MAKE HYDROLOGY AN INTEGRAL PART OF EARTH SCIENCE STUDIES

The December, 1997, issue of EOS transactions of the American Geophysical Union carries an account of the ceremony at Stockholm where Peter S. Eagleson of the Massachusetts Institute of Technology (MIT) received the Stockholm Water Prize from the hands of Carl XVI Gustaf, King of Sweden. The Stockholm Water Prize, with a prize money of $150,000, is an international environment award given each year to an individual or organisation in recognition of outstanding contributions in the field of water conservation. Previous recipients of the prize "represent a broad spectrum of water related activities, water supply and sanitation techniques and installations and environmental processes, ground water pollution, awareness building and transfer of knowledge."

Many of us in India are not aware of the work of Eagleson, who has merited this highest award in the field of Hydrology. It is said that he has made hydrology a key element of the earth sciences and that it is now-a-days "impossible to think of hydrology without his name coming to mind."

The citation accompanying the prize states "Eagleson has been a leader in extending hydrology from the local into the regional and global scales. On these scales, the budget of water is a fundamental part of the climate machine and changes on these scales underlie much of the present concern of the effects of climate change on society. His studies on interactions between hydrological and meteorological process are profound. He has shown how small-scale hydrology influences global-scale hydrology and the general global circulation influences hydrological processes." His text book 'Dynamic Hydrology' published in 1970, is claimed to have redefined hydrology as a rigorous and quantitative science. Hydrological aspects, in this country are handled more by civil engineers than geologists and their interest is more statistical, being concerned with data on river flow, information which is needed in the construction of major dams and hydro-electric projects.

Eagleson, however, was the first to change this narrow definition of hydrology by focussing attention on the water cycle itself. He started analysing the role that water plays in the development of global vegetation zones and began questioning as to why there was a close correlation between natural continental vegetation zones and rainfall distribution. The result of such enquiry was a series of papers 'focussing on the water balance dynamics between climate, vegetation and soil.'

Studies by Eagleson on cycling of water on a continental scale demonstrated that the clearance of a tract of rain forest in the Amazon valley affected the rainfall over most of South America. The effect of a piece of cleared rain forest in SE Asia would be felt not only along the Pacific region but in most of the United States!

We in this country are recklessly destroying forest cover in Himalaya as well as Sahyadri. What disastrous effects are in store over the rest of India by way of droughts, floods, lowering of water table, sea level changes and accelerated coastal erosion, no one has, as yet, any clear idea, nor have any studies been initiated. The contributions to our knowledge on hydrological processes, pioneered by Eagleson are therefore of the greatest value to us. Hydrogeologists would do well to take note of these new developments in hydrology particularly in the context of diminishing trend in the quantity and quality of our groundwater resources. The essential difference between shallow aquifers confined to the weathered zone tapped by open wells and those confined to deep-seated fractures and tapped by bore-wells in the hard rock area which covers a third part of the country needs to be emphasized. The danger of mining a resource which has taken centuries to accumulate has not yet been realised. Any neglect in gaining a clear understanding of the hydrological characters of these two aquifer systems and indiscriminate exploitation of this precious resource is going to spell disaster. The declining water table is a warning which must be needed. It is time that earth scientists take a keen interest in studies focussed on the water cycle and communicate their findings in the strongest possible terms to those in authority, directly and through the media.

Hydrology should become an important part of earth science studies and the efforts of Prof. Eagleson in changing the existing mental image of hydrology should become widely known and appreciated. The cycling of water on a continental scale should be clearly understood and taught in schools and colleges.

As recently emphasized in an editorial in *Groundwater* (July-August 1997, p.561) 'communication is vital. We need people who can transfer research findings to the field and who can also communicate water-users needs to the researchers.' The atmosphere of secrecy prevailing in our research organisations and denial of information to user agencies is deplorable and should be given up in favour of free exchange of ideas aimed at improving our understanding of the nature and complexity of our natural resources.

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CORRESPONDENCE

MALANI IGNEOUS SUITE OF ROCKS

Professor Naresh Kochhar deserves to be congratulated for drawing our attention to a very significant plume related, Later Neoproterozoic thermal event in the northwestern part of Indian shield (vide "Correspondence" on Malani Igneous Suite of rocks in the Journal Geological Society of India, v.51, p.120). The note is thought provoking. I felt that some additional input in this direction may not be out of place. Hence this appendix.

One disturbing aspect of the Malani rocks is the multiplicity of nomenclature used by different workers. The geological literature abounds with names like Malani Igneous Suite, Malani Volcanic Suite, Malani Volcanic Series, Malani Igneous Complex, Malani beds, Malani volcanics, Malani Rhyolites or simply the Malanis. The plurality of terms seams to highlight the prevailing confusion and uncertainty in regard to the lithological character as well as stratigraphic status of the rocks. Most of the terms imply that the components comprising the rock group are primarily acid volcanics. This is contrary to the fact that there are also mafic volcanics, granitoid plutons as well as some sedimentary beds in the rock associations called the Malani rocks. Recently available isotope data (Basu et al. 1993; Rathore et al. 1996) indicate presence of some Phanerozoic components within what has been described by different workers as the Malani rocks. Truly speaking, it is not clear to many workers as to what could be the precise criteria for describing the rocks as the "Malani Igneous *Province*" (Srivastava, 1988). The aerial extent also seem to be in the mind of Kochhar when he talks about things like "..... if a new area is to be included in the Malani Suite ....", etc. The problem with the Malanis is that the outcrops occur like 'inselbergs' surrounded by piles of desert sands. Widely spaced disparate outcrops of the rocks make the understanding of stratigraphic status as well as inter-outcrop correlation extremely difficult. The criteria of metamorphism and deformation cannot be applied to these trans-Aravalli rocks, as the rocks belong to the phase of stable continental, plume related anorogenic activities (Kochhar, 1984). Even the epizonal (subvolcanic) field setting as suggested by Kochhar would not be of any help in view of the known occurrences of very young Mesozoic-Cenozoic volcanic rocks exhibiting similar settings. We are thus left with two alternatives, the detailed geochemistry or geochronology. Srivastava's approach (Srivastava, 1988) appears to be quite appropriate under the circumstances. Based on major element data, he had been able to discriminate four distinctly different suites of rocks that have been traditionally described as Malanis. Srivastava, however, made it clear that all the geochemically discriminated suites might not belong to the same cycle of magmatism. Presence of four or five phases of igneous activities has also been described by