Biogenic origin of the early continents and the origin of the moon

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This paper was submitted to TERRA NOVA, but it has not been peer reviewed.
It contains own considerations and a new comprehensive scenario of the origin of the moon.
Mastodon username: NessiMoon

Abstract: Astronomical discoveries of water abundance in protoplanetary disks are the basis of my hypothesis of a cool formation of the Earth by hydrous accretion in the habitable zone of the disk our solar system derived from, under different pressure conditions than in disks observed at present, chemical evolution in times of accretion, early beginning of prebiotic and biological life. I arrange some of the processes in a new succession in which the presence of water is given greater consideration. Biomineralisation is a fundamental process for the origin of solid rocks. When the planetary embryo of the Earth developed, the shapes of the Precambrian shields were not only formed by physical and chemical processes. Colonies of procaryotes gave organic shapes to the early continents. Their biogenic sediments were transformed by pressure from collisions or heat due to intrusion. With an early beginning of life, the early Earth was a planetary embryo in the astronomical and biological sense. The Earth formation and the evolutionary history of life were not separate processes, but they were intertwined. Otto Ampferer (1925) suggested as initial cause for the break-up of the Pangea the emergence of the Moon. My hypothesis includes findings in geomorphology and plate tectonics that indicate the area where the Moon came out of the Earth, explaining the imbalance in the distribution of land masses and oceans.

Key words: Earth formation – Biomineralisation – Precambrian – Phanerozoic – Pangaea – Origin of the Moon – Plate tectonics

1. Introduction

Scientists still believe in the planetesimal theory assuming the Earth was a glowing sphere in the size of today's Earth, covered by a magma ocean, that had to cool down, before liquid water could be maintained. [1] There are reasons to no longer hold on to this idea. In the experiments in the growth of the planetesimals problems occurred. As the silicate grains fuse and grow, they start bouncing off each other more often. All attempts to prove a continuous accretion leading to an Earth-sized rocky orb have failed. [2] In the protoplanetary disks observed, there is only evidence of young gas planets. Around the T-Tauri-Star PDS 70 clouds containing water were discovered. Benistry et al. (2005) speak of gas accretion and ~ 26° Kelvin as local temperature of PDS 70 c. [3] On Earth the emergence of life and biomineralisation, assumed to have started *after* the cooling of some hypothetical magma ocean as earliest state, can have started *before* and with *moderate temperatures.* This is consistent with results of geochemical examinations of Zircons. [4] [5] The oldest rocks, gneisses, show metamorphism [6]. The surface temperature of the Earth embryo cannot have been glowing hot and moderate at the same time. New astronomical observations are important to prove the theories of Earth formation and to find out how moons arise.

2. Methods

This is no perfectly proven theory, but a scenario one can use as working hypotheses. My interdisciplinary work was developed by studying technical literature in various fields without conducting experiments or simulations. It is a synopsis of the results of other researchers, from which I draw plausible conclusions. I would not oppose the current state of science. I have just established some connections in a way that contradictions are solved. I arranged the order of some events differently resulting from the circumstance that early life contributed to the forming. This paper is written in a language that geologists with little knowledge of astronomy and astronomers with little knowledge of Earth history can understand. I consider the best possible communication between biologists, geologists and astronomers to be most important for the further progress in this field of research. One basis of my work is the common timescale of the history of the earth.

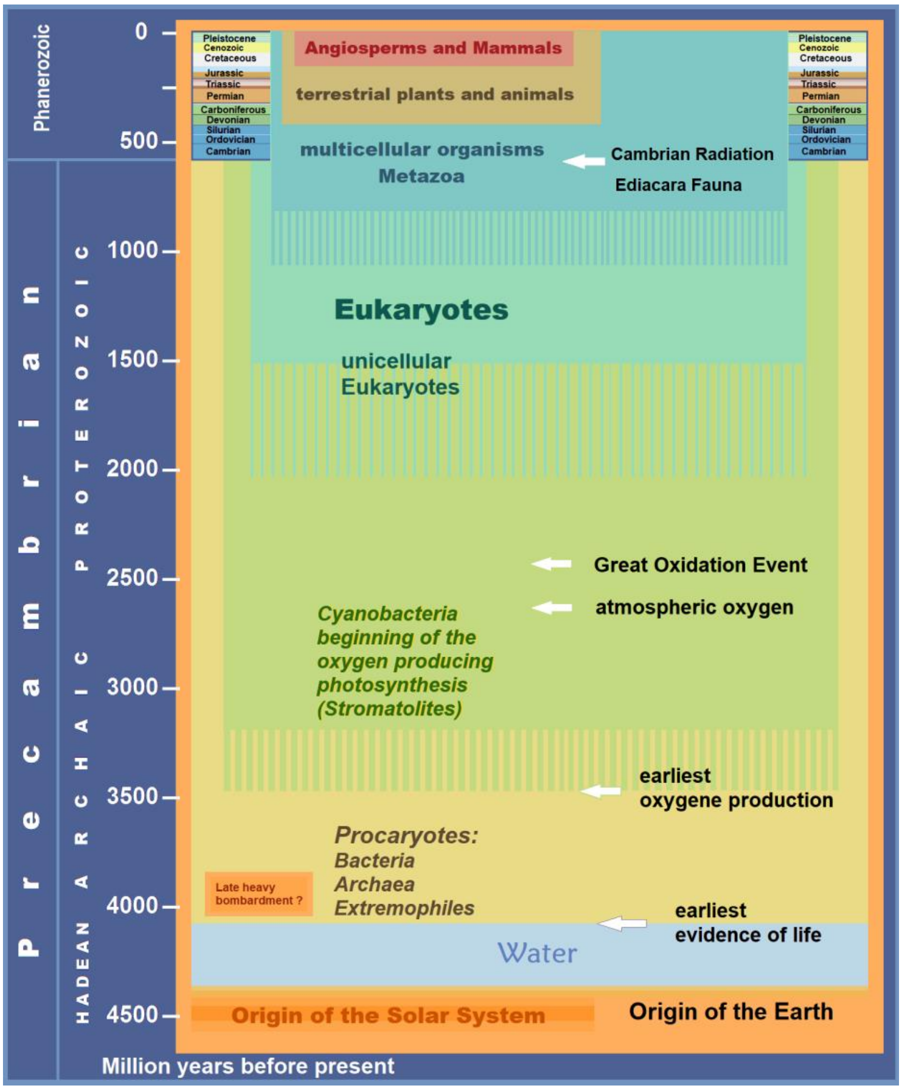


Fig. 1:

Top left and right: table for the Phanerozoic in the same scale.

Older than 540 million years before present: The Precambrian evolution of life.

According to the current state of knowledge the radioactive decay rates are and were constant under all conditions. As long as nothing new emerges here, I stick to this scale as common basis.

Image source: Wikipedia, public domain.

3. Hypothesis

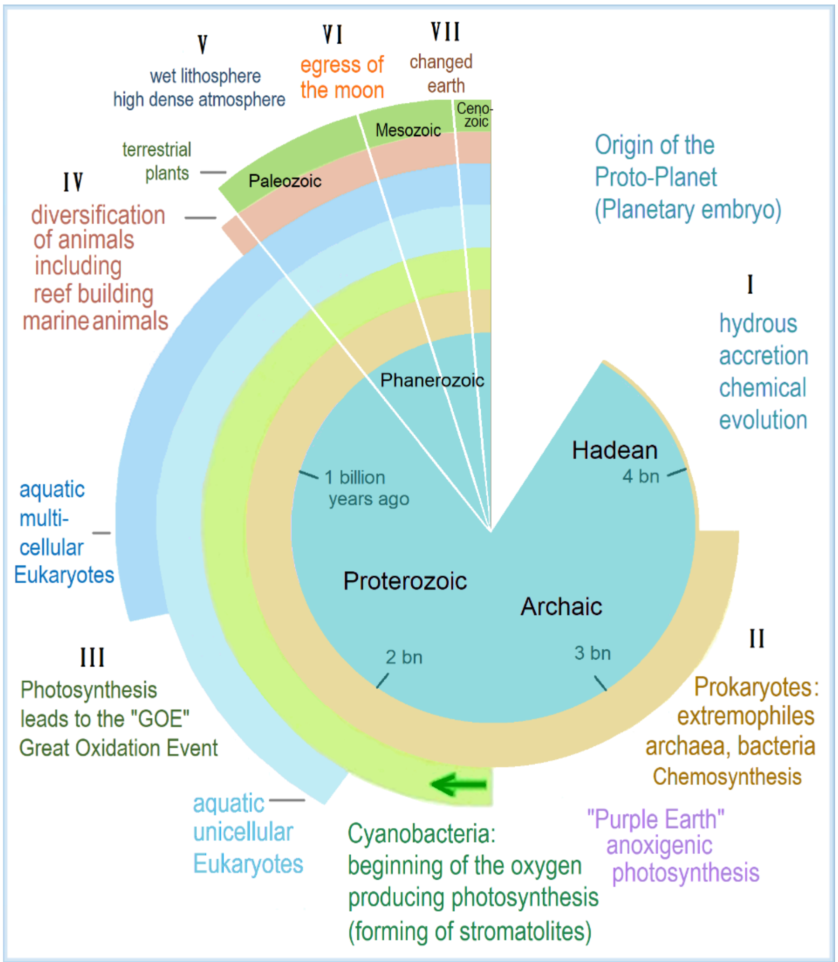


Fig. 2: Timeline (own image)

I: Gas accretion hydrous accretion and beginning of life
II: Begin of biomineralisation
III: Great rise in oxygen enhances biomineralisation
IV: Reef-building organisms
V: Embryonic stages until Carboniferous
VI: Permian-Triassic boundary: emerging of the Moon
VII: See transgressions and Seafloor spreading

3.1. Accretion and beginning of life

"More than 200 molecules in interstellar space have been detected. They range from simple diatomic molecules like H_2 and CO to very large fullerenes, … and include essential ingredients for the origin of life such as water, alkanes, alcohols, ethers, precursors of sugars and amino acids, and P- and S-bearing species." (Henning) [7] In the disks around the T-Tauri stars AS 205A, DR Tau and around FZ Tau is water in abundance [8][9]. The same can have been the case in the disk of our solar system, while it contained all compounds, from which in the Miller-Urey-experiment and newer settings amino acids form [10][11]. The building blocks for life can have been present as a starting basis for the chemical evolution or life existed even before.

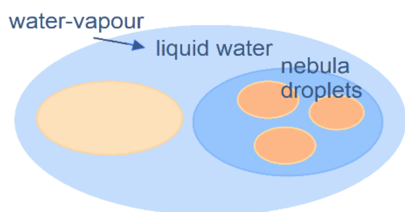


Fig. 3: Protoplanetary disk (artist's impression)

Fig. 4: Primary and secondary aerosols

Water in protoplanetary disks exists in the inner parts as hot or warm gaseous vapour, further away in cold parts as ice evaporating to gaseous water vapour by sublimation [12] [13]. The pressures in the protoplanetary disks observed at present are too low for liquid water. Regions of protoplanetary disks observed today, where astronomers assume that earth-like planets could form, can *later* turn into habitable zones, where they become capable of sustaining liquid water and life comparable to life on earth.

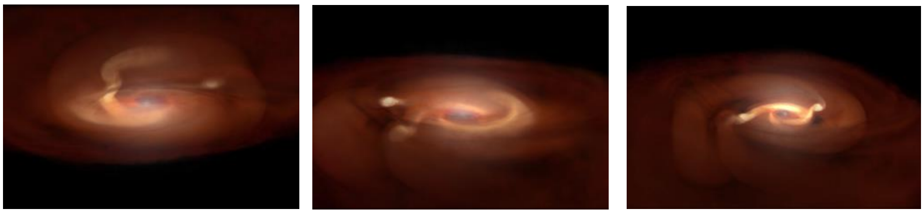


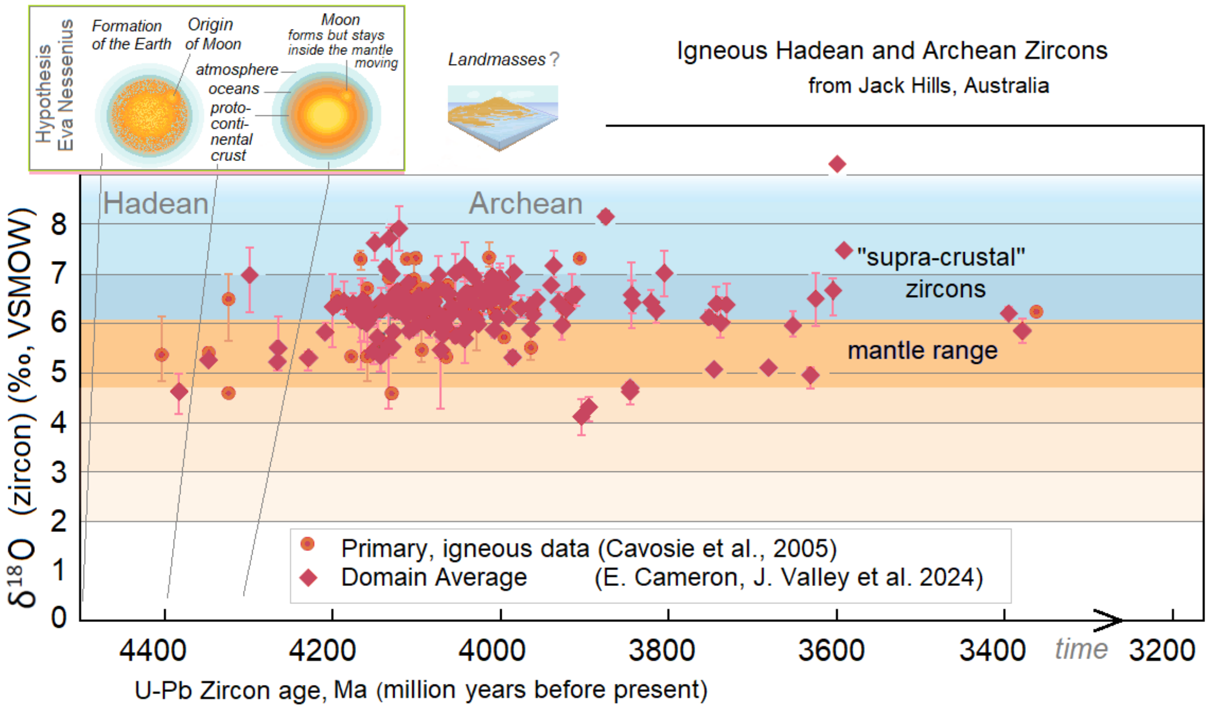
Fig. 5: Photo of a protoplanetary disk, its dust darkening the light of the central star.
Fig. 6 a, b, c: NASA computer visualization: evolution of a young protoplanetary disk
with the begin of planetary formation in the vortices around the protostar. [14]

We study star and planet formation regions 390 to 1500 light years away. We cannot observe planet-forming regions 4.5 billion light years away, from the time when our solar system formed, to have comparable objects with the physical conditions of the past of our Galaxie. We don't know what our solar system and the Proto-Earth looked like 4,5 Ga ago, whether the same conditions prevailed like now in our astronomical neighbourhood. Pressures can have been different than in the protoplanetary disks we observe at present. Based on the theory of a Big Bang at least ~13.8 Ga ago with extremely high density of the universe, the generally accepted time of the formation of the Earth ~ 4.5 Ga was ~ 9.3 Ga after the Big Bang. The average density of the universe was still higher than now. This includes possibly higher pressures in some of the star forming regions. "There remain considerable uncertainties at each step of planet formation. … even our most successful models are built on a shaky foundation. Looking to the future, the most important steps forward may be those that show how planets do *not* form." (A. Morbidelli, 2016). [2] Water in the PDS 70 implies that forming planets have access to a water reservoir (Perotti et al 2023). [15]

Although under known conditions gas giants form around a core with a larger mass, in my scenario the Earth began as gas planet, that lost its gas envelope later. Pressure from a thick high atmosphere made water-vapour condense to fog. Aerosols work as condensation nuclei. Ices enhance the particle growth and are discussed as planet formation mechanism. [16] Fog induces a greenhouse-effect, so does methane [17]. Fog or a primordial soup condensing in the fog with all compounds for life can have enabled an evolution of life with light and warmth in *aqueous* environments. The early Earth can have been comparable to some special type of super Earth [2] [18]. Heavy elements accumulated in the core under increasing heat. Mineral elements above the mantle prevailed in hydrous solutions. Hydrous silicates (colloidal silica) [19] can have worked as matrix for the formation of amino-acids and proteins. [20] Biogenic hydrocolloids and even organic structures may have been the glue for the accreting particles, scientists working in the laboratories would wish to use.[2]

"H^+ irradiation of silicate mineral surfaces produces water molecules … the Itokawa regolith could contain ~20 l m^{-3} of solar-wind-derived water and … such water reservoirs are probably ubiquitous on airless worlds throughout our Galaxy. The production of this isotopically light water reservoir by solar wind implantation into fine-grained silicates may have been … important process in the early Solar System". (Luke Daly, 2021) [21]

"No known rocks have survived from the first 500 million years … studies of single zircons suggest that *some* continental crust formed as early as 4.4 Ga, and that *surface temperatures were low enough for liquid water*. Surface temperatures are inferred from high $\delta^{18}O$ values of zircons. … The hypothesis of a cool early Earth suggests long intervals of relatively temperate surface conditions from 4.4 to 4.0 Ga that were conducive to liquid-water oceans and possibly life. Meteorite impacts during this period may have been less frequent than previously thought." (John Valley, 2002). [5] [6] A cool early Earth allows prokaryote life very soon. **Fig. 7:** [22]



"The crystals appear to *contradict* the conventional notion that the first 500 million years … the Hadean Eon … were a continuously violent and chaotic time, when endless volcanism and continual meteor bombardment kept a global magma ocean simmering across the surface of the newly formed planet. Instead, the chemical make-up of the Jack Hills crystals suggests that they formed in the presence of liquid water, likely even an ocean. These crystals provide evidence that even the very early Earth was cooler and wetter than scientists used to think. A gentler Hadean could have permitted life to evolve *far earlier* … than scientists originally supposed. … the magma that … gave rise to the zircons might have been *formed from what had once been sediments deposited on the floor of an ancient ocean*." (Lindsay, 2006) [23]

Possible, that the magmatism *followed* a cool origin, “that molecular water was present at or near Earth’s surface since at least 4.3 Ga.” (M. Harrison, 2020) [24]
Valley and Cavosie, not familiar with the problems of development to an Earth-sized rocky planet in simulations, assume an initial magma ocean, but place it at an earlier time, at least 4.5 Ga ago, as U-Pb zircon ages are distorted by intracrystalline Pb mobility and the length scales of these clusters make U-Pb age biasing impossible. They say that Pb migrated into the clusters during a 3.4 Ga ***reheating*** event. [25]
In my scenario this was the ***first*** so intense heating up to the Earth surface in places.

“Aerosol particles in the atmosphere … contain a large number of chemical elements and a high content of organic material. … The aerosol sizes with significant atmospheric lifetimes are the same as those of single-celled organisms, and they are predicted by the interplay of aerodynamic drag, surface tension, and gravity. We propose that large populations of such aerosols could have afforded an environment, by means of their ability to concentrate molecules in a wide variety of physical conditions, for key chemical transformations in the prebiotic world. We also suggest that aerosols could have been precursors to life, since it is generally agreed that the common ancestor of terrestrial life was a single-celled organism.”[26] (Ch. Dobson, 2000). Dobson’s findings are also applicable to the fog inside a planet embryo with the properties of a gas planet or a Super-Earth.

“Geochemical reconstruction shows that the ionic composition conducive to the origin of cells … is compatible with emissions of *vapour-dominated zones* of inland geothermal systems. Under an anoxic, CO_2-dominated atmosphere …” (Mulkidjanian, 2012). [27] This means that earliest life need not have originated in oceans or lakes. There may have been forms of life already while the planetary embryo was developing into a gas planet that much later lost its massive gas envelope and became a naked core, called a rocky planet. Carbonaceous chondrites contain carbon in organic compounds. “53Mn-53Cr ages of carbonates in Flensburg indicate that brecciation and contemporaneous formation of the pyrrhotite-carbonate intergrowths by *hydrothermal activities* occurred no later than 4564.6 ± 1.0 Ma” (Addi Bischof, 2021). [28]
ALMA detected snow lines of carbon monoxide around TW Hydrae and a water snow line in the circumstellar disk around V883 Orionis about 1305 light-years away. „We conclude that disks directly inherit water from the star-forming cloud and this water becomes incorporated into … icy bodies, … without substantial chemical alteration.” (John Tobin, 2023) [29] “Water-ice … regulates the efficiency of dust and planetesimal coagulation, … .” (Lucas A. Cieza, 2016) [30] Methanogenic life is independent from rocks. [31] A sphere of magma becoming rock wasn’t necessary for life and not necessary for our planet to form. Many minerals are products of the biomineralization, early primitive organisms make. In the core of a planet embryo, we expect magma and even plasma, in the mantle magma too, but not at the surface. Zircons 4.4 Ga old indicate that *small amounts* of granitic (sensu lato) proto-continents existed. [6]. Data from 3.26 Ga detrital zircons suggest that there was a

"weathering flux" of continental material into Paleoarchean seawater and a low-temperature surface alteration with effects on the oceanic chemistry. [32] Putative fossilized microorganisms, found in ferruginous sedimentary rocks, are at least 3.770 possibly 4.280 Ga old, interpreted as seafloor-hydrothermal vent-related precipitates.[33] "Habitable conditions for life existed … over 800 Myr before the oldest generally accepted microfossils." (Cameron, Blum, Cavosie et al. 2024) [22]
"An increased ratio of 12C to 13C, an indicator of the … carbon-fixing reaction of photosynthesis, is found in sedimentary organic matter dating back to almost four thousand million years ago — a sign of prolific microbial life not long after the Earth's formation. Partial biological control of the terrestrial carbon cycle must have been established very early and was in full operation when the oldest sediments were formed." (Schidlowski 1988) [34] "The mainstream of the sedimentary carbon isotope record can be best interpreted as the geochemical manifestation of the isotope-discriminating properties of the principal CO_2-fixing reactions(s) in biological carbon assimilation, suggesting an extreme degree of evolutionary conservatism in the biochemistry of autotrophic carbon fixation. As a consequence, biological modulation of the geochemical carbon cycle had been established at least 3.8 Ga ago, having been fully operative by the time of formation of the Earth's oldest sediments." (Schidlowski 2001) [35] Also the evolutionary history of life suggests that liquid water already existed in the Hadean. [36]
"With the paleobiological evidence from the currently known Archaean rock record at hand, the existence of microbial (prokaryotic and archaea-prokaryotic) life as from 3,8 b. yr ago seems to be firmly established. Both the paleontological record (microfossils and stromatolites) and the available biogeochemical data … convey a remarkably consistent picture of the existence of microbial ecosystems … as from the very beginning of the presently known sedimentary record. Residual questions primarily centre around the impairment of relevant information in the oldest record that bears a metamorphic overprint … and problems of the time scale of early organic evolution as posed by the unheralded appearance about 3.8 b. yr ago of the prokaryotic cell which leaves an ***uncomfortably narrow time span*** for the initiation and early diversification of life since the Earth's formation some 4.5 b. yr ago". (Manfred Schidlowski, 2009) [37]

If the Earth had been originated from a magma sphere even glowing at the surface, it would not have had enough time to cool down so that such early traces of life could exist. Biomineralization leads to the formation of enormous amounts of solid rocks in the long term. Planetesimals colliding were not the only thing required to form a planet-sized orb. Small parts of the continental crust formed before 3.5 Ga. Zircons in a craton of the Indian subcontinent are in granitoids emplaced at 3.47-3.44 Ga and 3.36-3.28 Ga during two magmatic ***episodes***. [38] They emerged later than microbial life. Magma at depth and water above are not mutually exclusive. The Earth mantle has a water storage capacity, there is "reintroduction of water into planetary interiors via subduction" and "volatile-bearing silicate melts". [39] [40]

Porous silicon can be carbonised, bind biomolecules. [41] Organically bound silicon has physiological effects on temperature tolerance, on forming-processes and others. [42] “Multiple local and global transport processes were essential for linking reactions occurring in separate locations; … no single environmental setting can offer enough chemical and physical diversity for life to originate. … any plausible model for the origin of life must acknowledge the geological complexity and diversity of the Hadean Earth.” (Stüecken, Anderson et al., 2013) [43]

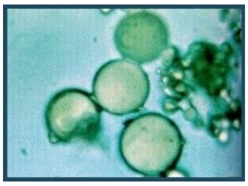


Fig. 8: Microspheres originate, when membrane-like sheaths form around coacervates by self-aggregation. They produce offsprings without genetic material. Probably they played a role in the origin of protocells and cells via hypercycles. Furthermore, there are membrane-enclosed polyenergide multinucleated structures that can grow to enormous sizes called syncytia.

Osmosis can create turgor pressure higher than in the environment. Extremophiles produce substrates for more biochemical reactions and exchanges within ecosystems. Worldwide colonies and biofilms of procaryotes, then eucaryotes also, inhabit the global ecosystem as global organism (Gaia hypothesis). Biofilms provide protection from harmful radiation and toxic minerals in the fluid. The Earth became habitable 800 million years before the oldest known microfossils. Ancient iron-rich rocks were formed by microbes. All the iron the humans use was processed by microbes billions of years ago [1] (see also: Iron sulphur world hypothesis).

Some researchers explain abiogenesis on the early Earth, others say that life did not begin on Earth in the first place. “All … elements for … life are produced during supernova, … dispersed to nebular clouds … . The molecules are incubated within nebular clouds, creating complex organic molecules, … amino acids, proteins, nucleotides, and DNA. These … mixed together, provided protection, nutrients and energy, over billions of years…, in over a trillion different locations, such that … in this galaxy, carbon-DNA-based replicons had been fashioned which evolved into proto-cells, then bacteria. Simultaneously, supernova ejected molten iron and other metals into nebular clouds, … providing the iron cores for … planets and stars. … There is no evidence that life has been or can be produced from non-life on this planet. The belief, that Earth is the centre of the biological universe and that life began **on** Earth, is based on religion and magical thinking.” (Joseph; Schild, 2010). [44] Without being able do decide that, one general statement can be made:

The Precambrian should not be considered as geologic age “after” the planet’s origin but as time of its further formation and growth. Descriptions of the interior are based on the theoretical knowledge. Geophysicists work with measurements relating to the present, astronomers relating to the stages observed today, lying in the past but not far enough in the past for comparisons with the unknown conditions in the Hadean. We assume a hot deep interior and a temperature gradient towards the outer regions. Biomineralisation in early oceans led to the irregular shapes of the early continents.

3. 2. The Beginning of Biomineralisation

In Archean large colonies of archaea and bacteria gained energy for their metabolism first by chemosynthesis, then also anoxygenic photosynthesis ("Purple Earth"), then by oxygen producing photosynthesis, Cyanobacteria building stromatolites. Organic matter from CO_2-fixation was liberated by fermentation or photorespiration into the sediments "pouring out of solutes or secretion of mucus". [45] Diatoms accumulate silicon in their cell walls. The membrane permeases transport *soluble* silicic acid, precursor of biogenic silica, resulting in Siliceous ooze [46]. "Microbially induced sedimentary structures … from … Dresser Formation … comprise tufts, … microscopic laminae are composed of primary carbonaceous matter, pyrite, and hematite, … Complex mat-forming microbial communities likely existed almost 3.5 billion years ago." (Nora Noffke, 2013) [47] Chitin and collagen play a role in skeletal structures in marine invertebrates. Both are organo-templates for calcium and silica biomineralization. [48] Substances generated by the metabolism of microbes, allowed a multitude of processes leading to the densification in oceanic sediments, that successively formed an early oceanic lithosphere by diagenesis.

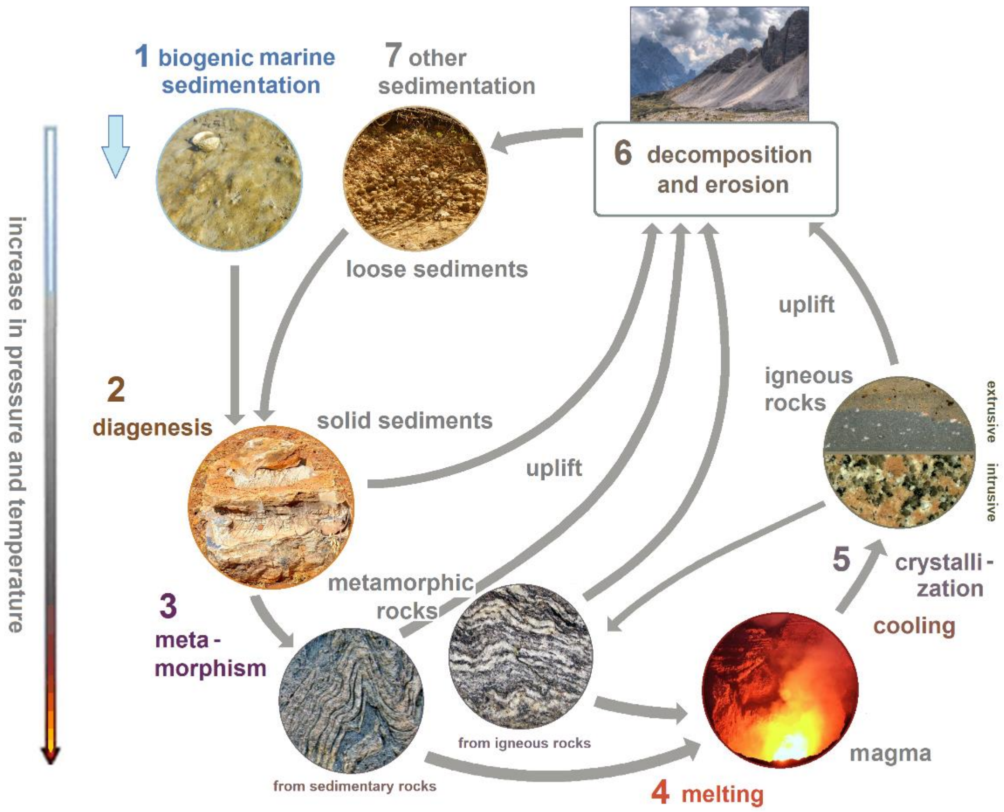


Fig. 9:

The rock cycle with the input of the biogenous marine sediments.

In the rock cycle you can write the number **1** at the marine sedimentation. This feeds important substances into the system. Metaconglomerates in the Jack Hills contain the oldest zircon crystals on earth. The **δ^{18}O** ratio indicates that they formed in the presence of liquid water. They are enclosed in a matrix of partly biogenic substances and are glued together this way. Early life processes are the glue that astronomers need in the experiments for the pebble accretion to work so well that planet-sized bodies can form. The oldest rocks are conserved in Precambrian shields, in cratons. The assumption that at first there was a solid crust, that plate tectonics began at once, one assumption justified by the other, although neither can be verified independently, is a circular conclusion.

Subduction has been proved since Mesozoic, in few areas before.: "The scarcity of high-pressure metamorphic rocks such as eclogite … in Archean cratons has been used to argue that plate tectonics did not operate until Earth had cooled to a critical point, perhaps around the 2.5 Ga Archean-Proterozoic transition." (Mints, Belousova et al. 2010) [49] Yes, but a cooling 2.5 Ga is not consistent with the biogeochemistry. Plate movements began ***locally*** in the late Mesoarchean. [50]

It seems plausible, that the planet embryo was heated up in places to near the surface long after the first forming, plate movements affecting the entire Earth started then. A large part of the earth was not solidified so early. The parts of the lithosphere, which hardened in the Archean, did not have the same dimensions as in the Mesozoic when the massive seafloor spreading began.

3. 3. Great rise in oxygen and biomineralisation

The Hadean and early Archean atmosphere was void of free oxygen O2. Then the oxygenic photosynthesis of algae caused an enrichment of oxygen in the oceans. Oxidation of Fe2+ to Fe3+ led to the deposition of banded iron ore. After all the oxidisable substances in the waters had been chemically bound, the now produced excess oxygen dispersed in the waters and in the atmosphere (Great rise in oxygen). The availability of the free oxygen set in motion the evolution of the eukaryotes and promoted the development of the multicellular organisms. In some biomineralisation processes, the oxidisable substances *outside* of the organisms get oxidised, resulting in a mineral precipitation in the environment. In the Neoproterozoic a rapid rise of marine algae creating food webs with efficient energy transfers, drove ecosystems towards increasingly complex organisms. [51] This means that since the great rise in oxygen, biomineralisation has contributed to an even greater extent to the increase in the Earth's solid mass.

3.4. Reef-building organisms

A submarine growth of lithospheric material also takes place at hydrothermal vents. In Precambrian, most future landmasses were still submarine, but the Panthalassa Ocean did ***not*** have the size drawn on the Paleomap. "The emergence of the Paleo-Tethys … coincided with the formation of … Pangaea. Intensive orogenic movements during this period increased the global land area and elevation." (Li Tian, Haijun Song 2023) [52].
(See Ordovician, Silurian, Devonian, Early Carboniferous, Late Permian.)

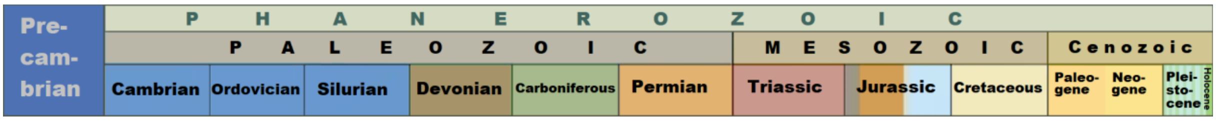


Fig. 10: Names of the geological ages in the Phanerozoic.

With the Cambrian radiation the Phanerozoic evolution of life began. Foraminifera and reef-building organisms such as sponges, corals and other shell-forming animals, mussels, snails, cephalopods, echinoderms, etc. made the lithosphere grow absorbing substances dissolved in the oceans building their shells and skeletons, which they left behind when they died. Parts of the Dolomites were coral reefs in the Tethys Ocean.

3.5. Embryonic stages until Carboniferous

Since Cambrian more and more areas arose above sea-level. The Paleo-Tethys with the Iapetus Ocean and Rheic Ocean were the only deep oceans. A Panthalassa Ocean covering *two thirds* of the planet, did not exist in Carboniferous. The cartographers must draw according to the dogma of a constant Earth size, established by the theory of plate tectonics, although plate tectonics does not contradict the fact that a planet consisted of a smaller mass and circumference in its early phases. Some proponents of the so called "expanding Earth" didn't take into account the Paleo-Tethys on the model globes, some denied subduction, disqualifying themselves from the scientific discourse. Nevertheless, we cannot avoid dealing with the topic of growth again. However: The Paleo-Tethys was the precursor of a part of the Indian Ocean.

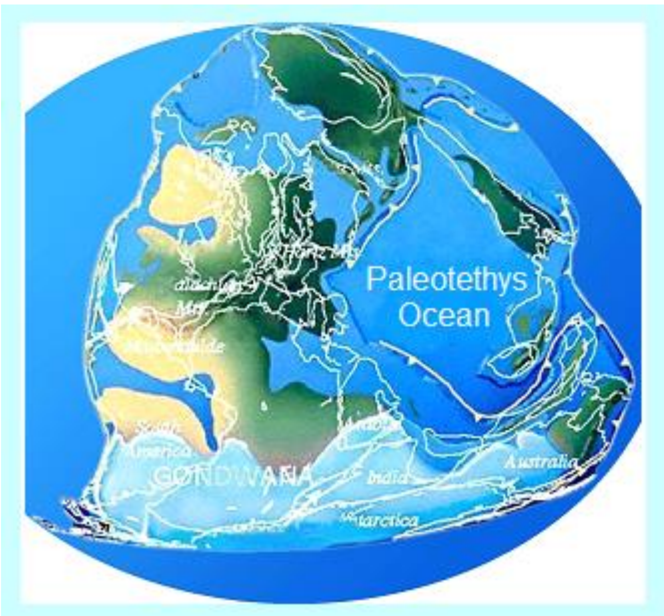


Fig. 11: Late Carboniferous Scotese Paleomap (2003)

Only the areas highlighted were the planet-embryo. The extent of oceans was the totality of large waters in the areas, Scotese marked with white lines including the Paleotethys. If you don't pay attention to the blue ellipse, you see the developmental stage of the Earth's embryo in the Carboniferous. This precursor of the Pangea was a sphere.

There was rich vegetation on marshy grounds and landmasses. The photosynthesis increased the atmospheric oxygen to a maximum in earth history. This planetary embryo contained more water and gases in its body and atmosphere than today, because the outgassing had not progressed that far before the hot global climate that followed End of Permian. The Earth had a lower average density and a larger volume. Giant dragon flies could fly in the dense atmosphere, rich in oxygen.

3.6. Understanding the Phanerozoic based on a review from the Hadean

We go back in time for a moment and will soon return to the Permian and Triassic in order to understand, why the atmosphere must have been very high in the Paleozoic. We look at the development in the context of the evolution of the young solar system. Before the Sun had accumulated enough mass to become a main sequence star, it can have gone through a T-Tauri phase.[53] "Earth's complete condensation included a 300 Earth-mass gigantic gas/ice shell,…" (Herndon, 2013) [54] "The rocky … planets are former giant planet embryos dried … to the bone by the influences of the parent star." (S. Nayakshin 2010) [55]

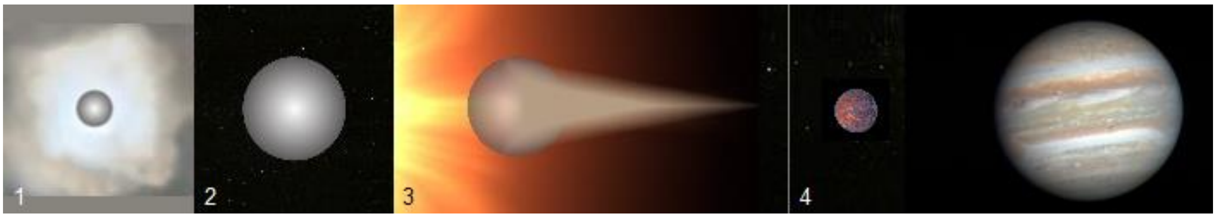


Fig. 12: The protoplanet like a gas giant "rains out" into the centre. [56] The Sun goes through phases of star formation. Due to T-Tauri eruptions with infrared excesses and strong solar winds the gas-envelopes of close young planets decrease. The Earth loses large parts of its atmosphere but not all of it. Based on Herndon's model, the pressures inside are not too low for liquid water. This can be assumed when trying to understand the further developments in the Phanerozoic.

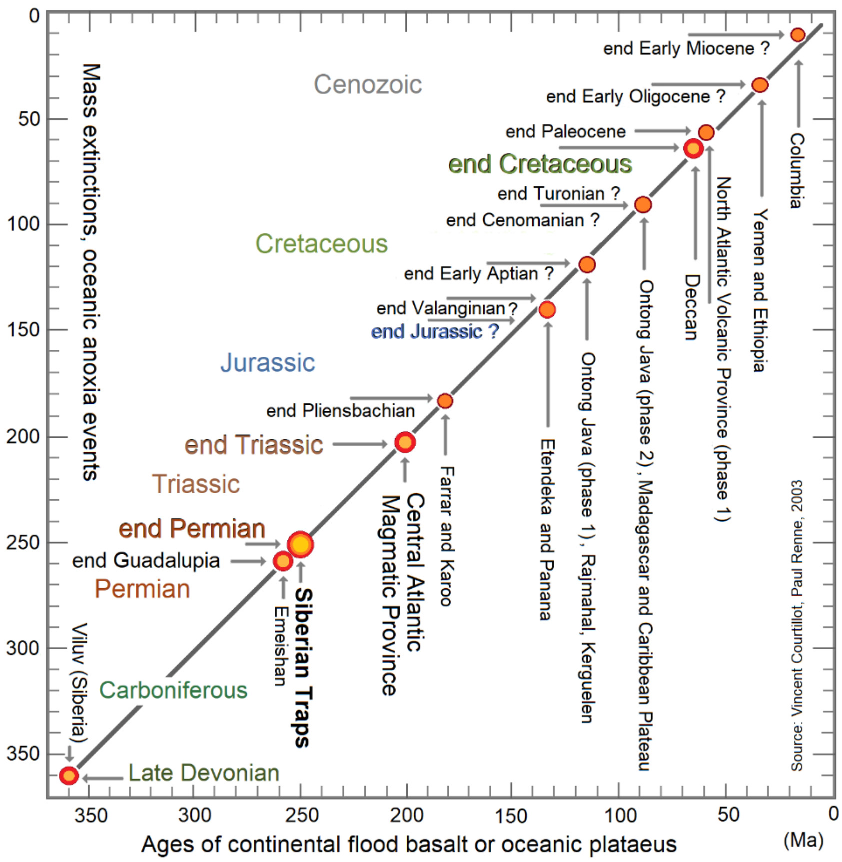


Fig. 13: Timeline [57]

The Late Devonian extinction. End of Permian the Emeishan Traps are the begin of a global catastrophe: Siberian Traps.

What were the causes for the flood basalts and the oceanic plateaus? Volcanism caused by tectonic processes released heat from the magma. What caused them? Plumes for sure.

Did additional cosmic events, besides the Milanković cycles trigger endogenous processes?

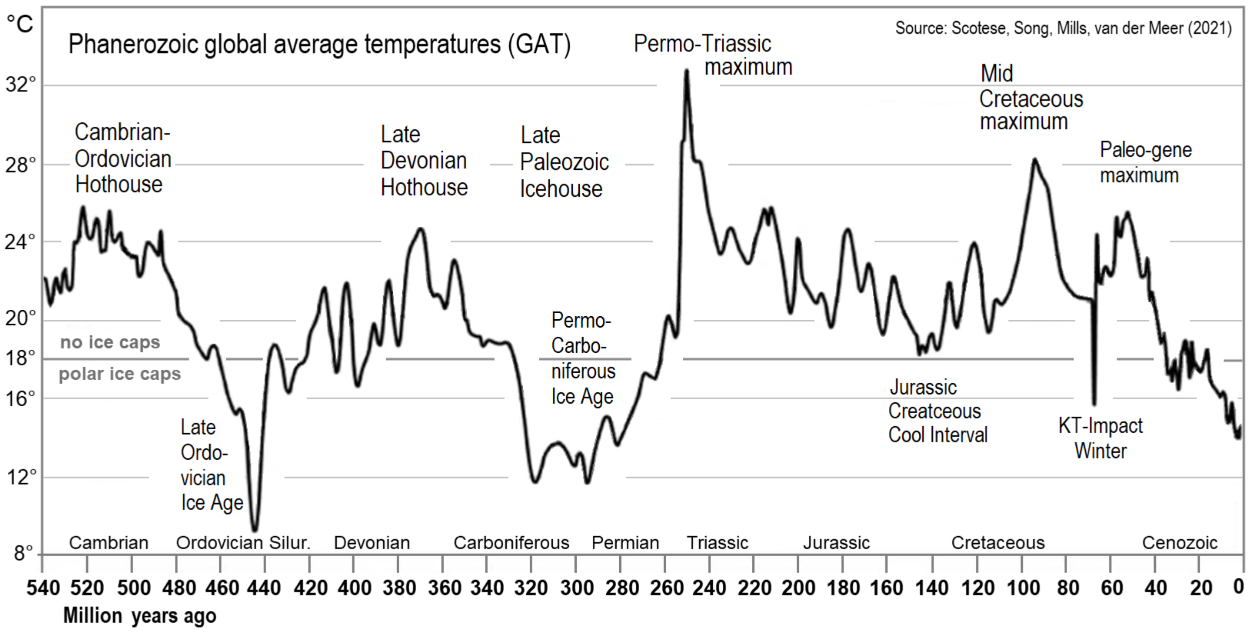


Fig. 14: Global temperatures from Cambrian until Cenozoic. [58]

On the average global paleotemperatures it can be seen that at the Permian-Triassic boundary there must have been an exceptional event that stands out from the normal fluctuations between ice ages and warm periods and the small fluctuations that exist within the long-term fluctuations.

Explanations are being sought for the uneven distribution of continental and oceanic crust. There was no "Paleo-Pacific Ocean" in the size of the hypothetical Panthalassa, but the Paleo-Tethys, the Rheic Ocean and the Iapetus Ocean. Between Cimmeria and Gondwana something underneath moved very slowly from east to west, exerting a westwards pressure resulting in the Caledonian and Variscan orogeny.

"The transition from the Paleo-Tethys to the Neo-Tethys was closely linked to the breakup of Pangaea." [52]. An extraordinary event at the Permian-Triassic boundary changed the nature of the Earth. The Permian ends with very hot climate getting even hotter in Early Triassic for an interesting period of time. [58]

Nuclear processes in the deep Earth mantle [59] and Heat-tsunamis from the mantle [60] enhanced the heating and the outgassing. Waters in lakes and swamp-lands evaporated, land surfaces got exposed to the sun. More infrared radiation penetrated the earth. The hydrosphere and the atmosphere lost water (hydrodynamic escape).

Fig. 15:

a) Late Permian
Paleomap Scotese

b) A baked bread
as a comparison.

c)
Rift Valley
on Mars

“Here we … demonstrate a … fracture mechanism analogous to thermal expansion-driven lithospheric uplift, in which globe-spanning rifting occurs as a consequence of horizontal extension.” (C.A. Tang, A.G. Webb, 2020) [61] In Permian and Triassic Rift valleys formed. Mantle plumes cause fissures, keep them open. Under the rifts decompression caused an expansion in the mantle. [62][63] Asteroid impacts were suspected as cause for the Perm-Triassic extinction, but no significantly elevated iridium values were found. “In the case of the P/Tr boundary, … the effects of the … Siberian Flood Basalt eruptions … seem to dominate, while no clear traces of a major impact have been detected so far.” (Koeberl, 2007) [64] The Araguainha Meteorite is related in time, but it was too small to cause such consequences alone.

3.7. Time and area where the Moon came out of the Earth

Geochemical analyses prove the Moon originated in the Hadean. Its material derives from the proto-earth mantle. [65] Mantle Zircons can survive up to ~ 1500 °C, in short term high-temperature events even more [25]. In my opinion, the U-Pb dating of the oldest zircons on the Moon shows the age of their terrestrial source magma (Zircon inheritance). Conditions to enable the Moon to emerge: energy sources and less gravitation from the Earth. There are several theories for the origin of the moon:

Fission: Increase in centrifugal forces through accelerated Earth rotation. [65]
Problem: The centrifugal force would not be sufficient to overcome the gravitation. An impact-triggered fission provides more energy, but not enough without explosion.
Explosion: A volcanic event fuelled by radioactive energy from the Earth's mantle as energy source ejects the Moon-matter and accelerates it so strongly that it leaves the gravitational field and enters the orbit.
Problem: This one energy source alone would not be sufficient to propel the mass into the orbit of today's Earth.
Giant-Impact: Kinetic energy from a hypothetical Mars sized orb “Theia” colliding.
Problem: The Moon’s isotopic composition is too Earth-like. [65] [66]

The Earth embryo can have been surrounded by a circumplanetary disk (CPD) [67] with influence on the gravitational conditions for the lunar mass emerging from the Earth. I think, the coincidence of several factors on which the different theories are based upon, made the egress possible, even at another time than assumed in the mainstream science.

A sum of factor causing less gravitation reduce the energy required: A smaller Earth, dense atmosphere [6], fast rotation, a still smaller Moon, plus gravitational pull from an ancient cosmic environment (CPD). Morbidelli: "Asteroids and the comets from the Jupiter-Saturn region… ***when the Earth was less than half its present mass***."[68] Addressing changes in size is not welcome among all geologists, since some of the proponents of a growing earth gave inaccurate reasons. [69] Neither the ether nor the expansion of the universe made the Earth grow. Particles from coronal mass ejections entering the poles add little. [70] Cosmic dust and meteorites enter the atmosphere, a large part evaporates, a part reaches the ground [71] bringing a mass gain estimated up to 100.000 tons per year. Accretion and biogenic sediments keep increasing the solid mass. A further growth is not measurable at present because it has slowed down.

Most of the Moon matter originated inside the Earth. Meteorites fell on the Moon after it left the Earth. While the Moon's distance from the Earth was increasing, the Moon's gravitation also collected particles from the CPD. These are two reasons why the Moon's mass was less before. Both, a lower Earth mass and a lower Moon mass facilitated the ascent into the orbit. The acceleration required an enormous amount of energy. For a correct calculation of the energy required, ***all*** the parameters that do ***not*** correspond to today's conditions have to be taken into account.

I doubt, that the Moon already emerged in the Hadean. I found some indications that the Moon remained in the Earth for a long time moving along under the lithosphere, slower than the lithosphere, causing the early plate movements. As a magmatic mass it orbited underground close to the equator, until the lithosphere opened and finally the matter was pushed out. There are traces from the outgoing Moon at the Permian-Triassic boundary. In the Permo-Carboniferous Ice Age with the ice accumulation on Gondwana (Fig. 12) and a decreasing amount of water in the equatorial zone, a pirouette effect accelerated the Earth rotation, so did a phase the Milanković cycles. End of the Permian the average length of day was ~ 22 hours. [72] Centrifugal force alone would not have been sufficient. There must have been also a gigantic volcanic eruption caused by an explosion coming from the core mantle boundary. Scenario:

The Earth still had a high atmosphere in Carboniferous and Permian and a less dense lithosphere. In a time of faster rotation, [65] an explosion happened. "The … source for … additional energy is nuclear fission. … It is feasible to form the Moon through the ejection of terrestrial silicate material triggered by a nuclear explosion at Earths core-mantle boundary (CMB), causing a shock wave propagating through the Earth. … created by … expanding plasma resulting from the explosion disrupts and expels overlying … mantle and crust material. … It is … consistent with the proposed Earth-like water abundances in the early Moon, … and with the early formation of a 'hidden reservoir' at Earth's CMB that is not present in the Moon". (de Meijer et al. 2013) [73][74] A cosmic orb migrating in the solar system can have caused a gravitational interaction with the Earth mantle and lithosphere, triggering the explosion. The Araguainha Meteorite can have been companion of such cosmic orb or a chunk from the emerged moon, that has fallen back to the earth.

"The presence of water in the primary crust implies a more prolonged crystallization of the lunar magma ocean … and suggests that water may have played a key role in the genesis of lunar basalts." [75] Under the model in which the moon formed by collecting hot ejecta from a giant impact the ejecta should have lost all water being degassed almost completely.

Archean sediments on a coast in Australia, indicating paleo-tides, were interpreted that the Moon was already orbiting outside the Earth. [76][77] The author didn't consider other scenarios. A cosmic orb migrating in the solar system can have caused the gravitational effect. [78][79] It did not have to be the Moon. The hypothetical Theia is supposed to have collided with the Earth, but such collision is not proven. In case Theia existed, a gravitational interaction with Theia can have led to the paleo-tides. "Palaeotidal records… from tidal rhythmites may be… abbreviated, … derived periods… frequencies can be misleading." (Williams 1998) [77] He became unsure, but today the cosmological calculations are still based on it. Otto Ampferer (1925) suggested that the breaking up of Pangea was caused by a tearing apart of the Moon.

"The assumption of the Moon's detachment offers the possibility of obtaining sharply delineated lighter clods and heavy masses next to each other on the Earth's surface." (Otto Ampferer, 1925) [80] (Continental crust "Sial" and oceanic crust "Sima").

Fig. 16: Permian-Triassic boundary in south-west Australia with dark grey sediment layers. The Permian-Triassic mass extinction was the heaviest ecological catastrophe in Earth history. [81]

It makes sense to investigate an egress of the Moon end of Permian, do computer simulations with preconditions I mentioned for a small less dense Earth 250 million years ago. The subcrustal motion of the future Moon can be reconstructed. At first, the dilatation of the ocean floors must be reversed admitting a smaller Earth, because most sea-floor spreading happened after Permian. The drifting apart of the Pangea, which was a sphere, occurred on the Pacific side simultaneously. Simulation can start before.

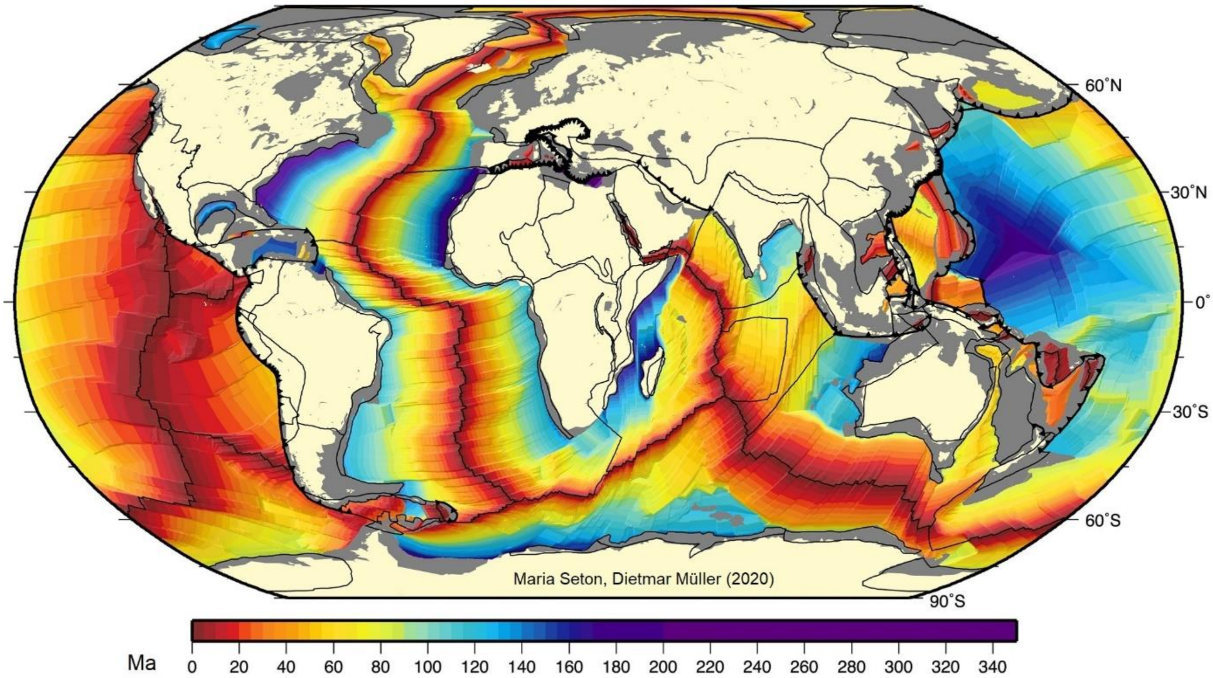


Fig. 17: Times of the origin of the oceanic crusts and traces from the emerging Moon: West-Pacific: the "old hole" is a remnant of the opening of the emerging of the Moon. It was covered by Jurassic ocean-floors afterwards. Cocos plate: area where the Moon once emerged coming from east under the Paleotethys and under the continental crust. Both holes where together as one before extreme seafloor spreading separated them. At both sides Maria Seton et al. (2020) documented areas with very high spreading rates in superfast spreading mode, [82] which in my opinion are the consequences.

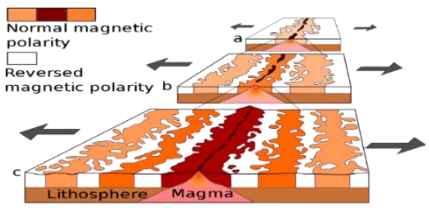
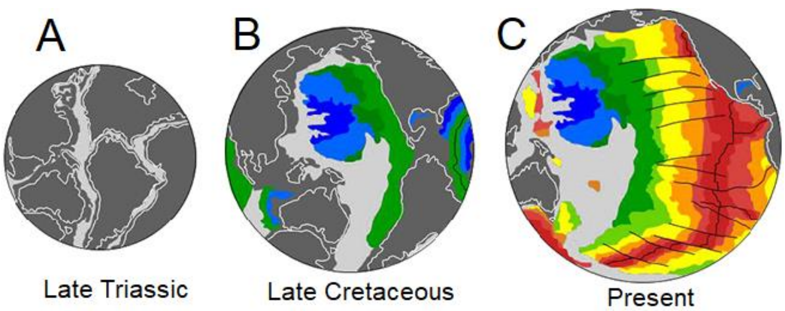


Fig. 18: Seafloor spreading in the World Ocean Floors



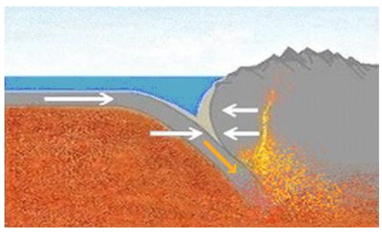


Fig. 19: Critical view on model globes of a growing earth

Fig. 20: Subduction today

A: Paleo-Tethys and the Tethys shouldn't be missing on a paleo-globe.
B: Asymmetrical degrees of subduction led to an asymmetrical Pacific.
C: This shows the consequences of strong subduction, which is denied by the same expansionists who use these model globes overlooking some essential outcomings.

The west part of the "old hole" (blue) is at the Philippine plate. The corresponding east part is the slab of the Farallon Plate [83][84] that was subducted under North America, filling the gap left by the emerged Moon. Then subduction swallowed more ocean floors including the North Pacific rise. The egress was followed by the origin of the Pacific ocean and its asymmetrical structures (map: World Ocean Floors).

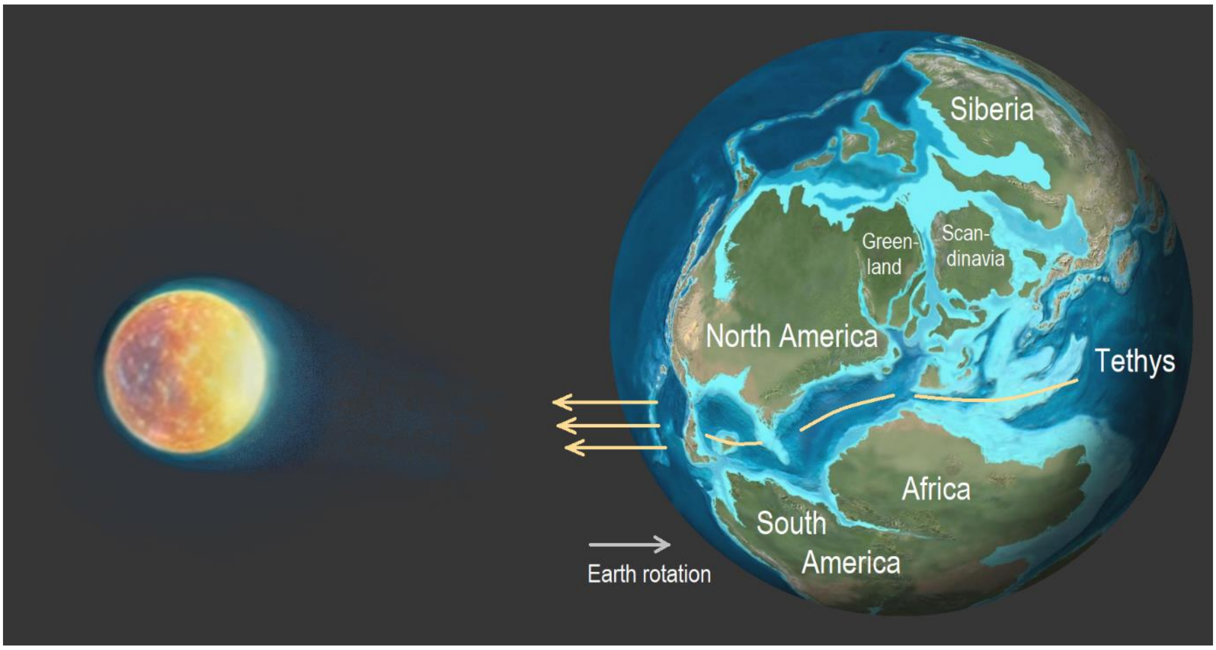


Fig. 21: Late Jurassic, 100 Ma after the egress: the former pathway of the Moon is still visible. (Paleoglobes from Early to Late Jurassic from Ron Blakey. He depicted the Earth with a large Pacific Ocean on the backside because there is a dogma that the Earth had always had the same size, as if the Pacific was already there in the same size, which can't be true.)

"The Earth's rotation and the tidal despinning generate a torque acting on the lithosphere, and producing a net westerly directed rotation of the lithosphere with respect to the underlying mantle." (C. Doglioni, G. Panza, 2015). [85] My scenario for the Paleozoic: While the Earth's rotation to east accelerated, the future lunar mass didn't fully adapt to it, due to inertia, so it made a net westerly movement. Example: A mass moving with a relative drift of 10 cm per year would move 5000 km in 50 million years. The subcrustal motion of the lunar mass westwards caused pressure and heat on the front, decompression melting and plumes on the back of its path. West of the Paleotethys this opened a rift, so the Tethys opened westwards. [86] The breakup of Pangaea opening the Central Atlantic Ocean [87] is a later consequence. In the future Pacific, the material came out in an extreme volcanic eruption. Going upwards its momentum westwards became slower. It ascended over China, then over Siberia. Its gravitation exerted extreme tidal forces that diminished with increasing distance. The ejection caused seismic waves that destabilized many parts of the lithosphere. The Siberian Traps poured out. Since the Triassic ~ 65.000 km of rift valleys opened, large oceanic plateaus and more continental flood basalts formed. "Most provinces agree with a … model in which volcanism may have lasted of the order of 10 Ma, often resulting in continental break-up, … most of the volume was erupted in about 1 Ma or sometimes less." (Courtillot and Renne, 2003) [57].

Today at continental margins Jurassic ocean-floor is the oldest (Fig. 15), except the Permian remnant in the Mediterranean. In Cretaceous, ocean floors broadened more from seafloor spreading at the rifts. In Cenozoic young ocean-floors were added. The Pacific widened much more than the Atlantic. In the east Pacific the Triassic and Jurassic oceanic crust were subducted soon. Space for an "initial subduction" [88]: the extreme slap pull, where the Moon material came out. The Pacific Ring of Fire formed. Nothing comparable exists around the Atlantic. "The rate of mantle overturn slows over time in proportion to the decrease in radioactive heat production." (Morgan, 1999) [59]. Finally, the spreading rates and the subduction rates reached an equilibrium.

The seafloor spreading always happens towards both sides of a midocean ridge. The arrangement of the basalts of the same ages is roughly symmetrical. But between the East Pacific Ridge and the Andes there is neither Jurassic nor Cretaceous crust, although in the West Pacific there is a lot of both. West of North America, even the Neogene is missing. The westward drift of the lithosphere [85] is not the only reason. This is evidence for an extraordinary downwelling, unique on earth, into the space of extremely low pressure in the mantle, the Moon material had left behind.

The Pacific and the Atlantic originated at the same time. There was a huge wound in the crust at the exit of the moon. After it was filled, the seafloor spreading began with more intensity on the Pacific side. It influenced the course of the convection currents so that on the Pacific side there are much higher spreading rates until today (Fig. 15). Today the Pacific Ocean covers about two thirds of the Earth. Why claim that two thirds of the oceanic lithosphere of the planet, that allegedly had the same size since the Precambrian, have been subducted? There is no evidence for such extreme scale. I am not calling into question the subduction, but it leads into circle conclusions to transfer the conditions of present plate tectonics to the distant past. The fact, that the Earth has grown, is not inconsistent with the proven and important fact of subduction.

In Early Triassic the margins of the continental crust did not go deep. There were no Mesozoic sediments putting weight on them, so the subduction started easily without resistance of a deep continental plate margin. Once the subduction had started there, it continued due to the slab pull and the convection currents. Therefore, the Northern Pacific midocean ridge was overthrust by the North-American plate. On the Asian east coasts, where the Philippine plate is, more complicated movements took place.

3.8. Developments after the egress of the Moon

At first the orbital velocity of the Moon was closely connected to the Earth rotation, the velocity of the Earth surface. The velocity slowed down with time and distance. Moon reached an orbit where the Earth's gravitational field is not so strong any more. Its way changed according to the known factors in the Earth-Moon-System.

The newly borne Moon first had an enormous tidal effect on the hydrosphere and the asthenosphere also, when it was still very close to the Earth. Motions inside the Earth caused the alternation between marine transgressions and regressions in Mesozoic. The Muschelkalk Sea, Jurassic Sea and Cretaceous Sea built formations of marine organisms, plants binding CO_2 by photosynthesis are the basis of the food chains. The remains of the diversity of consumers contributed to the increase in solid mass.

Around Antarctica rift valleys opened as well and became active, therefore Africa and the Indian Subcontinent were carried towards Eurasia. Most parts of the ocean floors of the Paleo-Tethys and Tethys disappeared, some were elevated, now hidden in the folded mountains. The fact that the subduction rates and the spreading rates correspond today does not allow to draw conclusions about the proportions of the rates in long past geological eras. It appears that a decompression occurred gradually after the egress, but not to an extent that on earth a disproportion between gravitation and volume would have arisen, as can be seen from the fact that the subduction has swallowed parts of the Pacific oceanic lithosphere. Endogenous energy sources were sufficient, [89] as good gravitational conditions prevailed in the cosmic environment.

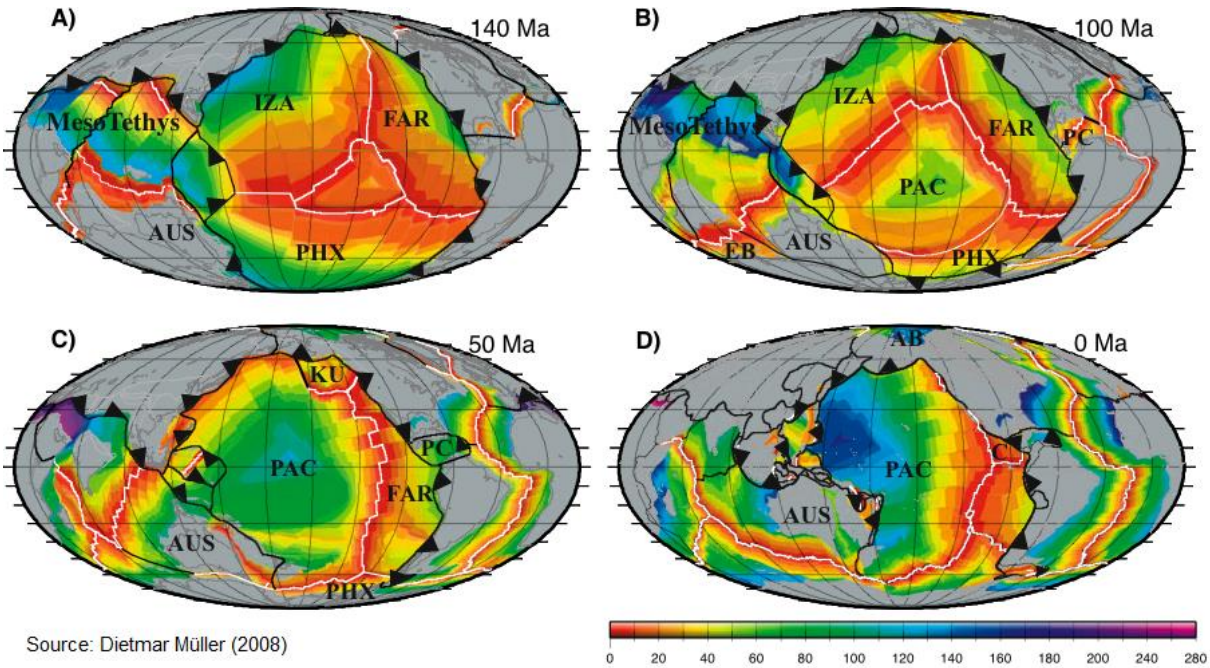


Fig. 22: Origin of the Pacific. A) Late Jurassic, B) Cretaceous, C) Paleogene, D) Holocene
The colour scale on the right refers to the time distance from the depicted geological time.

A) Late Jurassic: The red triangle in the centre is the remnant of the Moon's opening. Because there had been a huge hole in the lithosphere, the seafloor spreading is intense, creating larger areas of ocean floors than at the rifts on the Atlantic side and in the south.
B) Cretaceous: The areas around the opening widened due to extreme seafloor spreading. The rifts move away from the centre due to their activity, getting longer becoming a circle.
C) Paleogene: Most parts of the Izanagi, Farallon and Phoenix plates have disappeared. It is not sure, that they had the extent shown on the illustration. The sum of their extents

did not amount two thirds of the Earth surface. The visual impression on such maps results from the problem, that the cartographers are not allowed to draw the earth at different times with different circumferences.

D) Holocene: Almost nowhere the ocean floors are older than Jurassic. The Tethys and Paleo-Tethys are geologically proven. Because the subterranean future moon drifted under the Tethys before emerging, Permian ocean-floor lies under the Mediterranean Sea.

Around the Atlantic there are almost no subduction zones. Subduction zones do exist in the areas affected by the emerging of the Moon. One unique subduction zone in the Atlantic is at the Puerto Rico Trench, where the Moon emerged on its way from under the Tethys moving westwards. P/Tr: Pacific must have been a magma ocean.

Scotese made some animations of the plate movements, avoiding to leave out those parts of the oceanic lithosphere, that - in my opinion - didn't exist from the beginning, depicting the earth in a constant size. Maybe he doesn't want to offend the colleagues who still believe in the mainstream version of plate tectonics. Watch his animation, figuring, that Pangea was a sphere and at first the Moon was orbiting slowly beneath the lithosphere close to the equator, then opening it between Africa and America. The red triangle, where it comes out, was not separate from the continental margins. The space in between (the alleged ocean floors drawn in light grey) didn't exist yet. Distorted representations arise when you are forced to conform to a scientific dogma. Professor Christopher Scotese once said to me personally: "There is a hidden truth".

Scotese: Animation of Plate Tectonics from Permian to Holocene

4. Considerations

On Earth the Paleozoic and Mesozoic rocks formed under tectonic, climate and biotic conditions, the Moon was never exposed to. After the magmatic Moon material, that had left the Earth's mantle, had cooled down, not much rock formation took place, apart from the effects of meteorites and decay. According to U-Pb dating the Moon rocks are of Precambrian age (4.5 to 2 Ga). In lunar highlands in anorthositic rocks which crystallised from magma, zircons were found. $ZrSiO_4$ is stable until 1650 °C, above that it reacts to ZrO_2 and SiO_2. In a silica undersaturated system like basalt the decomposition happens at lower T. The main component of anorthosite, plagioclase feldspar, has a lower melting point than zircon, between about 1100 °C and 1500 °C. The material, ejected from the not so hot Earth's uppermost mantle end of Permian contained *unmelted* zircons that had been in the future lunar material beneath the proto-continental crust since early Precambrian. So, the dating 4.5 Ga can be correct, although the Moon we see in the cosmos today formed long after the origin of these zircons it brought with it. Just as the rocks on today's Moon have a slightly different composition than the Earth, the lunar material had this slightly different composition when it was still under the lithosphere. That explains its deviating velocity under the lithosphere causing the Paleozoic crustal motions. Underneath the area, where the lunar material was ejected by an explosion, there can have been a georeactor.[90]

In earlier times, if something was not understood, the reason given was that "God" had made it that way. The beauty of nature was taken as proof of "God" and therefore his allegedly proven existence was in turn taken as an explanation for questionable things, to avoid challenges and efforts in developing some scientific understanding. The same can happen in earth and planetary sciences with the hypothetical "Theia", being used as explanation for everything that is still not well understood. We should not go so far as to regard one model of moon's formation, developed with the help of "Theia", as evidence for its existence at that time. That would be circular reasoning too. Mainstream science now uses the Large low-shear-velocity provinces (LLVSPs) [91] [92] as alleged prove for "Theia" and a Giant Impact, which they aren't. LLVSPs could be sunken material from "Theia", they can also be accumulations of subducted slabs, or remnants of the original source of the lunar material. In $CaSiO_3$-Perovskite in the Earth's lower mantle there is an uranium and thorium storage [93], so these provinces may correspond to areas referred to by Herndon as georeactor, that were one of the energy sources for a catastrophic volcanic explosion.

If caused by an impact, that should have influenced the inner structure of the earth. It makes sense to search for an area where the geomorphological structures indicate a possible impact (that could have triggered an explosion), which need not have been so large that half of the Earth was melted. If the moon should have left the earth earlier, the areas it passed subterraneous and where it has left the earth should be investigated in the same way.

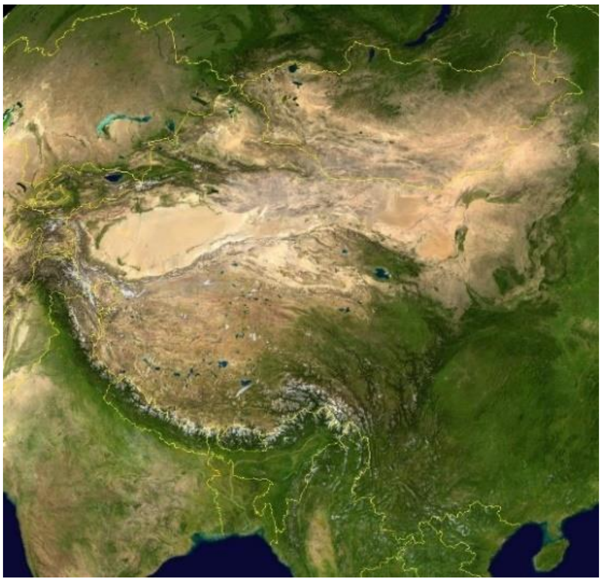


Fig. 23: Under the Tarim Basin seems to be one of the largest impact craters on Earth. [94] Its diameter is about three times that of the Chicxulub crater. It is very deep. The sediments locally exceed 15 km thickness. This may have been the "giant impact", bringing the energy into the Earth's mantle, triggering with high kinetic energy and the seismic waves a volcanic explosion in the area of today's Pacific, so an extreme amount of magma was ejected, the future Moon.

Too small to extinguish all life on Earth, but large enough, to trigger consequences that led to the heaviest mass extinction in Earth history wiping out 81–94% of marine species. [95] Normally after a large impact and/or a very large volcanic eruption, the global temperature drops. [58] At the P/Tr, the Pacific, where the Moon came out, was a magma ocean. This explains the extreme rise in global temperature (Fig. 14).

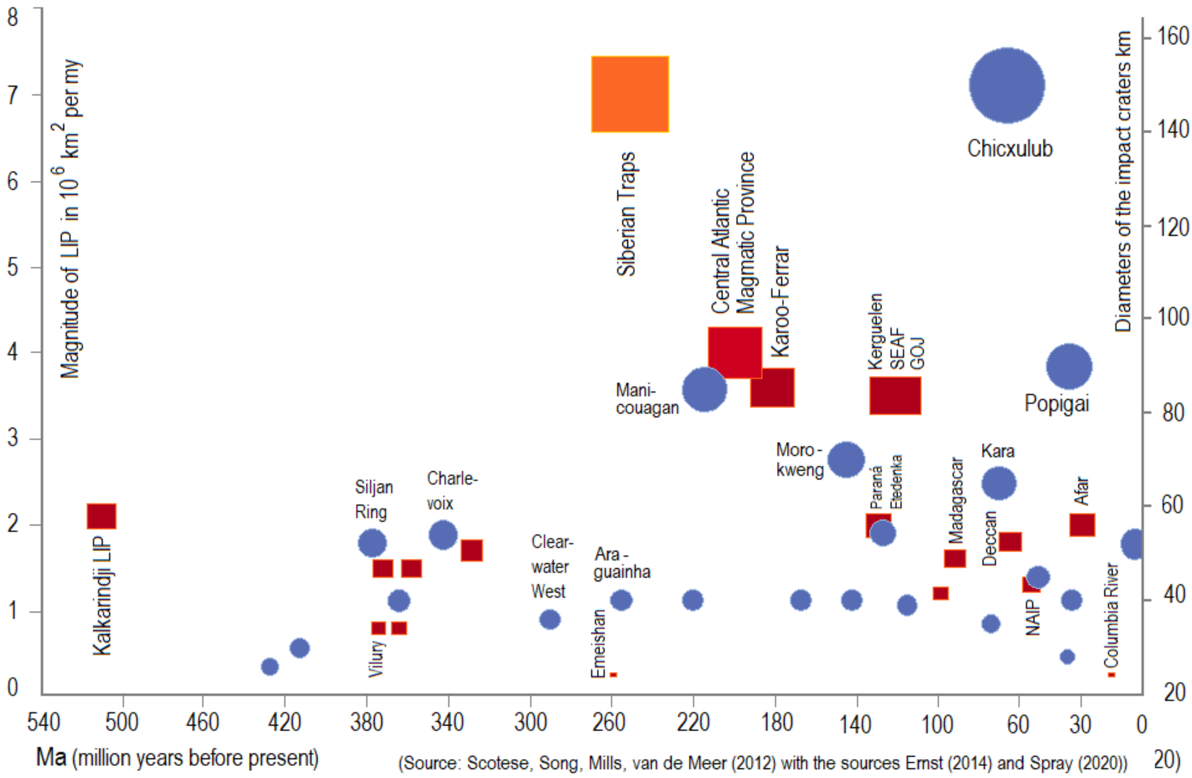


Fig. 24: Bolide impacts and Large Igneous Provinces in the Phanerozoic. [58]

Some large igneous provinces appear to be related to a bolide impact causing earth quakes and volcanism, which isn't always the case. The size ratio between Chicxulub and the North Atlantic Igneous Province (NAIP) shows that the largest impact in this diagram was before a LIP small compared to the Siberian Traps. No large impact in this diagram is related to the beginning of the Siberian Traps, which far exceed all others in magnitude. There can have been an ***endogenic*** geotectonically effective event. The ejection of the lunar mass from the area of today's Pacific and the extreme tidal effect of the Moon crossing of Siberia, still low in orbit, can have triggered these uniquely extreme eruptions with the sharp rise in global temperature (Fig. 14). [95]

It is conceivable that the Earth's rotation was accelerated by an undiscovered impact in the Paleo Tethys. [65] Accelerated motion of the still subcrustal Moon leaving low-pressure zones behind caused a slab pull. As later consequence the future Indian Subcontinent moved towards Asia. The Tarim Basin, the basin southwest of the Munizip Murzuq and the Araguainha crater are on one line. They can be craters from chunks of a large asteroid, one that - like Shoemaker Levy on Jupiter by entering the atmosphere - was torn into chunks striking in a chain. Burgener (2017) considers the Black Sea as an impact crater too. [94] Independently form the question if a big impact triggered the ejection of the Moon: On the southern hemisphere spreading zones opened and grew from an expansion by decompression melting, reaching its maxima in the Mesozoic, and then slowing down and ending.

The Vredefort impact in South Africa can have triggered the eruption of an earlier part of lunar material. A younger part can have merged with it in the orbit cleaning up the circumplanetary disk. Because “It is difficult to reconcile giant-impact models with the compositional similarity of the Earth and Moon without violating angular momentum constraints. … Here we present … simulations suggesting that the Moon could instead be the product of a succession of a variety of smaller collisions. In this scenario, each collision forms a debris disk around the proto-Earth that then accretes to form a moonlet." (Rufu, 2017) [96]

"Isotopic measurements of lunar and terrestrial rocks have revealed that, unlike any other body in the solar system, the Moon is indistinguishable from the Earth for nearly every isotopic system. This observation, however, contradicts predictions by the standard model for the origin of the Moon, the canonical giant impact." (Nielsen, 2021). [97]

"Impacts are not a dominant source for the Hadean zircon population. Geochemical modelling indicates ***extant*** craters well represent global impacts." (Wielicki, Harrison, Schmitt, 2012) [98]. "The temperatures substantiate the existence of wet, minimum-melting conditions within 200 million years of solar system formation." (Watson, Harrison, 2005) [99]. "After an initial hot period, surface temperatures in the late Hadean may have been clement beneath an atmosphere containing greenhouse gases over an ocean-dominated planetary surface." (Arndt, 2012) [100].

However, this does not mean that the Earth was the same size as in today's paleo-world-maps and paleo-globes and that there was a huge precursor of the Pacific called Panthalassa in the size of today's Pacific, but that the precursors of today's continents were still largely below the water level. This water above the future land masses was the Panthalassa Ocean, which John Valley and other researchers have proven with their geochemical analyses.

My point is, to free the geosciences from the alleged necessity to calculate the egress of the Moon before the beginning of life, since the merely hypothetical Theia impact would have required a complete reboot for the Earth, so the geologists refrain from not evaluating the very interesting geotectonic processes in a cosmological context.

5. Conclusion

In the introduction I mentioned the severe problems of the theory of pebble accretion falsified by a "bouncing frustration". Then I came to life processes as necessary glue. In many depictions of the rock cycle, the biogenic marine sediments were forgotten. They ***don't*** arise from erosion. Organisms absorb dissolved substances from gases and liquids and produce solid materials (biomineralization). Their mortal remains are incorporated into the earth's substance and become parts of the geological cycles. Biogenic sediments feed solid mass into the system. Methanogenic microorganisms may have already lived in molecular clouds from which our solar system was formed. [31] The Earth can have formed without an entirely molten phase in the beginning, where much water would have gotten lost. Say goodbye to the picture of the Hadean Earth as entirely glowing sphere.

In the Earth's embryo life existed from the beginning and survived. The phases in which the interior glowed up to the surface in places occurred later, in the Archean. The hot phases in Precambrian and Phanerozoic were not the remnants of an initial state, but later stages. Dispelling the outdated ideas about the beginning is the key to better understanding of the Earth's history from Paleoarchean until the Mesozoic era.

The subterranean moving Moon can have been the cause for early plate movements. I marked the area where the egress of the Moon can have taken place. Energy sources were sufficient under suitable cosmic conditions. For Permian it is possible to prove or disprove my scenario by computer simulations. Please scrutinize my hypothesis. If it works, we will have a logical explainable sequence of natural developments.

The great Austrian geologist Otto Ampferer should be honoured posthumously, just like Alfred Wegener, who was also not believed during his lifetime and was booed at his speech in Frankfurt am Main (1912) because there was not yet sufficient evidence. Half a century later the evidence was provided by the further geological research. For Otto Ampferer (1925) it may require a century or more. Earth sciences have always been researching thoroughly needing time. Ott Christoph Hilgenberg (1933), who intended to complete Wegener's work with his opinion that the Pacific side of the Earth has also widened, should also be honoured along with the other two.

5. Acknowledgements

I thank the personal reviewers for comments and Isabel Horstmann for proofreading. I declare that I have no competing interests.

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Fig. 6: Computer simulation of a developing protoplanetary disk
NASA's Goddard Space Flight Centre, the Advanced Visualization Laboratory at the National Centre for Supercomputing Applications.
A. Boley, A. Kritsuk and M. Norman, April 14, 2021
https://science.nasa.gov/resource/protoplanetary-disk/

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