

Geoscience to Geosense – A Basic Education

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Abstract: Geology as a Science and Science, as a type of knowledge (Gnana) has been explained and analyzed. Like any other Sciences, Geology too is “bend” to serve the society for supplying earth resources. The Earth is considered a holistic system where the various subsystems, Atmosphere, Hydrosphere, Lithosphere and Biosphere continuously interact. “Bending of Geology” for earth resources exploitation for anthropocentric developments interferes with Natural Cycles. When the intensity of exploitation damages the natural processes that sustain the Natural Cycles, Nature steps in for Checks and balances. Geologists who undertake mineral exploitation too, are at dilemma to find a bizarre of conflicts in mining and mineral based industries. **Based on earth Ethics a code of conduct for Geologists to serve the society without adverse interference with the Natural Cycles may lead to developments, unscathed by Nature. This is considered a common sense or “Geosense” in geoscience.**

Keywords: geo-science, Geo-sense, Anthropocentric development, Earth Resources

“The whole concept of Mother Earth shifts from symbol and myth to a dawning realization that every single one of us has feet of clays, and that we live on a parent, not on a planet.” -Lyll Watson

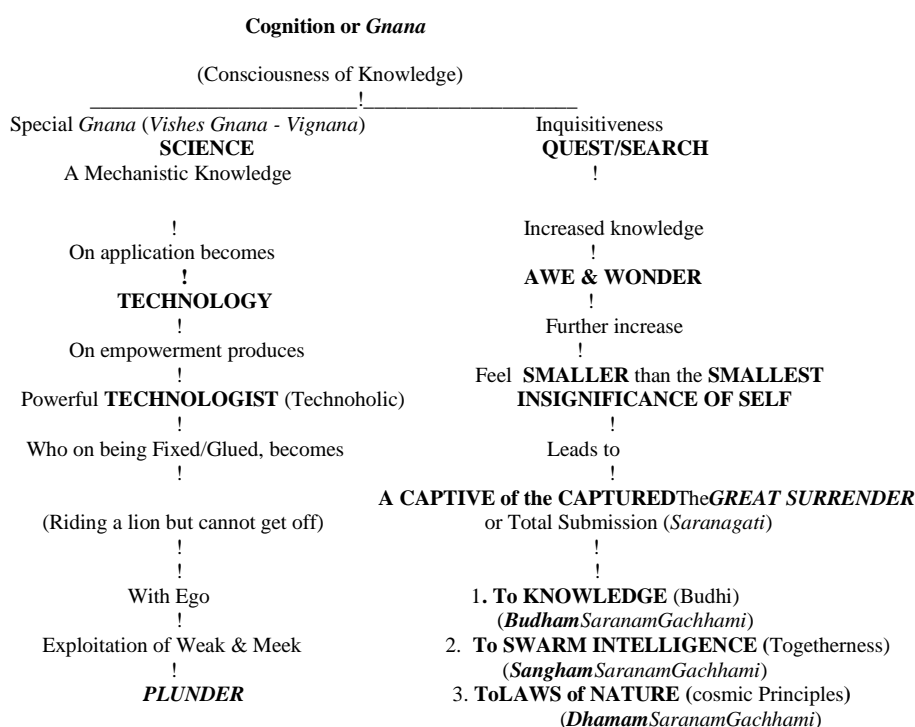
Geology is a science and science is a kind of knowledge:

Geology, Geosciences or Earth Sciences, by whatever name denoted, is basically the study of Earth – its origin, its constituents (Products and Processes) and evolution of life during a long geological time, now estimated to be about 4.6 billion years.

Geology is not a basic science, but like any other basic sciences, it is pursued through, logics and hypotheses. Theory, experiments, observation, analysis, verification and confirmation. Field component forms the core of contention in Geology.

Science or *Vigyan* in vernacular is a special type of knowledge (*Vishes Gnana*) and on application becomes Technology (akin to Applied Geology). Technology empowers the “Knower”. But power in essence, increases Ego, corrodes the “Learner” and leads him to exploitation of the less powerful, that is, the Weak and the Meeks. The problem however is, having been empowered and technologically fixed/glued, the Knower loses the freedom of choice and becomes a “Captive of the Captured”.

The Colors of Knowledge



To note:

1. Science is a sort of “Mechanistic” knowledge which requires observations, experiments, analysis and verification. In Geosciences “Field work” is the core of contention.
2. Knowledge is power, but power boosts Ego and corrodes the Knower (The Man). Therefore :
(a) *When Archimedes discovered the Lever Rules, he declared “Give me a place to stand, I shall move the Earth with a Lever” (Mackay et al, 1991).*
(b) *Similarly, on discovery of the Focus of the Concave Mirror, he designed the “Flaming Steam Cannon” or “Burning Ray Mirror” to concentrate sun’s rays at distance to burn enemy Roman ships.*
Modern efforts of Science are not different from “Archimedes’ ”
3. The “Captivity of the Technologist (The modern Man) can be understood by looking at the “Footlooseness” (Schumacher, 1972) of the car centric society or the glued hand (Handlooseness) of cell-phone users. Even the kitchen at homes stops functioning when its appliances run out of function.
4. Meeks and Weak are meant by the less powerful, such as an individual or groups of individuals, Societies, Tribes, Nations, Species of plants and animals; even inanimate natural objects or elements like Land, Mountains, Meadows, Rivers and Bays which silently bear the assault of the technological giant. The later are significant to Geoscientists engaged in earth resources exploitation, in which the exploitee is none but the “Mother Earth” and locally (For India), the sacred rivers like Ganga, Godavari and Cauvery. The talk of sharing the upper and lower parts of Cauvery by the two concerned States in which she flows, is obnoxious and is not different from the anonymous Graphito of Michigan University Campus in USA which writes “Mankind has an incestuous relation with mother earth” (Sahu, 2003). For the present generation Rocks and Rivers may not have right, but the future generation has a right to see a majestic boulder, an escarpment or a “Silent Spring”.
5. It is interesting to note that the SCIENCE stream of knowledge (*Gnana*) ends up with PLUNDER, whereas the other stream ends up with SURRENDER. Surrender or acceptance of supremacy is, (a). to *Budhi* or intelligence of the Self (*AhamBrhamasmi*), (b). to “Swarm Intelligence” to progress together (*SangachhadwamSambodadwam Sambo Mana Si Janatam- incidentally, this is the invocation song of IIT,Bombay*), and most importantly (c). to the Laws of Nature such as Laws of Gravity, Thermodynamics etc. In contrast, in the SCIENCE stream, the knower, Geoscientists in particular, work against the Natural Laws such as in damming a free flowing river, albeit for the benefit of a section of the “Earthlings” (Man, the powerful species) at the cost of the Weak and the Meeks downstream.

Geology Then and Now

Systematic studies of Geology as a Natural Science goes back to the 17th. Century, when Neptunist Alfred Warner (1880-1930), Plutonist John Hutton (1736-1797), Stratigrapher William Smith (1769-1893) and Uniformitarian Sir Charles Lyell (1830) recorded their views on occurrence of “Oceanic volcanism” and “Layering or Laminations”, mineral assemblies and fossil finds in rocks. Most of their studies were confined to Petrology, Mineralogy, Stratigraphy and Structural dynamics in understanding the origin and evolution of Earth. Contribution from Charles Darwin (1809-1882) on Evolution considerably added to earth’s Biostratigraphy and Paleontology. Although a variety of minerals and gems have been on use and sought after by Man from prehistoric time, and Britain, where the systematic studies on Geology started is no less important in having mineral resources like Tin & Tungsten in Cornwall, Lead, Zinc & Fluorite in Derbyshire, Coal, Clays & Limestone in plenty, no serious study on Economic Geology was undertaken in Britain. The matter was left to the mineral hunters, Mining Engineers and Metallurgists. When “Economic Geology” was proposed as a vital branch of Geology, many British Geologists discouraged the move as “Mundane interest”. However, serious studies on economic minerals and Ore- Petrology appeared in the Continent and later in USA where exploration and exploitation of mineral resources including Engineering and Applied Geology formed the major thrust in Earth Sciences and continues to be the principal aim of the present Geoscientists.

The very fact that useful metals and minerals are always associated with certain type of rocks (Geochemical affinity) and get concentrated under specific processes (Magmatic, Sedimentary and Metamorphic) in geological space and time (Metallogenic Province and Metallogenic Epoch respectively), intensive studies and extensive knowledge on Geology is a prerequisite for exploration and exploitation of earth’s mineral resources.

Modern approach in study of Geology with support from all the disciplines of Science and with the aid of sophisticated equipments and techniques, is exclusively directed for exploitation of earth resources including

energy and water. Remote Sensing, Space Applications, launching of satellites for assessment of earth resources and for weather forecasting to aid agriculture, are some of the latest developments in Earth Sciences. However, extra-terrestrial mining of minerals and metals for supplementation of depleting earth resources, vouched by some leading Indian “Geoscientocrats”, is but figment of imagination and a gimmick of fund search. Besides exploitation of earth resources, Scientists knowledgeable in Geology are engaged in Seismotectonicity for study of earth quakes (such as Geophysicists), in Ore-dressing and Mineral beneficiation, in Geotechnical & Engineering Geology (for Dam, Reservoir, Building foundation and slope studies etc.) and in Environmental problems like Geoconfinement of Wastes and decontamination of land.

The Earth is a System

The earth is a System of four components (Subsystems) or “Spheres”, the Atmosphere, the Hydrosphere, the Lithosphere or Geosphere and the Biosphere, that continuously interact and change within certain limits. Cosmosphere, the extra-terrestrial region dominated by Sun has astronomical influence on Earth, but for all practical purposes, is excluded from the Earth System. The Earth System Science seeks to integrate and correlate the interactions (mutual impacts) of the Subsystems. The integrated Earth System is virtually considered a “Closed System” where no addition and removal of materials are involved. A small amount of meteorite and cosmic dust reaching Earth is considered negligible. Receipt of energy from the Sun and loss of internal heat by radiation into space, prime all intersystem reactions. The scale and magnitude of reactions of the Subsystems are extremely variable and their imprints (Impacts) have been recorded in the history of the Earth by way of geological events.

Some impacts of interactions among earth’s subsystems.

Of Planetary magnitude and slow.	Magmatic & Tectonic Episodes, Plate Movements, Species Evolution and Extinction, Marine Transgression & Regression.
Of Intermediate magnitude	Volcanism, Cosmic Bombardment of Jurassic, Ice Ages, Erosion & Rock Weathering, Ozone Shield formation.
Of Relatively Fast magnitude.	Desertification, Global Warming/ Climatic Change, El Nino, Little Ice Age, Soil Salinity.
Instantaneous	Earth Quakes, Floods, Landslides, Forest Fire. (War, Famine and Global Terrorism When it comes to Anthroposphere).

All ingredients, water, gases, chemicals and nutrients exist on Earth in limited amounts. For life on earth to continue to function, these ingredients have to be recycled over and over. If any of the essential ingredients are used up, exhausted or seriously depleted or any Natural Cycles disrupted, the System is at a risk of disbalance and life dependent on it is in danger. For examples, the 21 % Oxygen content of the Atmosphere, availability of the Liquid Fresh Water and the Soil Mantel are critical constituents to sustain life in Biosphere.

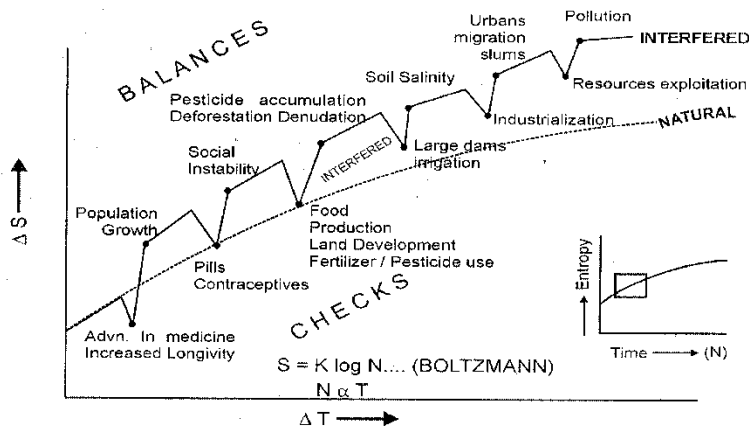
All living things on Earth function as one super organism, classically known as Gaia (James Lovelock, 1995), that changes its environment to create conditions to continue the life and made evolution possible. Thus, with a biospheric envelope, this huge ball of rocks, behaves as a single self-regulating System with its physical, chemical and biological components including Humans and is “known to suffer metabolic damage from “High temperature fever” (Global warming), Asphyxiation (Oxygen shortage), Acid indigestion (Acid rains), Ozonemia (UV-radiations), carcinoma (Nuclear Radiation damage) and “Dermatological dilemma” (Soil salinitization)”. The interactions and feed-back between the components are complex but homeostatic and production of human species is considered a great step upward for the Gaia – a sort of rapid evolution of brain tissue (Lovelock, 1995).

The assumption of this planet as a single self-regulating organism, automatically makes the Earth a “Holistic System” so that “When we try to pick out anything by itself we find it hitched to everything else in the Universe” (John Muir, 1838-1914). In other words, destruction and degradation of any sector of Earth affects others, at least in immediate surrounding or along the downstream region. Strip mining produces erosion, siltation and pollution of rivers.

The Earth-People System Has Become Anthropocentric

Making of Man on earth was neither a dictat of a creator, nor with Adam meeting the Eve in the Garden of Eden, but through 3.8 billion years of persistent evolution and Natural Selection from the prokaryotic cell to the

multicellular complex Hominids. There is no denial that humans carry the signature of the primitive organism and, in odd with Genesis, is 90 % Ape. Appearance of Man in the organic evolution too, is a mere flicker such that, if Earth is considered to be seven days old, Man appeared only in the last eleven seconds. But the last 2/3 rd. Second activities of modern Man, known as Anthropocene, has made him the privileged guest and the commander of this spaceship. Of late, he has become a powerful agent capable of bringing in large scale changes on earth. Modern Science and Technology has become a handy tool to produce the changes. Removal of mountains, creation of new sky-lines, diversion of river system, creation of lakes and reservoirs, clearance of Range forest ecosystem, reclamation of Bays and ocean etc. which Nature took million years to do, are made to happen in his own life time. Natural changes are slow, self-balancing and healed by recuperation. But Man made changes are sectoral and violent, therefore subject to Checks and Balances of Nature. Downstream and adverse impacts that commonly occur in case of such rapid changes are, water-logging, soil salinization, floods and draught when hydrologic cycle of a region is interfered; land and soil degradation, water pollution in case of mining and industrial agriculture; soil and sheet erosion when forest cover is removed and coastal erosion when Bays and ocean are reclaimed. Thus, when Man takes the role of “Little God” to destroy, build or sustain an anthropocentric culture, Nature comes heavily to discipline the errand child. Since cultural changes are very fast, ethical changes are slow and evolutionary changes are extremely sluggish, almost negligible, conflict becomes a necessary byproduct. Thus terrorism has become a byproduct of modern civilization, making identical brothers on arms.



In all Natural Systems Entropy or Chaos (Disorderness) increases with Time, but Human Interference (Checks) merely pushes it up.

Fig.1 Entropy vrs Time and Human interface

Conflicts in Mining and Mineral Based Industries

Minerals are primers of progress. No doubt mining, beneficiation, transportation, smelting and production, even use of minerals and mineral products bring in profound changes in environment, often of adverse nature, the activities cannot be stopped or postponed if the present developments are to be sustained. Even slowing down the activities is considered harmful and an act of conspiracy against progress. However, recent events world over have shown signs of turmoil and socio-ecological concern against the developmental practices in the mineral industries and cannot be ignored however minor the dissenting group or the opposing elements may be. The history of “Gold rush” in California or “Blood Diamond” in South Africa, cyanide pollution of Amazon river for gold extraction, the miseries of oil extraction perpetuated on Nigerian natives, untold stories of Chinese coal mining and the bizarre of agitations against mineral extraction and mineral based industries now going on in Indian subcontinent - from Rishikesh in Himalayas against the stone crushers to sand extraction in Alwae in Kerala and limestone mining in Meghalaya to granite quarry in the Aravallis, are writing on the walls of “World Mineral Factory”. An answer is due, as to why do the “Locals” rise against modern “developmental efforts” like setting up of Posco Steel Plant in Orissa, Vizag Power Plant in AP, nuclear power plant at jaitapur, limestone trading in Meghalaya, uranium mining in AP, Bauxite mining in Neyamgiri in Orissa or Radhanagari in Maharashtra and iron ore mining in Goa and Bellary in Karnataka? Over and above why is “a war against the State of India” has

been let lose by a significant section of Indian natives (Adibasi) living in the mineral belts of the country? The roller and caster of “Go,- No go” policy in coal exploitation itself arouses doubt on sustainability of development exclusively through mineral industry. The reasons for the endogenic turmoils are obvious. Most of the mineral rich regions are environmentally pristine, ecologically fragile or rich in biodiversity and inhabited by people who generally, are poor and totally dependent on the existing land resources. The present mode of mineral exploitation in the veil of economic progress pays little attention to the environment, habitats and the very people who are affected by the ingression of the new industrial culture. Regulatory acts, damage control practices, rehabilitation measures, remain in paper or rarely practiced and compensatory doles get lost in bureaucracy and intermediaries (vide Bhopal tragedy). The resources generated from the ground are pumped out to distant places to benefit others while the PAP (Project Affected People) is left with “bread and circus”. “Developments which destroy environment eventually destroy development itself”, said one of the late young prime ministers of India. At the end, it is the people that are exploited, not the minerals.

Anthropocentric Development has led to Ecocide, the Fore-runner of 6th. Extinction:

The anthropocentric changes have also cost heavily on other living species on earth. When destruction of natural environment or loss of ecosystem of a given territory is caused to the extent that peaceful enjoyment by the inhabitants of that territory is severely diminished and survival endangered, the act is now known as Ecocide and is a peace time crime. In the present world, Ecocide is wide spread in large scale land uses such as in commercial agricultural practices, Industrial belts, urban settlements, opencast and strip mining of coal, iron ores and Bauxite and in limited cases around oil-spills and dumping sites including Green House Gases in atmosphere. War time Ecocide, such as the ones practiced in Vietnam War by USA was considered to be International Crime. The present forms of Ecocide that prevails in all developmental practices world over, is no doubt “a crime against humanity” its international connotation is under controversy. **The UN is under great pressure to consider the present form of Ecocide that prevails and practiced in many developmental activities mentioned above, as an International Crime against humanity under Rome Statute and in Earth Law & Earth Jurisprudence.** Opponents oppose the move saying that this will mean criminalizing the whole human race and making business activities antidevelopmental

Ecocide, a fore-runner of 6th Extinction:

In a time span of 4.6 billion years of earth’s history and evolution of life from a singlecell organism to modern Man in course of about 4 hundred million years, at least five wide spread Global Extinction of living species have been recognized. These are:

1. 440 million years before, when 25 % of the marine families died and got extinct.
2. 370 million yrs. before, when 19 % of animals Fish and Invertebrates got extinct.
3. 250 million yrs. before, when 54 % of the species were lost, mostly Trilobites and Insects.
4. 210 million yrs. before, when 23 % of Reptiles and Invertebrate died, but Dinosaurs flourished.
5. 65 million yrs. before, when 17 % of the species lost, Dinosaurs got extinct but Mammals survived.

The great mastodons vanished in the Pleistocene period at the hands of hunter-man. Scientists have noted an alarming rate of extinction of modern species of animals and plants since Man appeared in the scenario, more so, after the Industrial Revolution. At least one million species of the presently estimated 3-9 millions have succumbed during the last quarter century. The earlier five extinctions were caused by natural disasters such as, marine transgression or regression, floods, draughts, climatic changes like Ice Age and meteorite bombardment from space. But the latest one, now known as the sixth extinction is manmade and primarily by pollution, “Islandization of plants and animals”, exploitation of habitats and resources and for vanity. Since some types of pollution are genotoxic, man himself is exposed to the ill effects of his own achievements, which not only makes him a terror for other species on earth, but himself an endangered species. “The Inconvenient Truth” of Global Warming is only one of the indicators of a sixth extinction. The two third second activities of modern man in its eleven-second life span on earth, referred above, apparently makes him a privileged guest and also the commander of this spacecraft. But the apocalypse of the sixth extinction brought out by his own achievement seems frustrating and humanity now seeking for a sustainable development with the available resources left on the earth. Some earth scientists believe that after the great realization of the frustrating Anthropocene, earth will enter into a period called Sustanocene and human civilization may continue for an indefinite period by recycling, reuse and revaluing the left over earth resources.

Geologists’ Dilemma

Earth resources like minerals, fuels and water are the key materials that keep the industrial society running.

Scientists in general and Geoscientists in particular are deeply involved in exploitation of earth resources for development of an anthropocentric culture. With increasing demand and depleting resources, exploration and exploitation are overstretched to the extent of compromising the environment and Natural Laws of Earth System. The 1969 USBM commandment to their Geologists said “Thou shall not tear apart the land, nor contaminate water and pollute the air but supply the requisite mineral materials to the society” (Flawn, 1970), but did not spell out how. A few instances of dilemma and dichotomy faced by working Geoscientists are described below:

Ecology or Economy: Whereas a mountain or a chain of hill range with green vegetation cover is meant to arrest rain cloud, heralds rainfall that runs down with weathered materials and nutrients released from rocks to form fertile land downstream and distribute the life sustaining precious constituents to all forms of life including humans. Demand of construction materials and occurrence of high valued minerals make the hill range vulnerable to quarrying and mining activities with consequent destruction of the mountain ecosystem followed by degradation of downstream elements through siltation and pollution. A mining and industrial settlement develops, biodiversity decreased, Ecology yields to Economy and the basic life supporting systems air, water and healthy foods become a cry of the inhabitants. Exhaustion of the mineral over the gaping hill range and depletion of rain fall consequent to denudation increases the ill effects. Ecology, the core of contention of life yields to Economy, the superficial mantel or wig of the society.

Only when the last tree has been cut down, (Refer Easter Island)

Only when the last river has been poisoned, (Refer Silent Spring)

Only when the last fish has been caught,

Only then you learn that money cannot be eaten.

Plains Sioux.

The “Go – No Go” Policy in Coal Mining: Imagine an isolated territory, a Closed System of Carboniferous geology with a thick coal seam below the ground and fertile soil above supporting a rich assemblage of flora and fauna including a land and forest dependent human society. Foods, fuels, fibers, timber, medicines, fresh water and air, all that a high quality of life requires are available from the environment. The society is sustainable and time tested through continuous supply of renewable resources. Mining of the coal for energy requirements, leads to destruction of the Natural System, forest disappears, top soil destroyed, rain fall depleted, agriculture ruined and emissions suffocate and poison air, a situation what one observes in the coal-fields of Jharkhand, Orissa and Chhattisgarh, albeit, akin to a “Partly Closed System” where some support is made available by external inputs and outputs. No wonder, in an intensely welfare country like UK where people are preferred than profit, coal industry was closed during the middle of the last century. The “Go-No Go” policy of Govt. of India for mining of coal in forest rich land was a sign of ecological relief but was abandoned due to lack of vision of holistic development and greed for energy, of which at least 60 % are abused in the country today.

More than 75 % of the coal generated in India is used in Thermal Power Plants for power generation. About 100 million tones of fly ash coming out of the Power Plants piles up around the generation site as “white desert” and only a minor fraction is utilized by local industries. Like the parent coal, the ash is rich, often enriched in toxic heavy metals. The large specific surface of ash grains and diaphaneity, combined, greatly increase the mobility of the heavy metals, making fly ash a potential source of metal contamination by aquatic leaching. Considering the magnitude of ash generation, the total toxic release from fly ash into environment is alarming. **Calculation by Rubin et al (1999) and revelation of EPA (1998) show that the “electrical utility” release of toxic elements to the environment substantially exceeds either of the two top polluting industries, namely, Chemical and Metallurgical, and could be as large as the two combined.** The Indian scenario of toxic release from coal-based power plants (fig1) is least known. **Tripathy&Sahu (1995) has emphasized that a super thermal power plant, using 8 million tons of coal, having 5 ppm of U, 40 ppm of Pb, 100 ppm of Zn and 10 ppm of Cd, will pump into its surrounding, 40 tons of U, 320 tons of Pb, 800 tons of Zn and 80 tons of Cd.**

annually, the fate of which is never realized. No wonder, of late, Fly Ash is listed by EPA as a “Hazardous Waste” based on Total Toxic Release Inventory (TRI) from the electrical utility services. Like any carbonaceous sedimentary rocks, coal is a repository of Uranium.

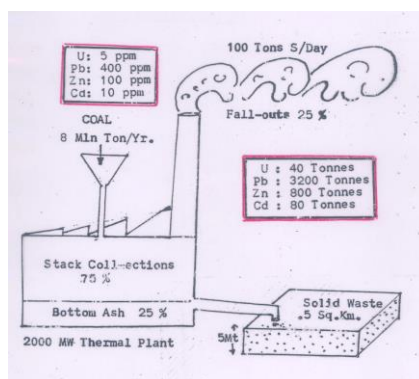


Fig.2 Toxic Heavy Metal Dispersion from a Coal based Thermal Power Plant

Coal mining and coal combustion annually brings out and disperse into biosphere, about 5000 tons of U, 13,000 tons of Th and many other daughter nuclides such as radium, polonium, bismuth, lead and K-40. Chakravarty (1991) reported uranium concentration in Indian coal in the range of 1.1 –3.6 ppm (uniform component) and 33-46 ppm (non uniform component), where as in Fly Ash it varies from 8-11 ppm (uniform) to 55-71 ppm (nonuniform). **Since the radio nuclides accumulate year after year, a century of coal combustion would elevate the global anthropogenic radiation to a level of “Subdued Nuclear Evening” without going into large scale nuclear warfare.** According to an ORNL Report (USA), the amount of U-235 alone dispersed by coal combustion is equivalent of a dozen nuclear reactor fuel loadings. No wonder, a coal based thermal power plant is considered more vulnerable than a regulated nuclear power plant when it comes to hidden fall outs.

Apparently by bringing out the coal from underground for power generation for an energy hungry society we have produced a “Bhasmasur” as byproduct, the devastating capacity of which is yet to be understood by Indian Scientists, particularly Indian Geologists.

1. **Profession and Ethics:** The first lesson a Geoscientist learns in Physical Geology is function of some of the Natural elements, such as a River. Beside its universal role of collection and distribution of precious rain water to every ones in its path – plants, animals and Man, the river dissolves nutrients from rocks, distributes downstream, cleans up land of wastes and debris and specifically supports a vibrant human culture. The Ganges, Euphrates & Tigris, the Niles, Danube and Volga, have all done it. In short a river is an artery of the body of Earth upon which we all live. Geologists must ponder what it means by blocking of some of our arterial channels by a group of experts called Civil (?) Engineer in the name of harnessing of water resources. It is a clear discriminatory act of translocation of common natural benefits to the mighty and deprive the Weak and Meeks. A dam is a damn thing indeed (in deed) and a clear case of “Robbing Peter to pay Paul” (Sahu, 2002).
2. **Neo-Kalidas:** Life has arisen from rocks and the health of the present forms of life is intimately dependent on the chemistry of the lithospheric equilibrium. That is, a change in chemical equilibrium of noosphere ought to disturb the fine tuning of life chemistry. Natural compounds of Heavy Metals, geochemically known as chalcophilic elements, because they form Sulphides, represent one of such lithophilic equilibrium. Breaking of Metal – Sulphur bond and releasing the Metal to native state is a process of destabilization of the lithospheric equilibrium, which, Nature in principle would tend to reverse. The detached metal would tend to seek Sulphur atoms to return to original Sulphide. Man is a store house of Sulphur atoms in the disulphide bridge of protein molecules, therefore vulnerable to this metallic attack. Heavy Metal toxicity has already registered its presence in human body in an alarming scale. It is a surprise that Geologists, the leading Natural Scientists are instrumental in an unnatural act of destabilization of Natural equilibrium and harming the very people they intend to serve. Have we become “Neo-Kalidas” cutting the branch on which we sit?
3. **Responsibility absolved:** Technophilic Index (Frostner et al. 1973), that is, the amount of minerals and oil consumed, is an indication of progress and development of a society. However, Pollution Index of material is defined by the magnitude of leakage of the material from the utility cycle into air, water and soil. Since leakage is proportional to the amount of material used, Pollution Index too becomes directly proportional to the Technophilic Index. (Nikiforova et al. 1975). Thus the basic life supporting systems

stand polluted by the very culture of mineral consumption, obviously primed by supply of mineral resources to the society. Can the Earth Scientists absolve themselves from this genocide? “It is the Musketeer that kills not Musket”.

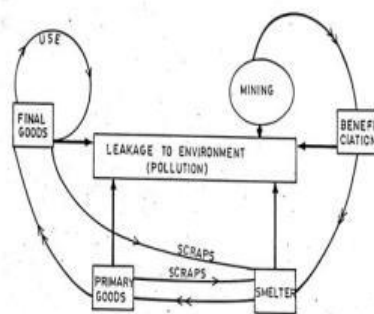


Fig.3 Leakage – In Utility Cycle

It is a common observation that whenever the great pontiff, Pope Paul visited a country, climbs down the aircraft and stepped onto the ground, his first action was to prostrate on the tarmac to kiss the Earth. For “Rest of us”, rampant digging of Earth for mining, constructional activities, laying of communication lines, etc. are acts of development and progress. The larger the bite of a shovel, the more advanced we are considered. However the

Throughout history, tribes and nations have been fighting against each other with arms and ammunition. Modern man fights against earth with chain-saw, bulldozer, shovel, explosives and excavators.

“Rest of us” (The Earth digger) long to reach the feet of the pontiff (The Earth kisser) with reverence. It is of course true that plants shatter rocks to extract nutrients, animals burrow earth for shelter and Man has been ploughing land for agriculture, all for survival, like a baby growing on mother’s breast. But a baby never “Milks” the mother as modern Man does onto the (mother) Earth. **Earth is not for digging but for living.**

*The crust of the earth has 8 % Ferrous Iron which is being continuously oxidized by our oxidizing atmosphere producing red soil (laterite). All forms of digging expedite the process by uncovering underneath materials. Oxidation of each atom of Ferrous Iron to Ferric state takes one atom of oxygen from atmosphere. Only 300ft. of crust if oxidized will strip out all the oxygen of the atmosphere. **Therefore, whenever we dig , we dig for our grave.***

ETHICS IN GEOLOGY

In an opinion poll among Earth Scientists, the American Geophysical Union found that 50 % of the economic Geologists, employed or funded by fossil fuel industries disagreed on “Human factors” responsible for Global Warming. The Australian Broadcasting Corporation sharply commented on this “Climate Skepticism” by saying “It is difficult to make a man understand something when his salary depends upon not understanding this.”(John Cook, 2011, ABC). For a professional Geologist working hard to supply resources to the Society, the conflicts in mining and mineral industries and impacts on Natural Cycles has become demoralizing. An ethic or code of conduct in mineral exploration and supplies compatible with protection of Nature, territories, inhabitants and tribes, will help to preserve the social, cultural and economic fabrics and clarify dilemmas faced by the Geologists. A group of awakened Geologists (Matteucci et al. 2012) have proposed that introduction of an Ethical Code of conduct that follows the example of Hippocratic Oath of Physician will help Geologists to acquire a binding awareness of their professional and social responsibility.

A Hippocratic Oath for Graduation into Geology Profession

*The Earth is my Home,
Her Air is my Breath,
Her Water is my Blood,
The Biosphere is my Flesh,
And the Rocks are my Bones.*

*The Mountains are my Inspiration
And Rivers are my arteries,
The Ocean was my Womb,
And the Soil is my Mother (Matti is My Ma' ti).*

To Preserve and Protect them is to Preserve and Protect my Self. (Author)

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