

THE ENVIRONMENT — ROLE OF EARTH SCIENTISTS

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Environmental science is perhaps the most multidisciplinary of all sciences and as Thomas Malone in a preface to the book on "Global Change", published by the International Council of Scientific Unions (ICSU) has stated:

"The rapid growth in the study of Earth, its environs, and life in the biosphere has progressed to a point where it is now possible to think seriously of fashioning a bold, holistic approach that will deepen and strengthen our understanding of the planets subtle and often synergistic physical, chemical and biological processes.

Such a framework would examine the oceans, atmosphere, hydrosphere, biota and the solar-terrestrial domain as a single system"

It is therefore vital that our scientists appreciate the interdisciplinary nature in what is best termed as the Science of the Total Environment. Such an environment awareness is surely though slowly, now being created in Sri Lanka. Even though much of the contributions have come from non-governmental and governmental organisations, one must realise that the environment is everybody's concern, no matter how small or large the domain is.

While such emphasis is often laid on the influence of man in modifying and polluting the environment, the effect of the natural environment on human, animal and plant life very often passes unnoticed. This is mainly due to the time factor that is often observed in the 'cause and effect' relationship of many processes involving interactions of the lithosphere, hydrosphere and atmosphere with the biosphere.

However, the geochemical interactions among the above mentioned spheres are as important as the influence of man on the environment, particularly

in the general health of the population. Sri Lanka provides an almost ideal testing ground for the researcher in environmental geochemistry, in that

- (a) Nine out of the ten soil groups are present in Sri Lanka.
- (b) Clearly defined climatic zones exist within a narrow area enabling one to study the influence of climate on geochemical processes.
- (c) Nearly 80 per cent of the population depend on chemically unpurified groundwater for drinking, thereby accentuating the importance of water chemistry on health.
- (d) There is an uneven distribution of the population in various geographical regions of the country. This enables one to study the effect of population density on environmental degradation and vice versa.
- (e) There are major irrigation projects involving the impounding of vast stretches of land. The changes in the geochemistry of the soil and water in these regions will have a noteworthy impact on future agricultural programmes.

The relationship between organisms and the environment is very intricate and delicate, and is to a great extent influenced by the chemistry of the environment and the natural resources. A change in the chemical composition of the soil for example, which may apparently have no visible effect on plants growing in it could be detrimental to the life of a particular species of organism living in it.

The geographical distribution of elements and their compounds result in a wide variety of environmental conditions and problems. The problems facing the environmentalists are therefore multi-

disciplinary and will change from one environment to the other. In the area of soils and plant nutrition these could mean a deficiency or an excess of an essential plant nutrient, both of which can cause problems to plants or animals that feed on plants.

Some environment based problems in Sri Lanka are of particular interest to earth scientists. Among these are

- * Problems of iron toxicity in paddy cultivation, notably in the southwestern and southern parts of Sri Lanka.
- * Trace element deficiencies in soils caused by excessive leaching, in the wet zone of Sri Lanka.
- * Excessive chemical weathering of rocks and the formation of unique geochemical landscapes, with their characteristic excesses and deficiencies of trace elements.
- * Irrigation schemes, salinity and agriculture
- * Iodine geochemistry and incidence of endemic goitre
- * Fluoride geochemistry and dental health of school children
- * Landslides, erosion and human settlements
- * Tube wells, water quality and health
- * Waste disposal and groundwater pollution
- * Coastal management.

Many of these problems, so commonly seen in Sri Lanka, could result in dire consequences if proper attention is not given them. The compilation of data banks and the preparation of background geochemical maps are of vital importance. The basic background chemical data are of use in a variety of disciplines, notably in epidemiology, agriculture, delineation of areas suitable for human settlements and forestry.

The case of endemic goitre should draw the special attention of the Sri Lankan earth scientists. In some parts of Sri Lanka, notably in the Kalutara District, endemic goitre often reaches a level of 45%. While iodine deficiency is certainly the main cause for endemic goitre, there appears to be other factors such as trace elements acting as goitrogens that appear to play a major role.

Interestingly, even in some areas where iodine is found in sufficient concentrations in the soil, goitre appears to be prevalent, indicative of other factors related perhaps to the soil chemistry.

In view of the prevalence of water-borne diseases in Sri Lanka, the quality of water must be continuously monitored. This is of special importance to Sri Lanka since nearly 80 per cent of the people do not use piped water. The chemical quality of water in an area depends on the chemistry of the soil and the parent rocks and it is interesting to note the wide variation of the chemical quality with respect to the rock types found in Sri Lanka.

As a result of this, community water supplies do have a noteworthy effect on the health of the people in many ways.

Water management must also take priority and in this context the environmental effects of the Mahaweli scheme need to be continuously monitored. Salinity and water quality deterioration caused by large hydroschemes have been known to occur in other countries and earth scientists play a major role in such environmental investigations.

The quality of the water in tube wells in Sri Lanka has caused concern among many, owing to the high fluoride and iron contents in some areas particularly in the Northcentral, Eastern and Southeastern parts of Sri Lanka.

Nearly 25000 such deep wells may be drilled in the near future and a detailed study of the chemical variation of water quality with depth and with location is necessary. It has been found that certain deep wells have fluoride contents exceeding the WHO danger limits by nearly 10 times. Research into mechanisms of defluoridating such water at the village level using commonly available local raw materials is of immediate necessity.

The highlands of Sri Lanka are prone to erosion and landslides, very often resulting in loss of life and property. With the onset of the monsoon rains such natural disasters become an annual feature. The preparation of maps showing areas susceptible to such landslides is a national need and earth scientists could make significant contributions in this venture.

Another area of great national concern is coastal erosion and coastal management, where the services of marine scientists and land geologists could be effectively combined. Timely advice could be given by the earth scientists to those pursuing development schemes along the coastal belt.

With the Law of the Sea convention and the granting of a 200-mile exclusive economic zone, oceanographic research has assumed a very

important role in Sri Lanka. Sea bed mining and other maritime activities could quite conceivably lead to marine pollution and the work now being carried out by the National Aquatic Resources Agency (NARA) is indeed laudable and should be fully supported by all earth scientists.

Oceanographic research holds great promise for the earth scientists of Sri Lanka, particularly in view of the fact that our land to sea ratio is as much as 1:8.

The ocean is the 'dumping ground' for many pollutants. Industrial waste and municipal sewage discharge reach the sea by stream and river. Other types of waste are transported in barges for offshore disposal or discharged directly into coastal water through outfalls. Rivers carry polluted materials from mines, farm operations, and land development activities to the ocean.

Insecticides, toxic metals, radioactive and other polluting substances reach the ocean through runoff by air movements and by direct discharge from pipelines. Dredges remove wastes from harbours and barges dump them at sea. Severe coastal pollution problems are evident in many local areas and regional pollution problems are increasing.

Sri Lanka being an island state should well be aware of these impending environmental problems and mitigatory measures should be planned for immediately.

The environment knows no boundaries. Earth scientists are often called upon to tackle a variety of environmental problems, which are essentially multidisciplinary. Obviously a close interaction between earth scientists and scientists from many other disciplines is necessary in the handling of such environmental problems.