About evolution before Cambrian Explosion

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Abstract

A more detailed TGD inspired vision about how life might have evolved in TGD Universe during pre-Cambrian era before relatively rapid expansion of Earth size by a factor of 2 assumed in TGD versions of Expanding Earth model predicting that cosmic expansion takes place in given scale as rapid jerks rather than continuously as in ordinary cosmology. The key ingredients besides standard facts are TGD inspired interpretation for Cambrian Explosion (CE), of dark matter as large h_{eff} phases, and the notion of magnetic flux tubes. These provide TGD view about Pollack's Exclusion Zones (EZs, as key factors in the evolution of life.

1 Introduction

In the following I try to formulate a more detailed TGD inspired vision about how life might have evolved in TGD Universe during pre-Cambrian era before relatively rapid expansion of Earth size by a factor of 2 assumed in TGD versions of Expanding Earth model predicting that cosmic expansion takes place in given scale as rapid jerks rather than continuously as in ordinary cosmology. The key ingredients besides standard facts are TGD inspired interpretation for Cambrian Explosion (CE) [K1, K3], of dark matter as large h_{eff} phases [K2], and the notion of magnetic flux tubes. These provide TGD view about Pollack's Exclusion Zones (EZs, [I1]) as key factors in the evolution of life.

I have gather useful links from web to build a more detailed version of TGD vision and it is perhaps appropriate to give a list of some useful links - they appear also as references. These links might help reader considerably in getting touch about the problems involved and reader can easily find more.

1. Data related to Mars
   Two generations of windblown sediments on Mars:
   https://www.nasa.gov/content/two-generations-of-windblown-sediments-on-mars,
   Sedimentary Mars: http://science.nasa.gov/science-news/science-at-nasa/2000/ast04dec_2/ *Liquid flows in Mars today: NASA confirms evidence*:
   http://www.sciencedaily.com/releases/2015/09/150928094114.htm

2. Metabolism
   Microbial metabolism: https://en.wikipedia.org/wiki/Microbial_metabolism
   Electron transport chain: http://en.wikipedia.org/wiki/Electron_transport_chain
   Metal-eating microbes in African lake could solve mystery of the planet's iron deposits: http://www.sciencedaily.com/releases/2015/09/150909125005.htm

3. When did photosythesis emerge?
   Ancient rocks record first evidence for photosynthesis that made oxygen
   http://www.sciencedaily.com/releases/2015/10/151006192107.htm
   Cyanobacteria: https://en.wikipedia.org/wiki/Cyanobacteria

4. When did oxygenation really occur?
   Great Oxygenation Event: https://en.wikipedia.org/wiki/Great_Oxygenation_Event
   Mass-Independent Sulfur Isotopic Compositions in Stratospheric Volcanic Eruptions: http://www.sciencemag.org/content/315/5808/84.abstract
   Neoarchean carbonateassociated sulfate records positive $\Delta^{33}S$ anomalies
   http://www.sciencemag.org/content/346/6210/739.abstract
   Great Oxidation Event "a misnomer":
   http://www.abc.net.au/science/articles/2014/02/20/3948092.htm
   An Oxygen-poor "Boring" Ocean Challenged Evolution of Early Life
   http://ucrtoday.ucr.edu/12843

5. The role of iron
   Evidence for a persistently iron-rich ocean changes views on Earth's early history
   http://www.sciencedaily.com/releases/2011/09/110907132052.htm

2 What happened before Cambrian explosion?

The story about evolution of life is constructed from empirical findings based on certain geological, chemical, and isotope signatures. The study of sediment rocks makes possible reasonably reliable age determinations but involves assumptions about the rate of sedimentation. Water, ice, acids, salt, plants, animals, and changes in temperature contribute to weathering and cause erosion involves water, ice, snow, wind, waves and gravity as agents and leads to sedimentation. Also organic material forms sediments both on land and at ocean floors.

Isotope ratios serve as signatures since they are different in inanimate and living matter because those for living matter reflect those in atmosphere and are affected by cosmic rays. The concentrations of various elements are important signatures: mention only oxygen, nitrogen, sulphur compounds such as sulphide, hydrogen sulphide. and sulphate iron, and molybden.

The story involves great uncertainties and should not be taken only as a story. In the following TGD view about how life evolved before Cambrian Explosion (CE) about .6 gy ago is summarized. The Pre-Cambrian part of TGD inspired story differs dramatically from the official narrative since only lakes would have been present whereas official story assumes oceans and continents. Earth would have very much like Mars before CE - even its radius would have been essentially same (half of the recent radius of Earth). This suggests that Mars could teach us a lot about the period before CE 1. The deviations seem to explain its paradoxical looking aspects of the standard story.

1. Life according to TGD evolved in underground oceans and at the surface of Earth containing lakes but no oceans. The lifeforms at the surface of Earth were prokaryotes whereas the life in underground oceans consisted of relatively complex photo-synthesizing eukaryotes.

2. The recent data from Mars 1 gives an idea what the situation at Earth was during CE since the radius of Earth at that time was very nearly same as that of Mars now. There is evidence for sedimentation and for water near to and even at the surface provided quite recently. The life at the surface of Earth before CE consisted mainly of prokaryotes and very simple mono-cellular eukaryotes and something like this is expected at the surface of Mars now.

3. Already around 3.5 gy ago prokaryotes using sulphate as energy metabolite were present. Photo-synthesizing cyanobacteria emerged about 3.2 gy ago 3. They became later the plasmids of plant cells responsible for photo-synthesis. The problem of the standard story is that this did not lead to oxygenation of the hypothetic oceans and rapid evolution of eukaryotes and multi-cellulars.

   In standard vision one can explain the absence of oxygen based life in hypothetic oceans by the presence of oxygen sinks. It is known that the ancient oceans (shallow oceans, lakes, or ponds in TGD) were oxygen poor and iron rich. The data about Mars 1 - the red planet because of iron rusting - makes possible to test the feasibility of this hypothesis. The oxygen produced by the cyanobacteria was used to the formation of rusted iron layers giving rise to iron ores. For 1.8 gy ago the formation of rusted iron layers ceased. A possible explanation is that all iron was used. The ores could have been also generated by bacteria using iron as metabolite 2 and transforming it to iron oxide. There are however now iron ores after 1-8 gy: did these bacteria lose the fight for survival?

   In TGD Earth atmosphere remained oxygen poor since the small lakes could not produce enough oxygen to induce the oxygenation of the atmosphere. The lakes however gained gradually oxygen. First it went to the oxidation of iron.

4. A general belief has been that about 2.4 gy ago Great Oxidation Event (GOE) 4 occurred. The basic evidence for GEO is from volcano eruptions, which seem to have produced anomalously small amount of sulphur after 2.4 gy. The reason would have been the formation of sulphate SO_4 from atmospheric oxygen and sulphur emanating from volcano.

   This evidence has been however challenged by measuring sulphur anomalies for recent volcanic eruptions. Their sign varies in time scale of month changing from positive to negative 4. It is quite possible that GOE is an illusion.

5. There is also problem related to to the "boring period" 1.8-.8 gy. It seems that the hypothetic oceans remained still oxygen poor and iron rich 4. It has been also suggested that the boring period continued up to CE: the first animals after CE could have oxygenated Earth's oceans 4. In TGD Universe GOE is indeed illusion for the simple reason that oceans did not exist! Life was boring at the surface of Earth from 3.5 gy to .6 gy.

6. Life would have evolved in underground seas containing oxygenated water, probably already 3.2 gy ago, and making possible photo-synthesis and cellular respiration. Animal cells formed by eukaryotes with nucleus carrying genome with prokaryotes, which later became mitochondria. Plant cells emerged when these eukaryotes engulfed also cyanobacteria, which made photo-synthesis possible. The highly developed eukaryotes were burst to the surface as the radius of Earth increased by a factor two in geologically short time scale. Oceans containing oxygen rich water were formed. CE can be equated with GOE in TGD picture.

   Plants are divided into green and red algae, a small group of fresh water monocellulars glaucophytes, and land plants. Land plants must have emerged after CE. Red algae are multi-cellulars (corals are representative example). Also green algae can be multi-cellulars and land plants are thought to have developed from them. An interesting question is whether multi-cellular plants and animals emerged already before CE as the findings would suggest.

The basic objection against this vision is that photo-synthesis is not possible underground. Did photo-synthesis occur in shallow lakes storing chemical energy transferred to the underground seas. This does not seem a plausible option but cannot be excluded. The volcanoes and hydrothermal vents bring water from underground. The water contains ground water and ordinary sea water, which ended underground in various manners, and also magmatic component. The geothermal vents and most volcanoes are however associated with the regions were tectonic plates meet and should not have existed before CE.

TGD inspired model [K3] for Pollack's EZs [I1] suggests a solution of the problem. The formation of these negatively charged regions of water is induced by solar radiation, IR radiation at energies which correspond to metabolic energy quantum, and also at energies corresponding to THz frequency. TGD based model proposes that the protons from EZ becomes large h_{eff} protons at magnetic flux tubes associated with EZ. These flux tubes could be quite long and extend

to the underground oceans. Dark photons with energy spectrum containing that of bio-photons could travel along these flux tubes. This suggests that solar radiation transforms partially to dark photons, which travel along flux tubes to the underground sea and transform to ordinary photons caught by photo-synthesizing cells.

Interestingly, also the temperature of Earth is such that thermal radiation would be in visible region and one cannot exclude the possibility that dark photons emerge also from this source. This would make possible also cell respiration and oxygen rich water.

Skeptic is of course wondering whether the flux tubes were long enough.

1. The basic idea about dark matter residing at magnetic flux tubes emerged in TGD from Blackman's findings [J1] about quantal looking effects of ELF em fields on vertebrate brain by assigning them to cyclotron frequencies Ca^{++} ions in endogenous magnetic field $B_{end} = .2$ Gauss, which is by a factor 2/5 weaker than the recent magnetic field of Earth and assigning large non-standard value of Planck constant to the flux tubes so that the energies of ELF quanta are above thermal energies.

2. The value of magnetic field at flux tubes of "personal" magnetic bodies of organisms have B_{end} in its value spectrum. B_{end} could be conserved in evolution somewhat like the salinity of ancient (underground) ocean. The flux tubes of B_{end} would have transformed the photons of solar radiation to dark cyclotron photons allowing them to travel to underground sea and transform back to ordinary photons to be absorbed by pre-plant cells. I have proposed that a similar mechanism is at work in biological body and could explain the reported ability of some people to survive without any obvious metabolic energy feed.

3 How the cellular life could have evolved before CE?

In the following I summarize what looks the most plausible view about evolution of life in TGD framework. I represent first basic classification to make reading easier.

3.1 Basic classification of lifeforms

Lifeforms are classified into prokarioties (no cell nucleus) and eukaryotes (cell nucleus).

1. Prokaryotes are mono-cellular and have no separate cell nucleus. They are divided into bacteria and archea. Bacteria do not have genome but only circular DNA strand and usually accompanied by an almost palindrome. Archea have also genes. Cyanobacteria are simplest photo-synthetizing cells: these prokaryotes have been engulfed by eukaryotes to form plant cells containing them as plasmids. Plant cells contain also mitochondria believed also to be ancient prokaryotes which have been "eaten" by eukaryotes. Plants cells contain both mitochondria and plastids whereas animal cells contain only mitochondria.

2. Eukaryotes have cell nucleus containing the genome. Eukaryotes divide into three kingdoms: animals, plants, and fungi. Fungi can be said to be between animals and plants: they do not perform photo-synthesis but have cell walls.

3.2 Prokaryote-eukaryote distinction

From the existing data one can conclude that during pre-Cambrian period only prokaryotes existed at the at surface of earth - presumably in small lakes in TGD Universe and ocean floors in standard Universe. The first photo-synthetizing prokaryotes - cyanobacteria - emerged about 3.2 gy ago and their predecessors where prokaryotes extracting metabolic energy from sulphate. Cyanobacteria 3 are able to survive in practically any imaginable environment:

Cyanobacteria are arguably the most successful group of microorganisms on earth. They are the most genetically diverse; they occupy a broad range of habitats across all latitudes, widespread in freshwater, marine, and terrestrial ecosystems, and they are found in the most extreme niches such as hot springs, salt works, and hypersaline bays. Photoautotrophic, oxygen-producing cyanobacteria created the conditions in the planet's early atmosphere that directed the evolution of aerobic

metabolism and eukaryotic photo-synthesis. Cyanobacteria fulfil vital ecological functions in the world's oceans, being important contributors to global carbon and nitrogen budgets.

It is therefore natural to assume that cyanobacteria migrated to underground ocean through pores and fractures at the floor of lakes. They would have fused with pre-eukaryotes having only cell nucleus but no metabolic machinery to become chloroplasts. This would have given rise to the first eukaryotes able to perform photo-synthesis. The primitive cells prokaryotes defining pre-mitochondria would have also fused with these pre-eukaryotes so that both pre-plant and pre-animal cells wold have emerged. Why there is no evidence for the existence of pre-mitochondria as independent cells at the surface of Earth? Did they emerge first underground oceans, where photo-synthesis was not possible and disappeared in the fusion with pre-eukaryotes and therefore left no trace about their existence on the surface of Earth?

Both photo-synthesis and cell respiration involve so called electron transport chain (ETC 2) as a basic structural element. It is associated with any membrane structure and in photo-synthesis it captures the energy of photon and in cell respiration it catches the biochemical energy which could be emitted as photon so that the fundamental mechanism is the same. This suggests that cell respiration emerged as a modification of photo-synthesis a the level of prokaryotes first. Before the emergence of mitochondria and plastids ETC associated with pre-eukaryote membrane would have served the role of mitochondria or plastid. Using business language, mitochondria and plastids meant "outsourcing" of photosynthesis and cellular respiration.

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[J1] Blackman CF. *Effect of Electrical and Magnetic Fields on the Nervous System*, pages 331–355. Plenum, New York, 1994.

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