

BOOK REVIEW

PROCEEDINGS VOLUME OF THE NATIONAL SEMINAR 'FOUR DECADES OF MARINE GEOSCIENCES IN INDIA – A RETROSPECT', commemorating 150th year celebration of Geological Survey of India (GSI), Special Publication No.74, Published by the Director General, Geological Survey of India, 27 Jawaharlal Nehru Road, Kolkata - 700 016. 325p, Price INR: 575/-, US\$: 32/-, UK£: 20/-

Marine Geology is a relatively young branch of Geology. It was initiated in India at the Andhra University, Waltair in the late 40's and early 50's (*see* Mahadevan and Das, 1948) and continued as a Special Assistance Program of the University until IIOE (International Indian Ocean Expedition-1960-65) launched by UNESCO. Several research papers were published before IIOE. The National Institute of Oceanography (NIO) was established in the year 1965. The Marine Wing of the GSI was established in seventies. History shows that the research in Marine Geosciences in India is older than 50 years.

The volume under review is a transcript of the seminar 'Four Decades of Marine Geosciences in India - A Retrospect', held at GSI, Mangalore in March 2001. The volume starts with four invited papers. Dr. Ravi Shanker, the then Director General, GSI covered the energy and mineral resources of the sea. It would have been in the scheme of things, had he mentioned the sequence of events which culminated in the establishment of the Marine Wing, GSI or, pioneers from GSI (Drs. Kurien Jacob, G.C. Chatterji, C. Karunakaran and H.N. Siddiquie) who prepared the mineral resources map of the Indian Ocean. In fact, some of these pioneers were responsible for establishing the Department of Marine Sciences, at Cochin University, Centre for Earth Science Studies at Trivandrum and a strong Marine Geology and Geophysics group at NIO, Goa. Further, it is not out of place to mention the names of Professors C. Mahadevan, M. Poornachandra Rao and M. Subba Rao from Andhra University, and Shri R.R. Nair and Dr. M.G.A.P. Setty from NIO, Dr. V.V. Sastry from Oil and Natural Gas Commission, who have advanced Marine Geology in India and contributed excellent publications, much before the Marine Wing, GSI came into existence. I feel it is our responsibility to remember these pioneering scientists in a publication of this type. The papers on 'Renewable Energy from the Ocean' by Prof. Ravindran and 'Law of the Sea and UNCLOS 1982' by R. Srinivasan and Inda are very informative. Dr. Kuldeep Chandra has

summarised excellently the 'Energy Requirements in India by 2020 and Future Strategies'.

Of the 51 contributed papers, 37 are from GSI and 14 from other Institutions and Universities. There are many good papers. The paper related to the sedimentary processes and structural framework of the Konkan Basin is well illustrated and arguments on seismic data are well supported by bore well data, both in shallow and deep waters of the Konkan Basin (pp.43-52). They indicated the possible prospects of hydrocarbons in the deeper Konkan Basin. Prasad et al. (pp. 53-56) discussed the Rock-Eval pyrolysis parameters of organic carbon in the sediments and the factors (productivity/preservation) responsible for the enrichment of organic carbon. The plot of T_{max} vs. HI should have shown to indicate the type of organic matter. The captions for figures 1 and 2 need to be interchanged. Studies on foraminiferal biofacies from the Bay of Bengal indicated that the change in planktonic biofacies is largely related to the influx of fresh water and sediment, and benthic biofacies to bathymetry and nature of substratum (pp. 80-85). There are two papers on the microfauna of the Andaman Sea. One paper reports the Aragonite Compensation Depth (ACD), which lies at about 1200 m, based on the occurrence and dissolution of pteropods (pp. 89-96). It also identifies the climatic transition at about 13,000 to 14,000 yrs BC (?). Other paper reports the distinct benthic/planktonic foraminiferal assemblages on either side of the deep seated West Andaman Fault (pp.102-107). No marked changes are seen at the Pleistocene - Holocene boundary shown in cores (*see* Fig.4). The Last Glacial Maxima (LGM) was identified in the sediment cores of the Carlsberg Ridge (pp. 119-124). A paper on palaeo-productivity variations from sediment cores of the eastern Arabian Sea (pp. 137-145) has a large data set, which was not described adequately. On the basis of assigned ages, the intensity variations in monsoonal regime during the late Quaternary was discussed, but the changes suggested were not in agreement with the findings of other workers

in this region (Thamban et al. 2001). Although descriptive, the figures in the papers on ostracodes (pp. 97-101) and bryozoans (pp. 125-131) are useful for beginners to identify the faunal components.

At present, scientists are modelling climate and looking into the second / third decimal level variations in temperature on decadal scale by using isotopes and precisely dating events by Accelerator Mass Spectrometry. It is unfortunate that no paper in this volume has employed stable isotopes or presented a core with at least one radiocarbon age. Paper no. 13 is helpful for understanding glacial/interglacial cycles and events recorded in ice cores and forcing functions behind the climate change (pp. 70-76). Another impressive paper is on sulfur isotope systematics and application of these isotopes (pp. 254-261). As the authors compiled sulfur isotope data from ores and sediments from a wide variety of environments and seas, this paper would serve as reference paper.

Another set of papers characterizes the surface sediments and underlying sedimentary structures of the seabed by remote methods. Backscatter data of the Side-Scan Sonar (pp. 57-60) and acoustic return signals and acoustic impedance (pp. 228-230) were analyzed in an area where sediment characteristics are well known and, successfully classified the type of sediments. However, there are limitations in the use of the backscatter data. Using satellite altimetry data, the subsurface geological structures were inferred (pp. 231-240). There seems to be something abnormal here. Bathymetric contours (Fig. 4), as expected, are parallel to the coast at shallow depths and deeper depth contours bend on the slope, but geoid contours obtained by Geosat (Fig. 2) extend right onto the coast. In the free air gravity map (Fig. 15) the features show E-W trend, instead of expected N-S trend. Fluorescence technique, which helps to detect nanolevel concentrations of hydrocarbons, was applied for the offshore sediments of the Karwar and Kachchh and found that this technique is beneficial for oil prospecting (pp. 187-191).

There are six papers on heavy mineral placers from different areas. Apparently several workers were involved in heavy mineral research (see authors in paper no. 26). One should accept that much labour has gone into generating large data set for each area. The authors have either estimated the resource potential or reported the transport pathways of heavy minerals. It may be realized that (a) offshore mining for placers has been abandoned in several coastal states due to environmental problems. (b) And there is hardly a paper on heavy minerals in the standard international journals for the last 10-15 years. Even if one finds a paper it is on isotope studies or rare-earth chemistry on specific heavy minerals.

Papers dealing with geotechnical properties (pp 206-225) and distribution of heavy metals in the sediments (pp. 269-278; 288-295) are well written. There are two papers on authigenic green clays and phosphorites. In one paper, the material is good but lacks focus. The authors describe all geomorphic features, terrigenous, biogenic and authigenic sediments (pp. 24-31). In doing so, some figures are not described in the results section but appear in discussion. Plates have no scale bars and are overly reduced. At one place, the authors are referring to the SEM photograph, probably a nanofeature, but the figure caption says 'replacement of calcite/aragonite by apatite nodules'. Something wrong! Another paper is on chemistry of phosphatic sediments from the same region (pp. 156-159). I am afraid the author has no clear concept on authigenic green clays which form within the substrates but not as loose clays, as mentioned in the paper. The author mentioned the fluorapatite but the fluorine content shown is low. Hydroxyapatite is a constituent of bone/teeth. How can Ca be 35 ppm when CaO is 36.8 to 52.2%? Discussion has no relevance to the results. Except Vaz's papers, he does not seem to be aware of any other phosphate paper in this region.

Some papers are not upto the mark. Is this valid - 'rapid rise of sea level carves submarine terraces'? (pp. 32-35). West coast fault in one figure is in the offshore but in the other figure it is on land. The concept on Panvel Flexure as a monoclinical fold is too old as the new concept says that it is due to faulting (Dessai and Bertrand, 1995). The whole paper appears to have been based on only one paper by Subrahmanya (1994).

I really do not understand the mindset of the authors. They have not cited landmark papers, which earned international reputation (e.g. Subba Rao, 1963, 1964; Siddiquie, 1967; Nair and Pylee 1967; Stackelberg, 1972). Did the authors bring out something new, so that these papers are outdated? Of course not! Although it is well known for years that the modern marine clays are detrital in nature, one paper talks of illitization and chloritization of smectite (pp. 36-42). The authors have divided the percentages of minerals present in the samples into six grades and the range of percentage for each grade is not given. How can one compares the data presented in the paper if the percentage of minerals is not known? Peculiarly, the X-ray diffraction scanning speed is '24 and 25 q/min' and X-ray target '⁶⁰Ni/Cu K α radiation' are given!

Another paper is on chemistry of the oolites (pp. 179-182). The Sr content and Sr / Ca ratio in aragonite oolites are expected to be 0.96 to 0.99% and 0.025-0.026, respectively (Milliman, 1974). Although samples chosen for

analyses have minimum boring or overgrowth, the values reported here are much smaller. So do we need to call them oolites? Why not consider an alternative (Rao et al 1994)? Although it is well known that there are no diagenetic changes, especially in recent marine sandy sediments, authors attributed the change in chemistry to diagenesis. Moreover, the authors ponder about authigenic green clays, which are of no relevance to this paper. The authors lack concept and the paper lacks focus. What do we learn from a paper which has 7 figures, but the results, discussion and conclusions were brought down to a half page (pp 241-243)? Is the paper means listing of objectives of International Programs/Projects or listing of facts from other papers (pp 77-79)? A paper without references (pp 296-300) and a paper without figures (pp 176-178) are also seen. Is the East coast of India a tidal wave-dominated environment (pp 296-300)? In one paper (pp 300-305) the study area is 'Kerala offshore' in abstract, 'Karwar offshore' in methodology and 'off Goa' in figure. I found a new definition for diagenesis! The chemical analysis of the sediments is done, but limestone chemistry was discussed. Besides, there are numerous other mistakes (spellings, citing and listing of references, unexplained abbreviations, absence of captions for tables, subscript and superscripts for chemical compounds and diffraction peaks, units for concentration of elements in figures as well as in tables etc.) in several papers.

Despite all these deficiencies, we need to appreciate the effort in bringing out the hardbound volume within eighteen months after the seminar. Although preliminary, the work incorporated is useful. As all of us are aware that the GSI recruits the best geologists through a competitive process. The reviewer is of the opinion that lot of talent is unutilized and geologists can do much better science, comparable to those in USGS or British Geological survey. What needs to be created is a suitable environment and infrastructural facilities to contribute in frontier areas of marine geosciences. The marine wing of GSI may have to redefine its objectives to show the nation that 'GSI not only

surveys and produces maps but also carries out world class science'

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