

scales, and the diverse goals outlined under the various themes. While gravity and magnetic methods are still the primary tools for regional and tectonic investigations, the application of deep resistivity surveys and seismic tomography has come to the fore. The papers on mineral exploration highlight the extensive use of induced polarization (IP) method in the search for gold, uranium and metallic sulphides, with one paper concluding that in the Indian geological context, only the measurement of I.P. in the time domain is effective. The quest for these minerals has also employed self-potential, magnetic and electromagnetic, spectrometric and several variants of the resistivity method. The conventional resistivity surveys turn out to be singularly useful in environmental studies related to groundwater as well as for the detection of voids in the coalmines. While the papers on hydrocarbon exploration present accounts of seismic stratigraphic analysis, 3-D seismic data analysis and an integrated geophysical survey, a perspective paper on Gondwana coal exploration turns out to be a good tutorial article on the topic. Two papers document the effectiveness of marine seismics in charting respectively the paleogeomorphology of a region in the East Coast of India and the seabed topography near a port in the West Coast.

The papers suggesting innovative techniques include one on inversion of magnetotelluric data by very fast simulated annealing method and another on signal enhancement by optimization of sweep parameters in the Vibroseis survey. Papers on laboratory work provide guidelines, useful in the field and in the design of sensors. The review articles include one on the seismicity of Deccan Trap, another on anisotropy in seismic exploration and still another on the utilization of satellite altimeter data.

The volume has a wealth of information for profitable use by students, researchers, professionals and policy makers.

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MINERAL WEALTH OF THE OCEAN: A Treatise on distribution, origin, exploration, mining and development of sea-floor non-living resources by Anil K. Ghosh and Randhir Mukhopadhyay. Oxford and IBH Publishing Co. Pvt. Ltd., 255p. Price: Rs.350 (Indian subcontinent only)

Oceans are the warehouse of minerals and energy and provide the cheapest mode of transport besides catering to recreational activity. Oceans also control the climate of the globe. The famous voyage of *HMS Challenger* in 1872-76 brought out a wealth of information on the oceans. The publication of a book entitled "The Mineral Resources of the Sea" in 1965 drew the attention of decision makers, scientists and technologists to the importance of ocean resources. To utilize the resources of the sea for mankind, debates on legal regime commenced as part of UN resolution, and UNCLOS-III established different regimes, which have become the law from 16th November 1994. Since last three decades, technologies have been developed for exploration, exploitation and extraction processes of resources of the sea. A series of publications have come out on this theme during the last four decades. G.S. Roonwal published a book on "The Indian Ocean - Exploitable Mineral and Petroleum Resources" in 1986.

The authors of the present book have described in nine chapters the evolution of oceans,

mineral resources of the seabed, exploitation of resources and extraction of metals, and resource management. Chapter 1 is devoted to the general importance of the ocean, historical background, projections for the future, research activities in the ocean, including JOIDES and RIDGE programmes, etc. and comparative cost estimate of land-based and deep sea mining of manganese nodules. In Chapter 2, they have briefly outlined the concepts of continental drift and sea floor spreading, and described the composition of continental and oceanic crust, general features of the ocean such as continental shelf, slope, rise and deep sea, distribution of sediments, sea-level fluctuations, seamounts and salient features of the Indian Ocean. The authors have devoted eighty-nine pages in Chapters 3, 4, 5 and 6 to the distribution and origin of seabed resources of placer mineral deposits of ilmenite, rutile, zircon, sillimanite, garnet, monazite, calcareous sands, lime mud, phosphorites, polymetallic nodules, manganese crusts and hydrothermal sulphide mineralisation. The authors have cited examples of seabed resources in greater detail for the Indian Ocean region in general, and the Exclusive Economic Zone (EEZ) of India in particular. The authors have dealt with in Chapter 7 the state-of-the-art exploration techniques including undersea surveys, various sampling gears, remotely operated vehicles (ROVs), submersibles etc. Assessment of the resource potential and estimation of reserves have been included under Chapter 7. Chapter 8 is devoted to the shallow and deep-sea mining techniques, environmental problems caused by mining as well as processing and metal extraction methods for manganese nodules. Chapter 9 deals with the various provisions of the Law of the Sea (UNCLOS-III), exploration activities and future perspectives of India within its EEZ and also in the Central Indian Basin in the Indian Ocean. The authors have also touched upon India's ocean research capabilities and its important position in the Indian Ocean Rim Countries. They also advocated the participation of private enterprise in India and abroad to take interest in marine resource exploration and exploitation within Indian Ocean Rim Countries.

The book has however the following shortcomings:

1. *References not listed:* Royar et al. 1989 on page 13; Keary, 1993 on page 24; DOD/NIO/ PMN Status Report for 1990-97; Reference should have been cited for para 3 on page 80.
2. *Spelling mistakes / incomplete sentences:*
Page 79 - 2nd para last line "has not be" should read as "has not been".
Page 187 - 2nd para 10th line "eoctoves"
3. *Blank pages:* Surprisingly the book has the following blank pages in the reviewed copy. 158 & 159; 162 & 163; 166 & 167; 170 & 171.
4. *Reserve estimation:* Authors should have given some examples for manganese, placer minerals and phosphorites.
5. *Indian capabilities:* Authors should have devoted a separate para on the Indian capabilities in the field of exploration and processing techniques, including research vessels engaged and national laboratories involved in chemical analysis and extraction of metals for the benefit of the Indian readers as well as for the Indian Ocean Rim Countries.

The authors deserve appreciation for bringing out a comprehensive account of mineral wealth of the ocean in this comprehensive book. In spite of minor shortcomings, the book should find a place in all the libraries of institutions/universities which are engaged in earth science activities. Scientists interested in ocean science may find it very useful reference book. The price of the book is reasonable and affordable by individuals.

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