

**An Overview of Litho–Bio–Chrono-Sequence Stratigraphy and Sea Level Changes of Indian Sedimentary Basin.**

D. S. N. Raju *et al.* (eds). Association of Petroleum Geologists, Special Publications 1. 210 pp. Price not mentioned.

This book is organized under various themes. Gradstein and Ogg's new geological timescale is retrogressive as it omits the subdivisions for the Precambrian–Ordovician span. Peters *et al.* have classified basins in various categories, which shall be useful in planning of oil exploration. Basins of Central India provide the tectonic framework, basin architecture and tectono-sedimentation model of the Vindhyan, palaeocurrents and Bouguer anomaly maps of the Satpura and South Rewa basins; these are valuable additions to the existing knowledge. Babu assigns Cambrian age to the Kurnool Group on the basis of trace fossils, published earlier from Paniam and Owk formations. The present reviewer had examined the type localities and found that these 'trace fossils' are sedimentary structures like synaeresis mud cracks, hence of no biostratigraphic value. Ravi Shanker *et al.* make a passing reference to hydrocarbon resources and synoptically describe events in the Peninsula and the Himalaya. Their Table 3 has numerous fallacies: The Jeori–Wangtu Complex has been assigned Archaean age, whereas it is much younger (Miller, Klötzl Frank, Thoni, Grasemann, *Precambrian Res.*, 2000, **103**, 191–206). The age of the volcanics associated with the Manikaran Formation is also wrong, and stands revised in the paper of Miller *et al.* Sanglung, Hangrang and Alaror (Lilang Group) have been placed within the Carnian. In fact, a part of the Sanglung Formation and the entire Hangrang and Alaror formations represent Norian age. The Spiti Formation is shown to range from Middle to Late Jurassic. It contains *Neocomites* and ranges up to Valanginian. Detailed account of events in the Himalaya was described earlier also (Srikantia, *Colloq. Int. CNRS*, 1977, **268**, 395–407; Bhargava, *Geol. Rund.*, 1980, **69**, 811–823). The age of the Jaunsar/Simla, Blaini-Tal since has been revised, though the relative order of events still remains in tact. For Kashmir, Ravi Shanker *et al.* have used a classification published in 1987 and ignored the one published earlier (Srikantia, Bhargava, *J. Geol. Soc. India*, 1983, **24**, 363–377). Table III

(provided in pouch, same comments applicable to Table IV) under the Zanskar column shows nomenclature proposed by Srikantia *et al.* (*Himalayan Geol.*, 1978, **8**, 1009–1033); yet these authors have not been acknowledged. In the Spiti column, the classification should have been more appropriately referred to Bhargava and Bassi (*Mem. Geol. Surv. India*, 1998, **124**, 210), where various details are available. In this very column, Thango has been spelt as Tango, the Alaror and Nunuluka formations succeeding the Hangrang Formation have been omitted, implying a major break at the base of the Kioto, while the Lagudarsi Group has not been mentioned. Adoption of the column by Arora is unfortunate; it is an armchair exercise with no field-effort to prove the mappability of several formations (e.g. Parahio, Niti). It divides Lagudarsi Formation further into three formations (!) and shows a regional break below the Kioto, which is neither backed by palaeontology nor by sedimentologic evidences. Under the Shimla region, the Jutogh, which encloses granites dated between 825 and 1100 Ma, is placed above the Simla Group and below the Blaini 'Group'; this placement is attributed to Srikantia and Bhargava, which is incorrect. In Garhwal, the Berinag Formation contains volcanics of Rampur age, yet this formation is placed above the Deoban Formation. Under Bhutan, Lingshi Group has been spelt as Linghi. In Nepal, the Dark Band and Chitlang formations have yielded Llandovery graptolites and conodonts respectively, also known are Givetian fossils (for details see Talent and Bhargava In *Silurian Land and Seas* (eds Landing and Johnson), New York State Museum Bulletin, 2003, vol. 493, pp. 221–239). These sequences and also the Triassic sequence (see Bhargava, this volume) have been omitted in the Nepal sector. Major geologic events, based on high-resolution biostratigraphy (Raju) shall aid deciphering the geological history of India. Information on Marine and near-shore sediments of Permian Gondwana Basin (Acharyya) has applied implications. Marine incursions in the Peninsula are coeval with transgression and/or deepening in the Himalaya. Deepening in the Himalaya occurred also during the Early Triassic and Carnian; corresponding marine influence in the Peninsula needs examination. Krystyn *et al.* utilize integrated conodont and ammonoid biostratigraphy to delineate Induan–Olenian

(also Griesbachian–Dienerian within Induan and Smithian–Spathian within Olenian), Olenian–Anisian, Anisian–Ladinian and Ladinian–Carnian boundaries; it is one of the most important biostratigraphic works in the Himalaya in recent years. Illustrated Jurassic ammonoid zonation (Jai Krishna) with comments on intra-basinal dynamics and sequence stratigraphy will be useful to Jurassic stratigraphers. Raju and Ramesh mention time-transgressive nature of the Raghavarapuram Shale. The alternative interpretation could be presence of diastems. As a result, different parts of the Raghavarapuram Shale were deposited in different sections. Depositional model for Mio-Pliocene delta of Tripura (Mahanti *et al.*) and faunal discrepancies in the Siwalik (Nanda, Sehgal) contribute significantly to the Neogene geology. Carbonate sediments, their palaeoenvironment and hydrocarbon occurrences (Raju *et al.*) need two corrections: basal part of the Lipak Formation has carbonate beds that have yielded Givetian and Famennian conodonts (Draganits, Mawson, Talent, and Krystyn, *Riv. Ital. Palaeontol. Stratigr.*, 2002, **108**, 7–35) and that the Kuling Formation has no carbonate worth mentioning. The theme of hiatuses and rates of sedimentation section has five papers. Raju and Prabhakaran mention that post-Cretaceous higher rates of sedimentation match with the Himalayan orogenic episodes. Another high rate of sedimentation recorded in the Cauvery Basin coincides with separation of Madagascar. For several orogenic events proposed by Ravi Shanker, no high rate of sedimentation is observed; obviously every hiatus does not represent an orogeny. Low rate of sedimentation (Raju, Prabhakaran) mentioned during the Proterozoic in the Himalaya, in my opinion, is due to non-recognition of unconformities in these sequences. Raju and associates briefly deal with various basins, relative sea-level curves and MFSSs, K/T boundary in Cauvery and K. G. basins, Middle Miocene–Early and Andaman Offshore with tabulated account and maps that vividly convey the geological set-up of these areas. The theme litho–bio–chrono stratigraphy has eight well-organized contributions, mostly by Raju and his associates. Most important are nannofossil biochronohorizons and illustration of Cretaceous and Cenozoic marker planktonic foraminiferal and their LAD and FAD, significance of miogypsinids and associated foraminifera in classifying Miocene in seven sub-

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division and advances in the study of dinoflagellate (Mehrotra). There is a tendency to correlate every event or boundary with European/American/Chinese events/boundary, which are seldom fully equivalent. Thus creation of Indian Stages (Raju) is most welcome. Raju *et al.* provide an insight in the paleogeography of the Indian plate during Cretaceous and Cenozoic. The theme of application of foraminifera/fossils in sequence stratigraphy incorporates eleven articles dealing with the use of foraminifera/fossils in stratigraphy, system tracts, set up of Bombay High coastal and sea-level changes during Holocene (eight contributions by Raju alone and/or with associates), sequence stratigraphy, bathymetry and hydrocarbon exploration (Ramesh, Peters and Raju). Illustrated review of petroleum systems in the Indian sedimentary basins (Kuldeep Chandra *et al.*) shall be of immense use to the earth scientists of various disciplines. The supplement has two sections: (i) Mesozoic stratigraphy of Nepal (after Bordet 1971; Gradstein *et al.*, 1992). More details are available for the Triassic in the works of Fuchs, Krystyn and Waterhouse (for details see Bhargava, this volume); (ii) Discovery of SSF from the Gangolihat Dolomite by Azmi and Paul (2004). Above the SSF level, search should be launched for younger fossils in the overlying carbonate sequence that is ideal for fossil preservation. Absence of the Blaini sequence, which is a marker in the Lesser Himalaya, needs to be explained. In the absence of both, the possibility of the SSF-bearing sequence either as an infolded outlier or tectonic involution like the Chilar (Rai *et al.*, *J. Palaeontol., Soc. India*, **42**, 71–80) in the Tons Valley (Bhargava, 2004, 2nd APG Conference, Abstr., 8–10) be considered.

The Editors of this volume have executed an ambitious project with dexterity and success. Except for minor printing errors and editorial inconsistencies, the publication is well brought out with a wealth of data concerning almost all the sedimentary basins. There are several articles which have overlapping data and are

complementary and also supplementary to each other. This was unavoidable under the present organization of themes. I hope that in the near future age/basin-wise compilation with holistic view shall be attempted by Raju and Peters. The only drawback in this volume is its big size. The APG has accomplished a great task by encapsulating enormous data collected by the ONGC over several decades, documented by figures and tables. This publication will be of immense use to students, researchers and professionals alike. I have no hesitation to recommend it to adorn the shelves of all the libraries – personal and institutional.

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**Pakshi Prapancha.** Harish R. Bhat and Pramod Subbarao. Price: Rs 465

Kannada being an ancient language, there is no dearth when it comes to evocative description of nature's beauty, her bounty or description of the myriad living beings that dwell in the forest-rich landscape of Karnataka. However, *Pakshi Prapancha* by Harish R. Bhat and Pramod Subbarao, has the distinction of being the first ever scientific field guide on birds brought out in Kannada.

The book boasts of excellent photographs that help a great deal in proper identification of birds, which is the primary objec-

tive of such a field guide. This itself is remarkable, as some of the birds captured by the photographers are exceptionally elusive and rare, while some of the birds though could be found in abundance, are difficult to be photographed owing to their swift movements, or inaccessible habitats. Karnataka has produced many nature photographers of international repute, and their contribution to the book is immense. It is gratifying that the quality of reproduction of these enchanting photographs is but satisfactory. Amazing are the photographs of the Malabar trogon, Malabar whistling thrush and the Malabar parakeet and other birds that dwell in dense reforests of Karnataka.

Of the 522 species of birds recorded from Karnataka, the book deals with 161 species. Each page of the book has a colour photograph of a bird, above which is written the Kannada name, common name (in English) and the scientific name. In most cases, the Sanskrit name and other names in local dialects are also given. One gets to appreciate about 200 photographs, and the book boasts of 85 quality sketches. Much effort has gone in the designing of the each leaf of the book. A table that pictorially depicts activity, food, etc. of a particular bird, and a sketch on its nesting habit renders the book invaluable. With a brief description of the habit, habitat, call, breeding season, average age, distribution, the most likely place to watch, and uniqueness of the bird, the field guide is complete in all aspects.

Yet another 100 pages are devoted to familiarize the reader with various aspects of bird life. Admirable are the efforts of the authors, who have painstakingly searched Kannada literature for poems that concern birds, and have placed such nuggets of poetry appropriately. As a result, one is also exposed to the richness of the language, the wisdom of the people and their ecological sensitivity. With all this, the book is also reasonably priced.

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