

## Earth Science Education on Cross Road in India

(“Lead kindly Light” for an ethical existence.)

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### Prologue

On 18<sup>th</sup> and 19<sup>th</sup> of October, 2024, the Earth Sc. Department of IIT- Bombay, under the dynamic leadership of Prof. Radhakrishna, held an interesting brain-storming session on “Earth Science Education on Cross Road in India” attended by many learned Earth Scientists. The sole purpose was to refine the Earth Science Education and Techniques for the benefit of both Students and Employers. I had the opportunity to witness the Val-function of the Seminar and received the Foundation Day Felicitation as one of the Founder Members of the Department.

### Brief Elucidation

Yes, the Earth Science Education is on cross road, not only in India but in the world in general, because: (7 points emphasised below):

1. In early 1980s, the doyen of Indian Geology Dr.B.P.Radhakrishna, while addressing the Geology students of the Institute, said “Earth is bejewelled- *Ratnagarva Vasundhra*”. The duty of the Geologist is to bring out these *Ratnas* (Gold, Diamond , Coal & Oil etc.) to sustain the family of Man. Soon after I attended a felicitation meeting at School of Mines, Dhanbad where the mining stalwart Mr. A.N.Banerji was honoured with Life Time Achievement award, but was stunned at his reply “I have made the largest number of pockmarks and holes on earth’s surface and degraded the land, yet the geologists are honouring me ”. I could imagine, “The *Ratnakr* of yore converted to *Valmiki*. But he put the Geologists on cross road.”
2. T.P.Flawn, in the opening chapter of his book Environment Geology emphasises the 1969 Commandment of USBM to their Geologists “Thou shall not tear apart the land, nor contaminate the water or pollute the air, but supply mineral matters to the Society”. But the Bureau did not specify “How”, putting their Geologists on Cross Road.
3. The famous Ecologist Aldo Leopold proposed a formula for Standard of Living as:  $L = A \cdot E \cdot T / P$ , where L is Standard of Living, A is Availability of Resources, E is Energy, T is Technology and P is for Population).

Looking around India, one sees people living in mineral rich belt are invariably found reeling under poverty but those consuming maximum amount of resources, the quality of life is not desirable. It appears, the value of Man in Society increases by the distance he maintains from the primary resource, for example, the Miner at the mine face and the Mineral Trader in the city market: clearly a societal aberration or Geologist in dilemma or on Cross road.

A curious observation in the imagery of India showing Night Lights, is a conspicuous dark circular region at the centre where most coal fields lie and supply the very basic material to produce electricity.

4. The Technophilic Index of a mineral/material say Lead or Copper is decided by the amounts of its production or use in the Society. While on use, a minute fraction of the material leaks from the utility cycle into the air, water and soil of the region. This is known as Pollution Index of the concerned metal. The more we mine or use, the more is the leakage to the environment making pollution a fait accompli for a mineral hungry society. Geologist, the discoverer and

supplier of minerals can not absolve from the responsibility by saying “It is the musket that kills, not the Musketeer”. Self-realisation puts Geologists on cross road.

5. Normally, the parents and progeny (offspring) are identical in nature irrespective of humans, animals or plants. If life has arisen from the rock, the siliceous earth ought to have given rise to a siliceous life indeed. But the biosphere is exclusively carbonaceous. The properties of Clay minerals show primeval characters of life such as Eating- Excreting (Cation Exchange), high fidelity replication, symmetrical growth and species variation etc. go to show that life did start with Silicate but immobility and “Complacency”(Stronger Covalency) of Silicon was an hindrance compared to the highly mobile Carbon which took over the grandeur of orchestration of life on the proto-earth. Silicon lost and Carbon gained. Geologists are aware of complete absence of native Silicon on the siliceous earth since last 4 billion years, but face today the free introduction of the element into the carbonaceous world to tap solar energy or for production Si-wafer or Chips. Transplant of Chips in body has been attempted. The resurrection of the elemental Silicon into the regime of victorious Carbon in the organic world needs surveillance. As such use of Silicone in body has been found to be carcinogenic and Si-Chips implanted are known to have been rejected. In this great experiment in Silicon the Geologists are in cross road too.
6. The first lesson a Geoscientist learns in Physical Geology is function of natural elements like Mountains and Rivers. Besides its universal role of collection and equitable distribution of precious rain water to every one along its path – plants, animals and Man, the river cleans our land and waste debris and supports a vibrant human culture. All world rivers have been doing so even before Man appeared in the scenario. In short, a river is an artery of the body. Geologists must ponder what it means by blocking of these arterial channels in the name of water resources harnessing. It is a clear discriminatory act to translocate common natural benefits to the mighty and deprive the Meeks and Weeks- a clear case of robbing Peter to pay Paul. Should Geologists support such misadventure? The Engineering Geologists are on cross road.
7. Digging of earth for various developmental activities including mining is very common. The action leads to exposure of earth materials to oxygenated atmosphere. The crust of the earth has 8 % Ferrous Iron, which on digging and exposure tend to be oxidised to Ferric state. The Oxygen required comes from the atmosphere. Calculation shows that if only 300 Ft. of the earth meet this Ferrous-Ferric transformation (Lateritization), it would strip out the entire Oxygen content of the atmosphere. Therefore, whenever we dig, it is for our grave.  
In contrast, we have also observed that the great Pontiff Pope Paul, while on tour, whenever comes out of the aircraft, his first action is to prostrate on the tarmac to kiss the earth. But the “Earth diggers” are known to rush to revere the “Earth kisser” at the earliest opportunity. We are on cross road.

## Epilogue

Environmental adversity is a driver of biological evolution, but its visibility is practically imperceptible in human history. However, cultural evolution with consequent behavioural changes apparently shows up during historical time span. Therefore, for us, humans, the ferocious lion has remained a lion and a toiling beetle has remained a beetle, but when it comes to Homo Sapiens, the Hunter & Gatherers in African plains have become the upright brainiac with computer, nukes and spaceship in about 100,000 years. Similarly, if persuasive domestication could transform the ferocious wild wolf to a passive pocket puppy, days are not far to put the brainiacs into a “Progress trap” by persuasive pressure of Artificial Intelligence, so that humanity adopts into a new *Avtar* of machine man or organic robot. Suggestion has been made in knowledgeable circle that the Homo Sapiens could put on an apparel of Cyborg – 90 %

Cyber and 10 % Organic in not very far future. The future has already become visible. Energy/Fuels resources are available on Earth and Earth Scientists getting prepared to meet the need (Greed).

In pursuit of supremacy and excellence, mankind is cruising in a Time Machine on a transformation Super Highway at speed approaching the velocity of light, when Red (Danger) appears Green (Safe) and now, have reached a Cross Road, wherefrom the gate of the Sixth Extinction at the other end of the Highway has been observed by many visionaries including experienced Palaeontologists.

To avoid the disaster of Sixth Extinction which awaits on the Super Highway ahead, we need to change track to the Left to run away (Flight) or turn Right to Fight the adverse situation.

Stephen Hawkins once said “Let us pack up to migrate to another planet, we have made a trash of the Earth.” There is no place or planet where humans can be settled since our metabolism is earth bound. We have only one home Earth A and Flight is not an existential solution.

To Fight the adverse situation, two alternatives are possible. 1. Take up the technological sword as the weapon of fighting. Our present dilemma of neck deep water is consequent to the technological reliance. Besides, the new panacea of AI, a by-product of Sc. &Technology, makes Man redundant, therefore not acceptable for self-integrity. 2. Adopt to the new environment and take up a new *Avtar*. Homo Sapiens become Cyborg, a new Species as stated earlier. With all that said, Geologists may stand confused at the cross road of the anthropocentric transformation. It is wiser to leave the matter to Darwins’ biological evolution instead of meddling with the Natural selection and run after a blinding technological track..

Figures:

1. Darkness of coal field regions in India in the imagery Earth by Night . (Darkness always prevails under the lamp).
2. Vision of possible *Avtars* of transformation of Homo Sapiens.
3. Homo Sapiens on cross road in Transformational Super Highway.

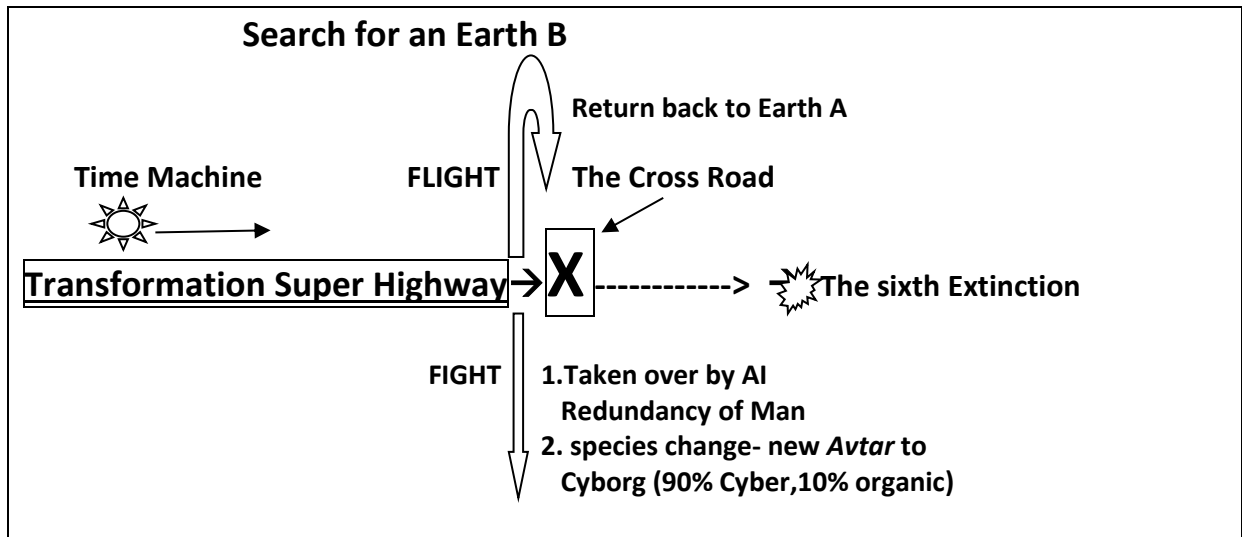


Fig.1



Fig. 2

Fig.3



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