From the Editor.....

This issue contains many variations on the theme of relationships between the biosphere and the "geosphere." Cook reviews biogeochemical cycles involving rocks, soils, water, air and living organisms, while Retallack, Grandstaff and Kimberley discuss the products of related processes during the Precambrian. Sudradjat and Tilling describe volcanic hazards in Indonesia, an example of the impact of geological events on "habitability." A different set of circumstances, where man may be "forcing" nature, comes into play in the matter of nuclear wastes. The highlights of a global survey by ICSU of research into geological disposal are reviewed by Harrison, together

with brief comments on national programs in Australia, Britain and Canada, each illustrating different aspects of the complex problems involved. The guest editorial by R.A. Price, the profile on Hugues Faure, President of INQUA, and news and conference reports on groundwater, land subsidence, seismic networks and urban geology, also help to set the scene for a forthcoming symposium on Global Change to be held in Ottawa this September. This will be the first public discussion of the worldwide, interdisciplinary research program on the interactions between the geosphere and the biosphere now being proposed by ICSU.

GUEST EDITORIAL

Lithosphere — The Library of Global Change

The record of global change in the geosphere and biosphere is written in the lithosphere. Changes in the chemical, physical, and biological environment at the earth's surface are expressed in the sedimentary, metamorphic and igneous rocks of the lithosphere as they are forming, and the timing of these changes can be established relative to the variety of physical and biological time scales. The geological record of global change established in this way stretches back through pre-historic time, with diminishing clarity and completeness, to 3.8 billion years ago, when the oldest rocks known formed. It shows that the earth, with all its inhabitants, has had a long history as a slowly evolving, complex ecosystem that normally exists in a state of stable dynamic equilibrium and that reacts to change in such a way as to minimize its effects and to achieve a new state of equilibrium. Explosive growth in the human population, in the per capita use of resources, and in the degree of human disruption of established ecosystems — the hallmark of mankind's recent and rapid emergence as the dominant species — appears to represent both a major departure from this state of equilibrium and an ecological crisis of global dimensions.

A well-documented geological record is a prerequisite to the thorough understanding of contemporary change. It provides not only the essential base-line against which to assess the nature and significance of the current situation, but also important insights into the processes that govern global change now. However, the geological record itself requires further elucidation before it can be fully utilized. A full appreciation of the nature and significance of global change requires an integrated, long-term investigation both of contemporary processes in the coupled geosphere-biosphere system, and of the geological record of past worldwide variations. The lithosphere is a library in which the record of past global change is preserved, and the key to this library is a better understanding of contemporary processes that affect the geosphere and biosphere. The past may thus provide a key to understanding the present, and to predicting the future.

The geological record has very recently acquired a unique and critically important new dimension — anthropogenic change. The human species has become the dominant agent of change at the surface of the earth and now has within its grasp the power to unleash global catastrophes such as the recently much discussed "nuclear winter." These profound changes began only 200 years ago when the industrial revolution made

possible the large-scale exploitation of fossil fuels and led to the creation of a positive feedback between growth in technology and the availability of energy.

In this century, as a result of advances in science and technology, the rapidly growing human population has participated in one of the most drastic transformations any species has ever experienced. The annual rate of use of new mineral material is now approaching 2×10^{16} g/yr — the global rate of formation of new ocean crust, or of mountain building and erosion. Anthropogenic changes are overtaking natural ones.

Human perceptions of the real nature and significance of these variations are, however, clouded. Profound alterations in the human environment and style of life now occur within a single generation. Change has had such a persuasive influence on the collective human experience that it has come to be regarded as the normal state of events on a stable earth, even though the geological record indicates that the present episode of profound change can only be a transitory epoch of short duration within the totality of human history. There is, therefore, an urgent need to establish quantitatively the nature, scope, and magnitude of anthropogenic changes, their significance in terms of the past geological record and their implications for the future habitability of the earth. This is a task that requires international and interdisciplinary cooperation, with participation from the social as well as the earth and life sciences. An international geosphere-biosphere program building, of course, on existing efforts, would stimulate scientific progress, for all participants would return with more than they brought.

R.A. Price
President ICL

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