earth's upper mantle: J. Geophys. Res. V. 99, p. 13835—13850.
2. Aki, K. (1980). Attenuation of shear waves in the lithosphere for frequencies from 0.05 to 25 Hz: Phys. Earth. Planet. Inter. V. 21, p. 50—60.
3. Bak, P., C. Tang, and K. Wiesenfeld. (1987). Self-organized criticality: An explanation of 1/f noise: Phys. Rev. Lett. V. 59, p. 381—384.
4. Banerjee, S., S.K. Bhattacharya, and S. Sarkar. (2006). Carbon and oxygen isotope compositions of the carbonate facies in the Vindhyan Supergroup, central India: Journal of Earth System Science. V. 115(1), p. 113—134.
5. Bolt, B. (1976). Nuclear Explosions and Earthquakes: The Parted Veil. W.H. Freeman. San Francisco. 309 p.
6. Bouillon, S., F. Dehairs, B. Velimirov, G. Abril, and A.V. Borges. (2007). Dynamics of organic and inorganic carbon across contiguous mangrove and seagrass systems (Gazi Bay, Kenya): J. Geophys. Res. V. 112, G02018, doi:10.1029/2006JG000325.
7. Buick, R., B. Rasmussen, and B. Krapez. (1998). Archean Oil; evidence for extensive Hydrocarbon generation and migration 2.5-3.5 Ga: AAPG Bulletin. V. 82(1), p. 50—69.
8. Burridge, R., and L. Knopoff. (1967). Model and theoretical seismology: Bull. Seismol. Soc. Am. V. 57, p. 341—371.
9. Canales, J.P., S.C. Singhb, R.S. Detricka, S.M. Carbottec, A. Hardingd, G.M. Kentd, J.B. Dieboldc, J. Babcockd and M.R. Nedimović. (2006). Seismic evidence for variations in axial magma chamber properties along the southern Juan de Fuca Ridge, Earth and Planetary Science Letters. V. 246 p. 353—366.
10. Carydis, P. (2007). The Catalytic Importance of the Vertical Component in Earthquake Engineering: Official Programme and Abstact Volume, AAPG and AAPG European Region Energy Conference and Exhibition "Challenge Our Myths", 18-21 November, 2007, Athens, Greece, p. 72.
11. Dziewonski, M., and D.L. Anderson. (1981). Preliminary Reference Earth Model — PREM: Physics of the Earth and Planetary Interiors, v. 25(4), p. 297—356.
12. Freund, F. (2002). Charge generation and propagation in rocks: Journal of Geodynamics. V. 33, p. 545–572.
13. Freund, F. (2003). Rocks that crackle and sparkle and glow: Strange pre-earthquake phenomena: Journal of Scientific Exporation. V. 17, p. 37—71.
14. Fytikas M., and G. Marinelli. (1978). Geology and Geothermics of the Island of Milos, Greece, Institute of Geology and Mining Research, Athens, Greece, and Istituto di Mineralogia e Petrografia of Pisa, Italy, 73 p.
15. Gold, T. (1993). The Origin of Methane (and Oil) in the Crust of the Earth: USGS Professional Paper 1570, The Future of Energy Gases: URL: http://web.archive.org/web/20021015163818/www.people.cornell.edu/pages/tg21/usgs.html
16. Hanssen, R., B. Vermeersen, R. Scharroo, B. Kampes, S. Usai, G. Ruediger, and R. Klees. (1999). Deformation pattern of the 17 August 1999, Turkey earthquake observed by satellite radar interferometry: Delft Institute for Earth-Oriented Space Research (DEOS), Delft University of Technology.
17. Hofmeister, A.M., and R.E. Criss. (2005) Earth's heat flux revised and linked to chemistry: Tectonophysics. V. 395, p. 159—177.
18. Houweling, S. (2000). Global Modelling of atmospheric methane sources: PhD thesis, University of Utrecht.
19. Jonsson, V. (1978). Simulation of the Krafla Geothermal field: MSc Thesis, Earth Sciences Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720, 70 p.
20. Kanamori, H., and E.E. Brodsky. (2001). The Physics of Earthquakes: Physics Today. V. 54(6), p. 34—40.
21. Kern, H. (2005). Linking laboratory seismic P- and S-wave data from core samples to sonic log and VSP data: Implications from Continental

Deep Drilling. Proceedings: International Workshop on Core-Log-Seismic Integration: New Scientific and Technological Challenges, Tokyo, Japan, October 3—4, 2005.
22. Lagios, E., V. Sakkas, P. Papadimitriou, I. Parcharidis, B.N. Damiata, K. Chrousianitis, and S. Vassilopoulou. (2007). Crustal deformation in the Central Ionian Islands (Greece): Results from DGPS and DInSAR Analyses (1995—2005), Tectonophysics. V. 444, p. 119—145.
23. Levorsen, A. I. (1967) Geology of Petroleum: W.H. Freeman. San Francisco. 724 p.
24. Mallock, A. (1924). Summary of the Results Obtained from Experiments Made during the Years' 1918 to 1923 of the Effects of Temperature on the Properties of Metals: Proceedings of the Royal Society of London. Series A. V. 105(730), p. 129—134.
25. Mundy, B. (1988). Expanding Earth?: Origins. V. 15(2), p. 53—69, URL: www.grisda.org/origins/15053.htm
26. Murthy, R.V., and H.T. Hall. (1970). The chemical composition of the Earth's core: Possibility of Sulfur in the core: Phys. Earth Planetary Interiors. V. 2, p. 276—282.
27. Noritomi, K. (1978). Application of Precursory Geolectric and Geomagnetic Phenomena to Earthquake Prediction in China: American Geophysical Union. V. 1(2), p. 377—391.
28. Pollack, H.N., S.J. Hurter, and J.J. Johnson. (1993). Heat flow from the Earth's interior: Analysis of the global data set: Reviews of Geophysics. V. 31, p. 267—280.
29. Press, F., and Siever, R. (1978). Earth. Freeman, San Francisco, 649 p.
30. Seed, H.B., and I.M. Idriss. (1982). Ground motions and soil liquefaction during earthquakes: Earthquake Engineering Research Institute (EERI) Monograph Series. Berkeley. V. 5.
31. Singh, S.C., W.C. Crawford, H. Carton, T. Seher, V. Combier, M. Cannat, J.P. Canales, D. Düsünür, J. Escartin, and J.M. Miranda. (2006). Discovery of a magma chamber and faults beneath a Mid-Atlantic Ridge hydrothermal field: Nature. V. 442, p. 1029—1032.
32. Szatmari, P., T.C. Oliveira da Fonseca, N.F. Miekeley. (2005) Trace element evidence for major contribution to commercial oils by serpentinizing mantle peridotites: AAPG Research Conference "Origin of Petroleum", Calgary, Canada.
33. Sornette, D. (1999). Earthquakes: From chemical alteration to mechanical rupture: Physics Reports. V. 313(5), p. 238—292.
34. Tassos, S.T. (2003). Micro and Macro-Manifestations of Excess Mass. In 'Why Expanding Earth? A book in honour of Ott Christoph Hilgenberg': Scalera G. and Jacob K.-H. (eds). Instituto Nazionale di Geofisica e Vulcanologia, Rome and Technische Universität Berlin, Rome, p. 297—331.
35. Tassos, S.T. (2005). A Common Generating Mechanism for Earthquakes and Tsunamis: Abstracts, 22nd IUGG International Tsunami Symposium, Chania, Crete, 27—29 June, 2005.
36. Tassos, S.T. (2006a). In the Context of EMST Vertical Displacement is the Common Generating Mechanism for Earthquakes and Tsunamis: Abstracts, Asia Oceania Geosciences Society 3rd Annual Meeting (AOGS 2006), July 10—14, Singapore, p. 999.
37. Tassos, S.T. (2006b). In the Pacific and Any Other Tectonic Belt Seismic and Volcanic Activity Relate to Positive Gravity, Geoidal, and Heat Flow Anomalies, i.e., Excess Mass, and Do Not Relate to Faults: Abstracts, Asia Oceania Geosciences Society 3rd Annual Meeting (AOGS 2006), July 10—14, Singapore, p. 1000.
38. .Tassos, S.T. (2007a). Five Myths and One Comprehensive Proposition in Geology: Official Programme and Abstact Volume, AAPG and AAPG European Region Energy Conference and Exhibition "Challenge Our Myths", 18—21 November, 2007, Athens, Greece, p. 135.
39. Tassos, S.T. (2007b). Hydrocarbons in the Context of a Solid, Quantified, Growing and Radiating Earth: Official Programme and Abstact Volume, AAPG and AAPG European Region Energy Conference and Exhibition "Challenge Our Myths", 18—21 November, 2007, Athens, Greece, p. 135.
40. Tassos, S.T. (2007c). The Solid, Quantified, Growing and Radiating Earth: Official Programme and Abstact Volume, AAPG and AAPG European Region Energy Conference and Exhibition "Challenge Our Myths", 18—21 November, 2007, Athens, Greece, p. 136.
41. Tassos, S.T., and D.J. Ford (2005a). An Integrated Alternative Conceptual Framework to Heat Engine Earth, Plate Tectonics, and Elastic Rebound: Journal of Scientific Exploration. V. 19(1), p. 43—89.
42. Tassos, S.T., and D.J. Ford. (2005b) Excess Mass Stress Tectonics — EMST. Abstracts, 12th Annual Conferenceof the Natural Philosophy Alliance (NPA), at the Mathematics Department of the University of Connecticut at Storrs: "On the Foundations of Natural Philosophy", 23—27 May 2005.
43. Tassos, S.T., and D.J. Ford. (2005c). Z ∞ Space. Abstracts, 12th Annual Conference of the Natural Philosophy Alliance (NPA), at the Mathematics Department of the University of Connecticut at Storrs: "On the Foundations of Natural Philosophy", 23—27 May 2005.
44. Tolstoy, M., A.J. Harding, and J.A. Orcut.t (1997). Deepening of the axial magma chamber on the southern East Pacific Rise toward the Garrett Fracture Zone: J. Geophys. Res. V. 102, p. 3097—3108.
45. Varotsos, P.A., N.V. Sarlis, and E.S. Skordas. (2008). Seismic Electric Signals and 1/f "noise" in natural time, arXiv:0711.3766v3.
46. Vaughan, R.G., S.J. Hook, M.S. Ramsey, V.J. Realmuto, and D.J. Schneider. (2005). Monitoring eruptive activity at Mount St. Helens with TIR image data: Geophys. Res. Lett. V. 32, L19305, doi: 10.1029/2005GL024112.
47. Vougioukalakis, G.E., M. Fytikas, and N. Kolios. (2007). Thermal Monitoring, Institute for the Study and Monitoring of the Santorini Volcano: URL: http://ismosav.santorini.net/index.php?id=382&L=0.
48. Winslow, N. (1998). Introduction to Self-Organized Criticality & Earthquakes. URL: http://www.geo.lsa.umich.edu/~ruff/Geo105.W97/SOC/SOCeq.html.

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ТВЁРДАЯ, ДИСКРЕТНАЯ, ИЗЛУЧАЮЩАЯ И РАСТУЩАЯ ЗЕМЛЯ

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В контексте предложенной автором Тектоники Избыточных Напряжений планета Земля представляет собой твердое тело, размер которого увеличивается со временем по экспоненциальному закону. Согласно предложенной автором теории, около 200 млн. лет назад диаметр Земли составлял около 60% от своего современного значения, и вся поверхность нашей планеты была покрыта гранитной континентальной корой, с узкими и мелкими окраинными морями. Богатая железом мантия, а также базальтовая океаническая кора и глубокие и широкие океаны сформировались за последние 200 млн. лет или около того.

Из ядра Земли как области высоких давлений и температур в мантию, где давления и температуры меньше, постоянно диффундируют устойчивые и неустойчивые атомы тяжелых элементов. На пути своего движения неустойчивые элементы распадаются, давая в результате жизнь более легким элементам.

Поступающие из области ядра вещества создают в мантии избыточное давление, которое при превышении некоторого порога давления приводит к образованию разрывов и микротрещин земной коры и просачиванию жидкого вещества мантии в земную кору. Иногда эти явления приобретают глобальный характер, что приводит к разрыву плит, подъему и опусканию фрагментов земной коры.

Расширение Земли происходит следующим образом. Плотное ядро передаёт часть своей массы в мантию и земную кору, где в условиях более низкого давления вновь поступающее вещество увеличивается в объеме. Увеличению объема способствует и синтез химических соединений, которые часто тоже имеют плотность более низкую, чем исходные вещества.

Значительную долю в увеличении объема Земли вносят обширные поднятия земной поверхности за счет давления на нее снизу расширяющейся мантии.

Ключевые слова: постоянный размер Земли, тектоника плит, тепловая машина Земли, упругая отдача, органическое происхождение углеводородов, пространство, изотропия, анизотропия, энергия, материя, стоячие волны, принцип сохранения, энергия связи атомного ядра, железо, микротрещины, тепловое излучение, диэлектрический коллапс, динамические напряжения, землетрясение, водород, углерод, кероген, пиролиз, уголь, нефть, газ.