than their strategic importance. In addition, a general summary is provided of the base- and precious-metal exploration which has been undertaken in this greenstone belt over the years. Tables compiled from the South African Mineral Deposit Database, which lists 433 economic mineral deposits and occurrences in the greenstone belt, are included as an appendix.

The Barberton Greenstone Belt represents an Archaean volcano-sedimentary terrain enveloped by invasive sial marking the geotectonic foundations and setting of the deformed depository. In addition to giving the stratigraphy, structure and metamorphism of the belt, the evidences for compression and inversion of the Barberton basin as a fold-and-thrust belt is recorded and interpreted, for modelling purposes, as a response to a primitive Wilson cycle.

Economic mineralisation in the belt is classified into three distinctive metallogenic groupings in terms of the major episodes of crustal shortening and accompanied compression and inversion of the Barberton basin.

Precollisional mineralistion is evidenced by syngenitic iron protore, stratiform barytes deposits, and a small Kuroko-like massive sulphide ore body. Syncollisional mineralisation is represented by epigenetic chrysotile-fibre deposits in serpentinised and deformed sill-like layered ultramafic bodies. Post collisional mineralisation is manifested by epigenetic, mesothermal-hypothermal, disseminated and lode gold ore bodies, and by epithermal stockworks of magnesite. Details of the mineralisation are recorded, analysed and interpreted in terms of the evidence for the geotectonic setting and metallogeny of the Barberton Greenstone Belt, as well as the general prospecting potential of the host rocks.

The author J.H.W. Ward, and the editors, Council for Geoscience, Geological Survey of South Africa deserve congratulations for producing a very informative and absorbing publication with an orientation on mineral deposits. The book is replete with very well produced geological and structural maps, cross sections, three dimensional block diagrams, presentation of all available petrological, mineralogical, isotopic and geochronological data and an extensive bibliography. The book makes an interesting reading for its scientific content, the clarity of the geological maps produced with soft colour schemes, and well reproduced photographs.

(The memoir is available for sale from the Director, Council for Geoscience, Geological Survey of South Africa, 280, Pretoria Street, Silverton, Pretoria, 0001. A copy of the same is available for reference at the library of the Geological Society of India, Bangalore).

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GEOMORPHOLOGY AND GEOLOGY OF THE BAY OF BENGAL AND THE ANDAMAN SEA

'Geomorphology and Geology of the Bay of Bengal and the Andaman Sea' authored by V. Purnachandra Rao and Pratima M. Kessarkar forms the Chapter 21 of a two-volume book: **Indian Ocean – A Perspective,** edited by Rabin Sen Gupta and Ehrlich Desa (NIO, Goa) and published by A.A. Balkema in 2001. In the introduction, the authors briefly mention the uniqueness of the Bay of Bengal in reference to its sedimentary record and trace the history of geological and geophysical studies in Bay of Bengal and Andaman Sea dating back to the 19th century commencing with the Challenger Expedition (1872-1876). Major physiographic features of the area are described under Geomorphology. Detailed description on shelf-slope characteristics of the Eastern Continental Margin of India with generalized bathymetric profiles at selected places is given. Brief mention has been made on the submarine canyons/valleys off the East Coast of India and northeast margin of Sri Lanka, which supply sediments to the deep sea Bengal Fan, the world's largest delta. The Bengal Fan covers an area of about 2.8 - 3.0 x 106 km^2 (length: 2800 - 3000 km, width: 830-1430 km) between 20° N and 10° S latitudes with a sediment thickness of about 20 km. The most prominent geomorphic feature of the Bengal Fan domain is the Ninetyeast Ridge extending from 30° S to 10° N with subdued expression further north up to 17° N latitude, but has not received the attention of the authors. Similarly, the subduction zone occurring west of the Andaman-Nicobar Island extending southeast along the Sunda-Java-Sumatra trench, and the Nicobar Fan find no mention.

The chief physiographic features of the Andaman Sea include the Martaban canyon, the rift valleys, sea mounds (Alcock, Sewell), banks (Mergui, Invisible), spreading ridge, volcanic islands (Barren, Narcondam) etc. Brief mention has been made on some of these features, but a few (eg: islands, rift valleys, banks etc.) are not at all touched upon. More details should have been given on the evolution of the different physiographic features of the Andaman Sea, which is a reflection of the subduction of the Indian plate and the spreading in Andaman Sea. Detailed bathymetric maps of the Bay of Bengal and the Andaman Sea as well as a representative E-W bathymetric profile from the East Coast of India to the West Coast of Malaya would have helped the readers better appreciate the geomorphic features.

Geology, which forms the major part of the write-up deals with both surface and subsurface sediments. The surficial sediments have been discussed under lithogenous, biogenous and chemogenous sediments. The contribution of sediments by various rivers, sediment accumulation rates, sediment distribution and grain size, distribution and dispersal of heavy and light as well as clay minerals are the aspects dealt with on the lithogenous sediments. The sediment distribution map of Bay of Bengal is after Subba Rao (1964) and that of Andaman Sea, after Rodolfo (1969). The authors should not be found fault for this, because sediment distribution maps compiled incorporating the recent data are not available.

A map showing the major clay mineral provinces along the eastern continental shelf of India based on montmorillonite/illite (M/I ratio) has been given, but maps showing the distribution of different clay minerals in the whole of Bay of Bengal and Andaman Sea should be more informative. At least one such map showing the distribution of smectite in Indian Ocean sea bed (including Bay of Bengal) is available (Wijayananda and Cronan, 1994).

Biogenous sediments in the Bay of Bengal and Andaman Sea are mostly carbonates and the write-up includes a calcium carbonate distribution map modified after Kolla and Rao (1990) in the case of Bay of Bengal and Rodolfo (1969) in the case of Andaman Sea. Authigenic green clays (glaucony and verdine facies), phosphorites, ferromanganese nodules and hydrothermal and organic rich sediments come under the category of chemogenous sediments. Though sparse in occurrence, the distribution and origin of the different chemogenic sediments have been described in great detail.

The nature of subsurface sediments as evidenced from the study of a number of Deep Sea Drilling Programme (DSDP) and Ocean Drilling Programme (ODP) cores have been enumerated in detail. The deep-sea sediments of the Bay of Bengal are predominantly turbidites of different facies. They provide invaluable record of the Himalayan erosion, which is related to the climate and the uplift history of the Himalayas. The role of turbidity currents during the two phases of sedimentation, viz., from Cretaceous to Oligocene and since Oligocene, in the Bay of Bengal, the characteristics and sources of turbidites, and controls on turbidite sedimentation (tectonics and eustatic changes of sea level) are some of the aspects the authors have paid attention to. The isotopic data (Sr, Nd, O and C) available on the composition of the turbidites and their significance in deducing the source are briefly dealt with. Finally, the authors have summarized the results of the Neogene and Quaternary palaeo-oceanographic studies largely from DSDP sites of the Ninetyeast ridge and Andaman Sea.

It is felt that the authors have not given due significance to the volcanic components of the sediments of the Northeast Indian Ocean, though their presence is occasionally mentioned. There are number of publications, which describe the volcanogenic components in the sediments from Cretaceous to Recent. The Cretaceous sediments of the NE Indian Ocean have volcanogenic smectite, derived probably from Rajmahal Traps (Brass and Raman, 1990). Cores recovered from the Ninetyeast Ridge record sediments that are rich in volcanogenic sediments over basaltic basement (Campanian). On the northern part of the Ninetyeast Ridge, the Site 758 shows the beginning of a continuous volcanogenic component from 22-23 Ma (Venkataramana, 1974) to the Recent (Dehn et al. 1991), which is taken to indicate volcanic activity along the Indonesian arc. Further, numerous piston cores obtained from the NE Indian Ocean show ash layers, which can be correlated to the Indonesian arc volcanism over the last 5 Ma (Ninkovich, 1979; Ninkovich et al. 1979).

The Geological Survey of India has carried out systematic surveys in most parts of the Bay of Bengal and Andaman Sea as part of their mapping programme in EEZ of India, since 1984 after commissioning their Research Vessel *Samudra Manthan*. Most of the data so collected on bathymetry, magnetics and sediments remain unpublished. It will be a great service to the scientific community, if the Survey undertakes the task of collating all the data and brings out publications on the geology of Bay of Bengal, Andaman Sea and Eastern Arabian Sea. After going through the present write-up, the need for such publications is felt all the more important.

The write-up could have been improved substantially had more attention been paid in editing the manuscript. Shortcomings shall be there always in such attempts, but it is to be said that the authors have done a commendable job in synthesizing all the available information in various publications (the references run to 315) and present them in a readable form. This work will be of great interest to researchers as well as professionals working in the field of marine geology. The write-up is available for consultation in the library of the Geological Society of India.

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CONTROLS ON FORMATION OF BEACH SAND DEPOSITS ALONG ANDHRA PRADESH COAST: A STUDY ON HEAVY MINERAL DISTRIBUTION PATTERN, SIZE CHARACTERISTICS, SOME BENEFICIATION PROBLEMS AND COASTAL ZONE MANAGEMENT PLAN*

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EXTENDED ABSTRACT

The coast of Andhra Pradesh extending over 900 km length exposes varied compositional suite of heavy minerals. Formation of the sizeable economically viable heavy mineral deposits along the coast are principally controlled by the presence of a suite of suitable rocks in the hinterland, existing drainage, climate, coastal processes and geomorphic features favourable for sediment deposition. Although the provenance is a key factor for contributing substantial amount of heavy minerals, the climate plays a vital role in releasing the heavy minerals from the source rocks. Many beach placer deposits of the world occur between the latitudes 30° S and 30° N. The ideal case is the alternate tropical to subtropical climate, which favours effective weathering processes. The transporting agents like rivers, streams, and wind carry the resistant minerals, quartz and heavy minerals to suitable depositional environment.

In case of coastal processes, the sorting of heavies takes place by wave action on foreshore. The bulk of sediment is carried away by long shore currents resulting in the formation of sandbars extending over several kilometers along the coast. Rock promontories, bay features, creeks etc. are more favourable sites for sediment deposition. The sea level oscillations and other coastal features like shape of coastline beach-slope control the sediment deposition and may give rise to better concentration of heavies. The marine transgression with low sediment-input allows rich concentration of heavies on beaches, where as dunes are affected. On the contrary, marine transgression with high-sediment causes the dispersal of heavy minerals in sand dunes, where as beaches are preserved. Marine regression with low or high sediment result in erosion of beaches and dunes are preserved. Thus, the mechanism of sediment

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