

Medical Geology

Sometime ago, in order to remove certain misconceptions about geology prevailing in responsible quarters, a note was written on the important role which geology has played in the building of modern civilization. In listing the benefits conferred by geology there was a glaring omission of one aspect which, for want of an appropriate term, can be designated as Medical Geology. The civilized existence of man is made possible by keeping him physically healthy through the application of medical knowledge. Although this is an important aspect of life, surprisingly little serious attention appears to have been given to it by the very persons who should have realized its important role in the study of the effects of various elements and metals on the human body.

The geological profession has made considerable progress in studies on the distribution of elements, even in traces, in rock materials to understand their manner of evolution. A geochemist who takes to such studies rarely gives a thought as to which of the elements he has been examining are beneficial or harmful to the human race although the civilized existence of man requires a number of elements and metals. The soil which covers the underlying rock, in the process of weathering, concentrates some of these elements and even transfers some to plants grown on such soil, while groundwater which filters through the soil profile dissolves certain other elements. Civilized man, in order to coax more from the soil, adds fertilizers and uses pesticides for destroying pests which affect crop growth. Also with the good intention of keeping the human body in good condition, he introduces certain elements in the form of drugs under medical advice. The geological factors which control the distribution and dissemination of these elements, as also their presumed therapeutical effects, is a factor of great importance to which geologists must direct their attention.

The Environmental Protection Agency (EPA) of USA has carried out extensive work on trace elements and toxicity and stipulated permissible limits in soils, water and atmospheric air. Many of our State level agencies are not in a position to analyse a whole range of such trace elements (like selenium, mercury, arsenic, cadmium etc.) to the very low detection limits. National agencies like the Geological Survey of India and other National laboratories/ Research Institutes have of late equipped themselves with sophisticated analytical tools. A certain amount of their time and energy should be devoted to Medical Geology in view of its great societal relevance.

Wisdom of Ancient India

The history of Indian civilization extends backwards in time for several thousand years and in this long period, our ancients, through persistent observation and experimentation, had developed a sense of what was good or bad for them. They were great astronomers and

could predict with a fair degree of accuracy the movement of stars and planets; they were also good at mathematics and their knowledge of the curative value of many earthly plants and mineral products of the day was considerable. Vast untapped reservoir of medical knowledge exists in the remotest parts of India which is to be scientifically recorded.

Till about 1500 AD India and China were leading the world in science and technology. China first made paper and invented the printing press and also invented gunpowder. India was leading in metal production, and was exporting gold, copper, lead and zinc and textiles manufactured by its weavers commanded a world market. The only producer of diamonds, it was considered a rich country, attracting the attention of freebooters and plunderers. It is distressing to the modern mind that a country in which science and scientific observation had progressed to such a remarkable extent as to occupy a leading position in the rest of the world should, within a few centuries, be reduced to dire poverty and ranked as a poor nation. What killed this scientific endeavour of the ancient Indians? Why did modern science and technology develop only in Europe and not in India or China is a question to which no satisfactory answer is forthcoming.

Sad Demise of Indigenous System of Knowledge

It is a historical fact that the British, who came to India as traders, by extraordinary luck took control of the whole land, and so successfully managed their survival and, through their diplomacy and indoctrination, made us hug the very chains that bound us. Macaulay and his minions, who took control of Indian education system, declared that a single shelf of a good European library was more important than the entire ancient literature of India. The old learning that had sustained Indian civilization was mocked and no chance given for its development and the life of an Indian was reduced to that of a beggar. The worst consequence of the colonial rule was the glorification of the western way of life, killing in the minds of Indians all vestiges of original thinking.

Advantages Gained by Contacts with the West

While the truth of the above observation cannot be denied, we cannot be blind to the benefits of the English education which we have received and continue to receive. Western science has helped remove the widely prevailing prejudices and made knowledge accessible to all without distinction of class or creed. This has also thrown up a few seekers of knowledge, well versed in English and Sanskrit, who are able to sift through the ancient literature and extract nuggets of information. It needed great scholarship and knowledge of modern science to be able to distil real knowledge out of these ancient texts. There is no doubt, much information of great value can be gathered from these texts. Our prestigious institutes of science have, unfortunately, given least thought to inculcate in the minds of their students a desire to know the early stages of development of science in India, in which I include medicine as explained in *Cāraka*, *Mādhava*, *Susrata* and *Vāgbhata*.

One of the reasons ascribed as to why Indian science did not progress is because the Indians did not give much thought to experimentation and the teachers were intolerant of criticism. If these deficiencies are overcome we may yet be able to gather the essence of the knowledge pooled together by the early scientists of ancient India especially about the tropical diseases and their cure.

The British lorded over the people of the land and functioned as Louis Fisher said "as superbrahmins and treating the Indians whatever their attainments as untouchables". Mill went even further and said "British regulated India as a huge cattle farm". This was the arrogant attitude of the colonial rulers which killed all initiative in the people of the land and made them the camp followers of the west. The worst calamity of the British colonial rule was the development of an inferiority complex which made Indians incapable of lifting themselves up, unaware of their inner strengths which in the past had made them face problems with courage and confidence.

Geological Science has not been of Particular Help in Curing Diseases

Geological establishments in the country do not appear to have given any thought to the importance of research in fighting diseases. Indigenously available plant and mineral products have not been analysed for their trace element content, especially of those known to have beneficial effect in curing disease. S.R.N. Murthy formerly of the Geological Survey of India furnished a long list of names of minerals having medicinal value e.g. — *Vaikrānta, Māxica, Vimala, Shilajātu, Sasyaka, Capala, Rasoka, Gairika, Kāsisa, Kānkshi, Haratala, Manasila, Anjana, Kaukushta, Kampila, Gouri Pāshāna, Navāsādara, Kaparda, Vahijāra, Girisindūra, Hingula, Mrudārushringa* — there must be many many more used in medicine. Quite a few appear to be mixtures of sulphides of copper, lead, zinc and nickel in various proportions, and known to have curative value.

One of the principal beliefs of the indigenous medicine is that the cure of diseases which crop up in a particular country can best be achieved by the locally available plant and mineral products. Treatment of locally prevalent diseases require a different treatment depending on the mental attitude and culture of a person, his physical ability which western medicine seem to ignore. Gross standardisation, prescribing particular drug for particular disease may not be appropriate to local conditions and behavioural patterns.

Diseases are not decimating the population of India, despite the fact modern medical attention is accessible to very few individuals which leads to the inference that indigenous system of medicine although greatly neglected is still playing an effective role in curing diseases. With more scientific and analytical studies better results are to be reasonably expected.

Medicine and Money Power

The more than 5000 year old Indian culture was essentially a rural culture. Our

grandmothers and village elders knew more about the plants and minerals in their neighbourhood and their curative value. Even today, when modern medicine has not been able to cure a persistent malady, some herb or root of a plant or a mixture of a plant and mineral matter have effected a cure!

Modern civilization is built around money power and poses a great threat to the Indian way of life. Simplicity, perseverance, patience and frugality are at a discount. The civilization taking shape in the west is exercising a fatal attraction towards a system which multiplies wants and makes the people slaves to greed and consumerism. With the dawn of freedom and the lifting of the colonial yoke it was thought a day would come when India would discover itself again and occupy a higher place in the comity of nations but this has not happened and we have become blind imitators of the west.

Take for instance '*Ayurveda*', the science of Indian medicine, which is as old as the Vedas. The average man of that period could identify a number of species of plants and as well as minerals, giving each a specific name. He knew too the therapeutic value of most of the products and the more knowledgeable among them diagnosed the more serious diseases, their charges being minimal. But modern medicine of the western brand is highly expensive and beyond the reach of common man. The whole profession is now mercenary and not missionary oriented. Drugs are not available at affordable prices, a large amount of the cost going towards packaging and advertisement and the curative value of many is suspect.

The institution of a family physician has disappeared with modern medicine dependent on carrying out endless tests, each costing an enormous amount of money. Doctors take least interest in the patient and he or his attendants are directed from one specialist to the other. Drug research, on the other hand, has made tremendous advances, and powerful drugs have been found which can bring under control the deadliest diseases and effect a quick and spectacular cure, making the patient develop a high opinion of the western system of medicine. *Ayurveda* was comparatively less expensive and the drugs were slow acting but would not cause bad side effects. But *Ayurveda* too has caught up with western showmanship with dispensaries and drugs displayed in eye-catching packages, costing as much if not more than the western brands.

Ancient Practice of Medicine

History shows that there were many brilliant doctors in ancient India. We understand that even in that early period human cadavers were routinely dissected, long before such practices were introduced in the west. The neglect of the Indian system of medicine is the saddest part of our history.

My object in dealing with this ancient history of medicine is not to glorify our past but to emphasize the enormous amount of work waiting to be carried out in the almost forgotten field of medical geology. Among the numerous laboratories attached to the geological surveys, or the university departments equipped with latest tools capable of measuring

metals in trace quantities, any concerted effort at finding out the trace metal content in the mineral, soil and water samples and ascertaining the differences existing between region to region has not been attempted. The laboratories continue, as Raja Ramanna once said, to 'function as uninspired factories'. Most of the work turned out is routine, imitative, with no urge to deeper analysis.

Present Method not Enough

Among all the hundreds of geologists and chemists who have passed through the Survey, only one person S.R.N. Murthy took an interest in the medicinal value of minerals. This was largely due to his deep knowledge in Sanskrit as he came from a family of Sanskrit scholars. But his study was also of a general nature, not going into depth. The Geological Survey of India has recently brought out a bulky volume composed of papers presented at a workshop in February, 2004, at Nagpur as part of the IGCP 454. But most of the papers are concerned with the disastrous effect of arsenic and fluoride on human health. Larger problems relating to the residues left behind by insecticides and pesticides in soils, which enter into the food cycle and cause enormous damage, are not studied. A systematic examination of the pesticide residue in soft drinks marketed under an attractive brand name has not been attempted. Sunita Narain of the Centre of Science and Environment has been able to expose multi-national firms indulging in practices which affect the health of the people. Highly priced drugs flooding the market are not being subjected to study and the evil consequences of consuming such drugs fearlessly exposed. Many drug manufacturers are reluctant even to disclose the metal content in the drugs marketed by them despite a mandatory provision that labels should contain this information. Journalism has descended to adopting shady practices publishing scientific papers that are little more than marketing tools for the sale of spurious and substandard drugs. Bogus clinical tests of such drugs are published and thousands of reprints ordered assuring substantial revenue to the Journals. The tentacles of drug companies are widespread. Our laboratories are not well equipped to test samples of such drugs and expose malpractices. The risk posed by metals in traces in drugs has to be investigated more thoroughly.

With changes in government policy opening the doors to the world, a new generation of confident young men has come with modern gadgets like the internet providing all the information they need. I am sure they will become better physicians if they take the trouble to know our ancient system more intimately and the way, especially of tropical diseases affecting India. A more sympathetic approach to some of the crude but otherwise effective methods employed in rural parts is also required. Mere imitative knowledge may not carry us very far – there must be an effort to resurrect the knowledge buried in ancient texts and subject them to critical examination. There is an unwillingness to change with time and adapt which has to be overcome.

The lack of courage, not so much physical, but intellectual and moral is detrimental to

progress. This can only be remedied through a correct understanding of cultural heritage coupled with new knowledge acquired through experiments. Criticism should be welcomed and not resented, as is the fact with the practitioners of medicine. India presents a vast field for testing, clinically, the effectiveness of each drug, mineral and metal content on the human system. 'The entire world is a teacher for the wise' says Cāraka, the great medical practitioner and teacher of India of yester years. But our tragedy lies in not experimenting and learning from a practice of trial and error which has revolutionized western medicine when India neglected the pursuit of science.

USGS has carried out detailed work on the effects of radon, asbestos, selenium, chromium, mercury and uranium on human health by developing necessary interface with the medical profession and other environmental agencies.

What is to be Done?

Scandinavian countries have done pioneering work in bringing out geochemical atlases of their entire region covering a wide range of trace elements of interest. Dr. Olle Selinus of the Swedish Geological Survey has recently brought out a book on Medical Geology that should be of interest to all of us (Essentials of Medical Geology – Impacts of the Natural Environment on Public Health, Ed. Olle Selinus, Academic Press, 2005, 1024p).

There is a deplorable tendency even among our educated people, an inexplicable indifference to filth and pollution. Our people, our governments, it has to be said with great regret, 'are our worst murderers because they are the practitioners of filth and the emperors of garbage'.

In this atmosphere what should be our role as scientists deeply concerned about the future. We must know about all the elements and how they are dispersed in the environment. We must go a step further and get to know through innumerable trials and case histories, the effect of elements on the human system and its well being. The Geological Survey should strengthen its geochemical wing and one section should devote itself specifically to a systematic study of rocks, minerals and mineral products and residues backed by the observation of the field geologists whose attention should not be directed to just rocks but to the people and their environment and the geological factors affecting their health.

Medical Geology as an emerging interface between the ecosystem and human health attempts to study exposure to trace metals and minerals; inhalation of mineral dusts (like asbestos) and volcanic emissions and all other aspects of human health related to earth processes. It is time that we bestow some attention on this emerging inter-disciplinary field where geological sciences can play an important role directly related to human well-being.

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