PAST OF THE PRESENT

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Abstract

There is a natural curiosity to know and understand our origins and beginnings. In this article some of the scientific and philosophical views on the subject are summarised and important sequential evolutionary steps leading to advent of man traced. The authors believe that crises in biosphere, though seemingly retarding the steps in evolution, lead to more efficient life forms.

Inquisitiveness is inherent to man. This combined with intelligence must have made even the primitive man wonder about the universe and his own place in it. Who made it, When, and Why ? What is its future and Where to ? This perennial curiosity gave rise not only to religion but also to philosophy and science. Inspite of all the scientific and technical progress made, the very same questions still puzzle the modern man. The collective wisdom of philosophers and scientists has enabled to forward plausible answers to atleast some of these questions. A new question surfaces—is there an antiuniverse ?

It is believed by many that the vast universe was once condensed into an ultra-dense, ultra-small 'ylem'—the primeval atom or primeval nucleus. How this primeval nucleus was created or how matter was packed into it to an inconceivable density are problems only men with strong religious or scientific convictions have the courage to answer.

This primordial unit exploded about 15 billion years (Ga) ago—the Big Bang—and gave rise to energy and matter, space and time. The Big Bang comes fascinatingly close to the postulates made by ancient Indian seer-scientists who believed that in the beginning there was only the HIRANAYAGARBHA (primeval nucelus=source of all power) that exploded, accompanied by the eternal sound OM (ॐ) to give rise to the universe.

The Rg-Ved, the most ancient scripture of the Indians, describes the creation thus (Rg-Ved, Book X, Hymns 72, 121, 129, etc.) :

Then was non-existent nor existent
There was no realm of air, no sky beyond it
Death was not then, nor there was aught immortal
Darkness there was, concealed was indiscriminated chaos
All that existed then was void and formless
Existence from non-existence arose
Who verily knows and who can declare it
Whence it was born and whence came creation
In the beginning rose Hiranayagarbha
Born only Lord of all created beings
He the first origin of this creation
Whether He made it all or did not make it !

As if in response to it, thousands of years later, Bertrand Russel exclaimed 'Whether it was or whether it was not, it is what it is' (*The Scientific Outlook*, Allen & Unwin Ltd., London, p. 122, 1949).

Even today no hard facts are available regarding the origin of the universe. It is presumed that 10^{-43} seconds after the Big Bang (ABB) the universe was just 10^{-28} centimetre in diameter. At 10^{-35} seconds ABB the universe expanded to 10^{-24} centimetere, continued cooling and developed a negative gravity like condition that inflated it exponentially to the size of a soft ball (Gore, 1983). Towards the end of this split-nannosecond epoch, the universe became reheated and strong electroweak forces began to materialize. Energy began to congeal into particles of matter like quarks and electrons and antimatter—matter with an opposite charge.

The universe grew to the size of our Solar System 10^{-6} seconds ABB. The quarks combined to form neutrons. Some of the neutrons decayed into protons. Matter and antimatter annihilated each other. There was slightly more matter—an excess of about one in a billion protons and one in a billion electrons (Adair, 1988). This excess comprises the matter in the universe today. If antimatter also exists in our universe today it cannot be more than 1 part in 10 million of matter (Alfvén, 1967). The protons and neutrons fused into nuclei three minutes ABB to form a deutron. Through a rapid succession of neutron captures and electron emissions all elements were built in the first burst of expansion. The present chemical composition of the universe was decided within half an hour ABB (Fowler, 1956).

The temperature of the universe was 250 million degrees when it was 1 hour old. The temperature dropped to 6,000 degrees (temperature of our sun) 2,00,000 years ABB and fell to about 100 degrees below freezing point of water on its 250 millionth birthday (Gamow, 1956). At this point matter became gravitationally more important than radiant energy. Radiation separated from matter and light could travel through space. The matter which was uniformly spread in the form of a thin gas broke up into giant gas clouds—the protogalaxies. This gas soon condensed into stars and formed quasars and galaxies (Nicolson, 1979).

The galaxies, perhaps 10 billion in number, comprise innumerable star systems, big and small, with their own suns and planets. Our galaxy **Akashganga** or Milky Way was formed around 10 Ga ago. Our Solar System came into existence probably around 4.8 Ga before present (BP), condensed from a cloud of hydrogen and helium. The Earth possibly formed soon thereafter as evidenced by radioisotope dates. Ancient Indian seer-scientists calculated that the earth was formed, 1,972,949, 088 years BP. This figure is in the right order of magnitude as compared to other postulates. The earth is only a medium-sized planet and its comparative size in the universe may be compared to that of a particle of dust in the Indian Ocean. The planets orbiting the Sun have a cumulative mass that is about one seven-hundredth of the mass of the Sun.

Unlike the time of origin of the universe and the long period following that, the history of the last 4.5 Ga on the earth is documentable to some extent. To follow this history it would be convenient to assume that the Solar System is only a day old and accordingly one hour of the clock represents a time period of 200 million years (Ma) (Geological Clock—Plate 1). The zero hour naturally started 4.8 Ga BP. On this time scale the earth came into being about 90 minutes after the solar system was formed, i.e., at 1.30 a.m. Next 2 hours and 30 minutes, i.e., 500 Ma were spent in cooling of the surface and in the formation of terrestrial rocks, the oldest of which at Isua in Greenland have been dated to be around 3.8 Ga old.

During the course of cooling of the surface large amounts of water vapour and gases were released. These condensed and fell as torrential rains for cons and formed the mighty oceans. The major agencies responsible for land erosion, viz., air and water became active by the end of the 5th hour, i.e., about 3.5 Ga BP, and this erosion of terrestrial rocks and their redeposition in the ocean gave rise to the first sedimentary rocks. Life elements apparently appeared around this time. It is not an event that need happen again and again. It was perhaps enough for it to happen once. When exactly this event happened we do not know for sure. No rocks have been found that have survived from the earliest 600 Ma of earth history that may well have encompassed initiation of biological activity. According to a recent interpretation abiogenesis could have happened as early as 4,200-4,000 Ma BP in deep ocean hydrothermal vents and 4,000-3,700 Ma BP on the surface of the Earth. Multiple extinctions and possibly origins are suggested (Maher & Stevenson, 1988).

How the most important event in the history of this planet, which makes it unique atleast in our solar system, the appearance of life in an ocean of lifeless matter, came about ? Opinions differ. According to some, life was created supernaturally while others believe, it is created continuously from the nonliving. Organic signatures have been found in asteroids suggesting wide-spread distribution of organic matter in the Solar System. Complex organic molecules could have been transported to Earth from remote location. Most scientists now accept that the origin of life was by abiogenic synthesis. Creation of an organism demands the right substances in the right proportions and in the right arrangement under right conditions. The sea had the necessary constituents, infact it gradually turned into a dilute 'broth', sterile and oxygen-free. Life perhaps began at the interface of solid, liquid and gaseous surfaces where normally there is an energy influx. Water, carbon and hydrogen, the primary sources in life-forming process essentially remain the same. It is interesting that all living systems are made primarily of hydrogen, carbon, nitrogen, oxygen and sulphur, the most common elements in the universe. The dilute 'broth', activated by solar energy and lightning first formed the amino-acids, then proteins and gradually the first organism. It has been suggested that ribonucleic acid probably was the first biological polymer to be formed. Infinite number of proteins can be created using over twenty amino-acids in various combinations and sequences. No wonder, every species of plants or animals possesses different proteins. The primeval organism was of microscopic size, prokaryotic organisation and a generalised, simple morphology. Having arisen in an oceanic broth of organic molecules it lived upon them by fermentation ; no oxygen was then present. In the process the organisms consumed their heritance, as we are consuming ours,of coal and oil. However, the waste product carbon dioxide came to the rescue ($C_6H_{12}O_6 \rightarrow 2CO_2+2C_2H_5OH+$energy). It entered the ocean and the atmosphere. The process of photosynthesis was invented before the organism exhausted the supply of organic molecules. The by-product of photosynthesis is oxygen, a new source of energy, used through a process of cold combustion called respiration ($C_6H_{12}O_6 + 6O_2 = 6CO_2 + 6H_2O +$energy). The diversification of anaerobic biota and origin of anaerobic photosynthetic bacteria took place by 10 O'clock. The advent of diversified forms took another 3 hours, the first evidence being at about 13.00 hours or 2.2 Ga BP. The complex systems of organelles and membranes developed between 2 and 1 Ga BP. The oldest eukaryote—organism with a definite nucleus—has been recorded around 16.00 hours or 1.6 Ga BP (cf. Schopf, 1983).

So far the biota reproduced asexually. It developed sexual reproduction around

17.30 hours and surprisingly gave birth to Death, in the process losing its immortality. Death in its true form now started stalking life. The first identifiable animal made its debut perhaps as late as 18.30 hours, or 1.1 Ga BP.

The plant life that developed in the sea as early as 5 O'clock remained confined to water till as late as 21.45 hours, or 450 Ma BP. It mostly comprised blue-green, red, brown and green algae. The sun's radiation contains ultra-violet rays which the living cell can not tolerate. Water very effectively absorbs this radiation and therefore as long as ultra-violet rays reached the earth in quantity, life remained confined to water. With the release of oxygen through photosynthesis, a layer of ozone gradually developed high in the atmosphere and formed a protective cover that absorbed the ultra-violet radiation. With this important event the organism could safely emerge from water and populate the earth and air.

Around 21.45 hours began the colonisation of land by the plants and then events moved in quick succession. Aquatic plants required no roots as they were in direct contact with the nourishing medium and there was hardly any need for anchorage. However, the transition from aquatic to terrestrial mode of living required development of organs suited to perform specific functions. And thus, evolved the root, shoot, leaf and the reproductive organs. Mosses and liverworts were the first to possess distinct leaves and stems. Ferns, Equisetales and Lycopods developed roots, enabling them to absorb nutrients efficiently in liquid form. These Equisetales and Lycopods rose to heights of 30 metres or more and formed luxuriant forests (cf. Seward, 1932). With this the process of greening of the earth was stablised.

The living world is not just the animal/plant divide. It is now considered to belong to 3 urkingdoms, viz., Eubacteria, Archebacteria and Eukaryota and five independent kingdoms, viz., Monera, Protista, Mycota, Zoa and Planta. Whereas the Zoa (animals) lack a cell wall, plants, fungi and algae are characterized by the presence of rigid cell walls consisting of cellulose, chitin and heteropolysaccharides, respectively. Curiously, in both sea-water and blood, the concentration of salts, especially the proportion of sodium and potassium chlorides, is identical. These salts are compounds which the animals took with them as they made their perilous journey on to the land. The sweat that we exude is nothing but seawater.

Gradually new plant groups appeared on the scene. Their genetic material had an enormous opportunity to change and modify due to ultra-violet radiation and fluctuating climatic conditions. Some could not compete and quickly vanished. Others changed their form, became adapted and evolved as new plant groups. A few of these groups persist even today but with changed composition. At times large areas with luxuriant vegetation subsided and became entombed in the sediment load brought by giant rivers. Through complex physical and chemical changes the entombed vegetation became transformed into coal over millions of years which is the mainstay of the present day energy requirements. Oil, the other source of energy, was also formed of vegetal matter, but its origin is in a coastal/marine environment. Major coal deposits were laid down between 23.00 and 22.15 hours.

By experimentation, permutation, combination and mutation arose the Angiosperms or the flowering plants, the main components of the vegetation on most parts of the habitable land. Whether the first angiosperm was a relative of the present day palms or a distant cousin of Champaka (*Michelia champaca*) is not established.

The sudden appearance of angiosperms about half an hour ago, i.e., at 23.30 hours was preceded by a large scale realignment of continental blocks. India, that lay near

the south pole for most of the time as part of the Gondwana Supercontinent, broke reins and migrated a few thousand kilometres northwards to collide with Asia and in the process formed the mightiest and loftiest mountain ranges on the earth—The Himalaya —only 7 minutes ago.

And where was the *Homo sapiens* during all this time ? He appeared on the scene just about 30 seconds ago. His forebear roamed the earth much before that and he remains the product of his biological inheritance, i.e., his genes continue to mutate. In general, the effects of mutation are detrimental but some mutations are beneficial and useful otherwise there would be no evolution. On this time scale the first civilisation, that of the Indus Valley, is only 10^{-1} second old. Now we are at the end of the day. Is there going to be another day for the human race or is this the last day ?

Man knows that he has evolved and is evolving further. Although man is the last entry to this natural world, he is unique in many ways. No other animal has influenced the environment as man has. He has almost developed the capacity to divert natural selection by conscious direction and harness many a forces of nature which if not controlled rationally may devour the master. The question is not whether man will survive but will he perish alone or take all the living world with him ? Or, will he let Nature take its own course ? Who knows ? May be HE knows, or knows not ! Humans are so unpredictable. It also depends on the level of intelligence of future generations.

However, the geological record shows that extinction of any organism is by no means a catastrophe. It is just a progressive evolutionary sequence. Life forms have survived threats, injuries and losses with innovations and improvements. Each one of the extinctions in the geological past has been answered with more dynamic cause and effect modifications. For example, the accumulation of oxygen—toxic to majority of organisms living around 1 Ga BP—prompted the evolution of aerobic bacteria. It thus increased the efficiency of the organisms to derive biochemical energy. These bacteria were originally symbiotic and later coalesced with one another to form the eukaryotic cells. These in turn became multicellular, leading to the entire biota of today through a number of stages of appearances and extinctions. Each extinction has paved way for newer and more efficient forms of life. For example, one of the major extinctions, that of the dinosaurs at 66 Ma BP, cleared the way for the first primates to develop.

Each crisis in the biosphere though seemingly retarding the steps in evolution has led to progress in a multifold way. The inherent pulse (in our belief **Shakti**) in the biosphere has ensured that growth or expansion is the rule and that each tragedy motivates and accelerates evolution of the biosphere. There is an eternal fight between the '*sura*' and '*asura*' shaktis. The asura shakti creates hurdles but the sura shakti—the primordial energy or the *aatman*—clears the hurdles. Even the nuclear holocaust, or the so-called nuclear winter or the hole in the ozone layer, cannot be the end of life on the earth. The biosphere prepares after each catastrophe for a better and improved form of life. For example, after the dinosaurs—the mammals, and after the primitive mammals the primate and the man. Or, after early land plants pteridophytes, pteridosperms, bennettites, conifers and finally the angiosperms. The succeeding life forms will naturally be different from present day plants and animals. These will be more efficient life forms.

What about the universe ? It is still expanding but already the velocity may be slowing down. Some day it will reach maximum permissible expansion and recontraction may then begin. All matter will again become concentrated in the primeval nucleus—the Hiranayagarbha—compressed to a certain maximum density, possibly a hund-

red million million times denser than water. And then another Big Bang ! So will continue the cycle.

Lord Krishna says in the Srimad Bhagwat Gita 'all beings remain unmanifest in the beginning; they become manifest in the middle. After death they certainly become unmanifest. What lamentation can there be with regard to them ?' What is the meaning of this profound statement in interpreting the natural world and the universe at large ? As the living beings live and die, so do the stars, galaxies and the universes. It is the Universal Law !

Acknowledgements

The data presented in the geological clock and the dates of various events have been gathered from various sources. We thank Dr. Nilamber Awasthi for help with data collection and Shri P. K. Bajpai for drafting the figure. Professor H. Y. Mohan Ram critically read the manuscript and gave many helpful suggestions. We are much obliged to him.

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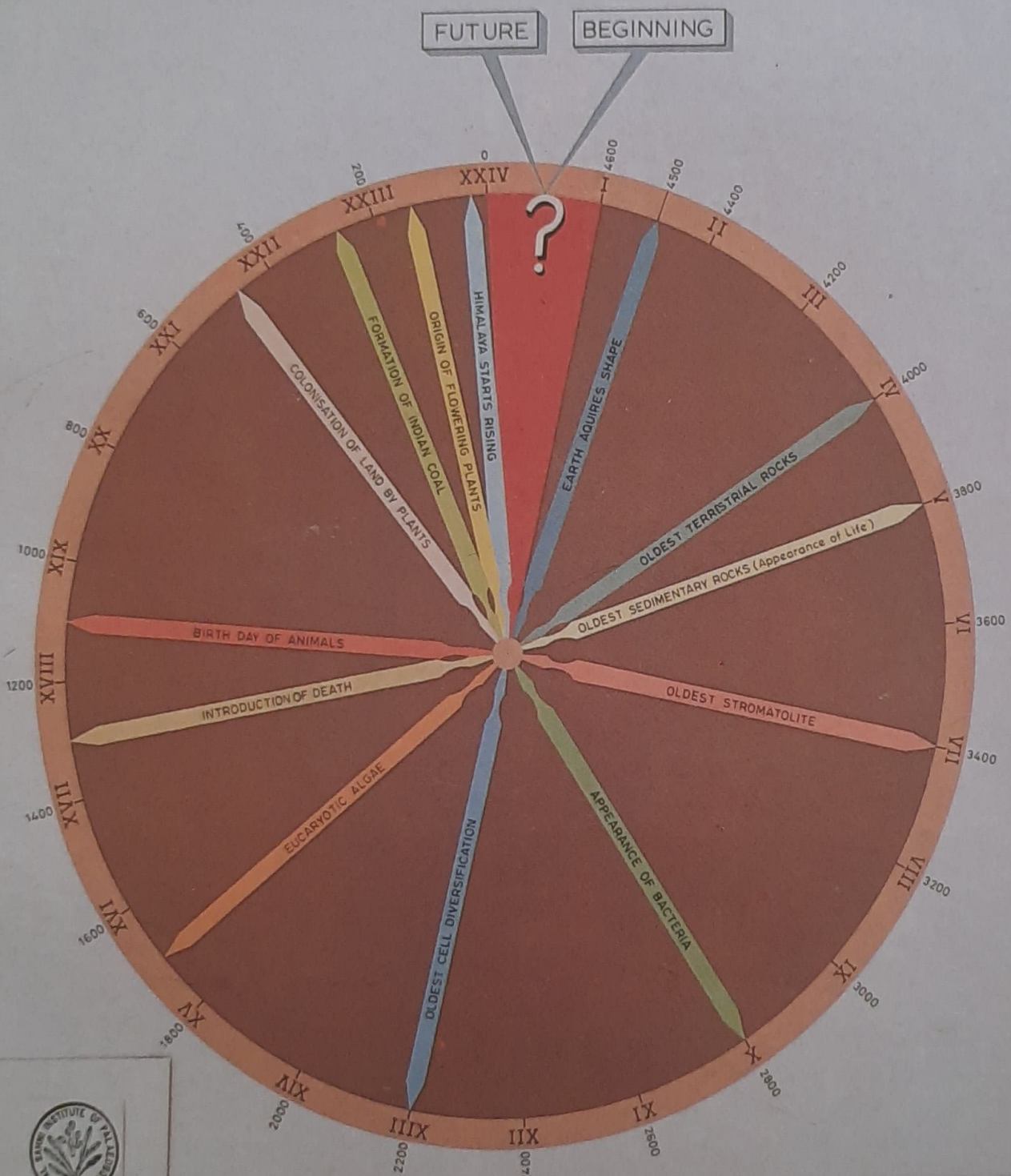
GEOLOGICAL CLOCK

IF 4,800 MILLION YEARS = 24 HOURS THEN:



IF LAST 480 CRORE YEARS = 24 hours THEN

EARTH AQUIRES SHAPE AT	0. 30 hours	INTRODUCTION OF DEATH AT	17.30 hours
OLDEST TERRESTRIAL ROCKS FORMED AT	04.00 hours	APPEARANCE OF ANIMALS AT	18.30 hours
OLDEST SEDIMENTARY ROCKS FORMED AT	05.00 hours	COLONISATION OF LAND BY PLANTS AT	21.40 hours
FIRST APPEARANCE OF LIFE AT	05.00 hours	FORMATION OF INDIAN COAL AT	22.45 hours
APPEARANCE OF BACTERIA AT	10.00 hours	FLOWERING PLANTS APPEARED AT	23.25 hours
OLDEST CELL DIVERSIFICATION AT	13.00 hours	RISE OF HIMALAYA AT	23.53 hours
FIRST EUKARYOTIC ALGAE AT	15.30 hours	MAN APPEARS AT	23.59.30 hours