

BOOK REVIEWS

GEOCHEMISTRY FOR HYDROLOGISTS, (1996), B.C. Raymahashay,
Allied Publishers Limited, 15, J.N. Heredia Marg, Ballard Estate, Bombay 400
038, 190 pp.

In the sixties, we have had in India petrochemists, analytical chemists and water and soil analysts looking at the geochemistry of waters from their own perspective, training and end-utilization. Geochemistry of waters as a systematic study on its own took shape in our country in the late sixties. By this time, however, William Back, J.D. Hem, J.H. Feth, H.D. Holland, R.M. Garrels and many notable figures of the time already established the broad contours of the science of Geochemistry of waters in the USA and enunciated what may be called the distinct natural laws of Hydrogeochemistry. It is truly heartening to note that Allied Publishers brought out a sleek volume on the subject after about three decades for Indian Hydrology students.

As one opens and reads through the nine chapters, it appears like an abridged version of the well-known book by Garrels and Christ (1965) which itself was an enlargement of Bob Garrels' earlier volume. It is mentioned in the preface that the target users of the book are hydrologists, that the book is suitable for post-graduate teaching and it highlights the recent research in the field of low-temperature geochemistry in India. While these aims are laudable, the following paras indicate some of the lacunae.

After the preliminary introduction, weathering is dealt with in the second chapter. The next four chapters consider the physical chemistry of water-rock interactions. The remaining three chapters discuss in a cursory way some applications of the principles of hydrogeochemistry. The book opens with a reference to the hydrologic cycle and geochemical cycle. But no mention is made to the all important hydrogeochemical cycle and the concepts and equations of mass-balance derived from hydrogeochemical cycle.

The concepts of throughput, residence time of a dissolved species as it moves through the hydrogeochemical cycle and many other fundamental elements of geochemistry of waters have not been introduced. The effect of altitude on $p\text{CO}_2$ and therefore, and the dissolved CO_2 in waters which are relevant particularly for the river basins in the Himalayan range are not discussed. The famous problem of salinity in Kutch, Gujarat and Western Rajasthan are dealt too lightly from p.51 onwards missing many important published papers in this area. The origin of bentonite clay deposits in this region could have been discussed as an example in chapter five and the world renowned Indian BHQ and the Kudremukh ores in chapter six, if the book is to help the Indian Hydrologists. Similarly, published literature of Indian examples of the water quality of base-flow of a river basin (p. 112) and the problem of fluoride in ground waters on which much research has been done (chapter seven) are also sadly missed.

If the book is addressed to Indian Hydrologists, apart from missing the basic concepts, very few Indian field-studies are cited. Out of a total of 49 Indian references in the nine chapters, nearly 40% belong to the author or his co-workers. It can be seen from the acknowledgements that the author has failed to tap the considerable amount of literature in hydrogeochemistry existing in the State and the Central Government Agencies like the Water Boards, Central Water Commission, Defence Research Labs., Indian Railways, and

many others. To meet the requirements of larger audience of hydrologists, the material covered is incomplete and falls short of the current concepts that are developing in geochemistry of waters (*e.g.* diffusion of dissolved ions, water-quality models) which are of day-to-day concern to hydrologists dealing with problems of pollution, water quality management, age dating and water conservation.

Despite these limitations, the present volume can form the nucleus of a future edition with enlarged scope and utility for a wider circle of hydrogeologists.

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**GEOLOGY AND HAZARDOUS WASTE MANAGEMENT, (1996), by
Syed E. Hasan, *Prentice Hall*, New Jersey, 387 pp.**

The Bhopal gas tragedy has opened our eyes to the heavy price in terms of human life paid for our errors and omissions in the past. The current problem of arsenic-contaminated groundwater in parts of West Bengal is yet another developing example of lack of environmental awareness in human health and well-being.

Therefore, this recent publication authored by Professor Syed E. Hasan of the University of Missouri-Kansas City is not only most relevant and timely but a welcome addition to the literature on Environmental Geology and Hazardous Waste Management. The author has succeeded admirably in interweaving the basic geological principles and processes with the engineering, scientific and regulatory aspects of hazardous waste management. The book written with the objective of serving as a text at the University level for courses in hazardous waste management offered in the geology, environmental science, geotechnical and geological engineering fields is lucidly written with a wealth of information culled from diverse sources.

The introductory chapter includes a historical perspective, relevance of geology to waste management and the inter-disciplinary nature of the subject. Basic geological concepts are introduced in the second chapter covering the geochemical, hydrological and climatic cycles.

Chapter three opens our eyes to the mind boggling variety and volume of hazardous wastes generated in modern industrial-urban complexes and the definition of hazardous waste according to the US Environmental Protection Agency (EPA). Environmental laws and legislation in USA giving the permissible contaminant levels of synthetic organic chemicals, inorganic chemicals *etc.* are dealt with in chapter four.

Chapter five deals with environmental legislation in different countries, where India is also covered. The author's comment pertaining to India that "despite the regulatory changes and more stringent action by the courts, compliance with the law has been sluggish. Some of the reasons: understaffed Pollution Control Boards, lack of comprehensive industrial zoning policy, financial constraints faced by companies and lack of cost-effective technology". Except Japan, no Asian country appears yet to address the environmental problems comprehensively, according to the author's opinion.