BOOK REVIEW

FORELAND SEDIMENTATION IN HIMALAYAN TECTONIC REGIME: A RELOOK AT THE OROGENIC PROCESS by V. Raiverman. Bishen Singh Mahendra Pal Singh, Publishers, 23-A, New Connaught Place, P.O. Box 137, Dehra Dun - 248 001, 2002, 378p. Price: Rs.3000/-; US$125.00.

The Himalayan foreland basin is a vast repository of Cenozoic sediments along the foot hill in two distinct structural belts respectively of Palaeogene and Neogene period. V.Raiverman, based on his studies in these belts, has attempted in this book a review and synthesis of all data collected by him. In the introduction the author provides a succinct description of the tectonic setting of these belts in the southern Himalaya with a view to bringing out the relationship between sedimentation and tectonics in orogenic setup.

The main Cenozoic formations are variously classified conventionally as Subathu, Dagshai, Kasauli covering the Palaeogene and the Lower, Middle and Upper Siwaliks covering the Neogene. However, as yet no standardized, broadly accepted classification has emerged for the Cenozoics of the foothill belt.

The stratigraphy first proposed by Medlicott (1865) still remains the best attempt so far to classify the Cenozoic lithostratigraphically and is the one which is easily understand for adoption for the entire foreland belt. The names such as Dharmasala, Murree, Nahan also find wide usage.

The main focus of the book is on aspects of energy sequence in the tectonic evolution of Cenozoic sedimentary basins and their sedimentation history. According to the author the energy sequence classification marks out stratigraphic units of optimum size suitable for regional correlation. He brings out the broad difference between the sequence stratigraphy and the energy sequence. The author developed the energy sequence for the sediments in the Himalayan foreland basin that is subjected to repetitive tectonic pulsation. In addition, the time aspect has equal relevance as emphasized by the author. The clastic components and grain size reflect the regional effect of uplift, subsidence and geomorphic environment.

The energy sequence classification is dependent on moving average value of grain size plotted against depth. The strata between two markers constitute an energy sequence unit which the author refers as *enseq*. In terms of stratigraphy an *enseq* consists of a package of relatively higher energy deposits succeeded by one of lower energy. The author argues for a time stratigraphic status to *enseq*. Based on these concepts, the author classifies the Cenozoic succession of Western Himalayan foreland and Indo-Gangetic foredeep into three superenseq, from bottom to top, they are: as Charing Cross, Sutlej and Beas. The main enseqs are Dharmpur, Kumarhatti, Makeri, Jawalamukhi, Kalidhar, Sadhot, Batwan, Wahdevi, Sarda, in the ascending order with the corresponding litho-stratigraphic classification.

In the chapter on heavy mineral correlation, the author emphasizes on its importance as a correlation tool in the study of foreland Cenozoic sedimentation. He, however, limits their utility as "Index Minerals" for local rather than regional correlation, though they reveal information on aspects of tectonism as related to provenance and rate of sedimentation. He discusses the energy sequence in relation to heavy minerals in various foreland sections of the Western Himalaya.

In the next chapter, he describes how energy sequence classification regroups lithostratigraphic units in time frame for ease of regional correlation.

In chapter six, the author focuses on tectonic control in sedimentation in relation to age of enseqs. It is a well known factor that a subsiding foreland basin accommodates enormous thickness of sediments from a rapidly raising land adjacent to the basin, as borne out by sediments in the Siwalik basin. In fact the development of Cenozoic belts clearly suggests a sequential evolution of uplift of land, foreland, subsidence, deposition of sediments, again followed by uplift of sediments and migration of basin in cyclic sequence. There is no doubt as the author concludes, that there was perfect synergy between Himalayan elevation and foreland basin sedimentation.

In the chapter on basin architecture, unconformities and transgression-regression cycle, the author presents tectonic framework of foreland basin with particulars of ridges and depressions. He deals with various unconformities in the fold belt and the foredeep, correlating each *enseq* with an unconformity, further dilates their relationship during

different periods and analyses their significance in time and space

In the chapter on evolutionary history of the Indo-Gangetic foredeep the author analyses in particular the significance of energy sequence classification of the Cenozoic succession of the foredeep based on the data from 11 wells from the foredeep and the interpretation of sedimentation pattern with respect to unconformities and basin evolution Though the foredeep is largely not in a state of compression, it cannot be denied that the effect of thrusting of the Neogene Siwalik belt over the Indo-Gangetic belt has caused subthrust structural deformations

The lithofacies analysis regarding depositional energy and environmental factors in Cenozoic sediments cover the ninth chapter These aspects are discussed taking into consideration the texture, primary sedimentary structures, trace fossils, floral remains as related to individual *enseqs*

In the next two chapters, the author based on size of clasts, petrography and compositional changes in each *enseq*, interprets their source area, palaeodrainage, palaeoclimate and order of cyclicity

The twelth chapter deals with the evolution of drainage system in the foreland basin This study based on palaeocurrent patterns and detrital heavy minerals provided a basis for understanding the palaeodrainage system for parts of Palaeogene and Neogene sequences Combining this data with primary sedimentary structures, the author suggests a multidirectional current system and three main drainage systems for the Western Himalayan foothills, all flowing west and southwest This included proto-Ganga and proto-Yamuna The author also briefly touches upon the ancient course of the Saraswati river which existed from Late Oligocene-Early Miocene to Holocene

In chapter thirteen based on palaeoclimatic indicators in the Cenozoic sediments of the Himalayan foreland, the author discusses palaeoclimate in the context of global climatic cycles and tectonic pulsations He proposes a long spell of hot climate during Dharmpur *Enseq* (Late Palaeocene-Middle Eocene) interrupted by cold interval during Makreri *Enseq* (Late Oligocene-Early Miocene), followed by warm cycle during Jawalamukhi *Enseq* (Early Miocene-Middle Miocene) Kalidhar *Enseq* (Late Miocene) represents a cold interval The cold spell continues upto Middle Pleistocene represented by Batwan *Enseq* The Middle Pleistocene represented by Wah Devi *Enseq* heralds the onset of warm climate though the lower part of Sarda *Enseq* (Late Pleistocene-Holocene) marks a spell of cold climate However, the uppermost part of this *enseq* (Holocene) marks a warmer transition in the Indo-Gangetic valley The author believes that the Himalayan elevation and the global climate are independent factors

In the chapter on structure of the foreland fold belt, the author deals with various structural features within the Cenozoic belts and identifies them in a series of seismic profiles It also covers the interpretive aspects of major structural differences in the Neogene autochthon and Palaeogene parautochthon to bring out that in the former wrench faults are common, and thrust faults in the latter It is difficult to accept the contention of the author that all wrench faults and thrusts originated from synsedimentary basement faults, excepting along the boundary of these belts where basement Mesoproterozoic carbonate belts with Palaeocene-Eocene Subathu cover (the author isolates Subathu alone as an inlier) are involved in thrusting over the Neogene belt

In the penultimate chapter, the author discusses the sequence of faulting and, thrusting in relation to topographic relief He attempts the correlation of Himalayan intracrustal thrusts, Vaikrita and other thrusts in the south, and the Himalayan thrusts west of the Jhelum syntaxis He presents a model of structural evolution of different tectonic units in the Himalayan orogen and discusses deep seated faulting versus thin skinned tectonics and makes no bones about his preference for the former

In the epilogue the author discusses the search for Himalayan roots whatever it means He advocates that the Himalayan structures have basement control He opines that the tectonic translation of the Lesser Himalayan block is small He questions validity of estimate of translation of the Lesser and Central Himalayan blocks However, he seems to have overlooked the existence of tectonic windows which supports the translation of crystalline thrusts over a distance of 130 to 160 km

The author's discussion on aspects of his idea of vertical tectonics as opposed to thin skinned tectonics seems to be a digression from his main theme and he could have spared these thoughts for a separate publication It would have been prudent if he had confined to foreland tectonics where he worked over a long period rather than to stretch it to other sectors without much of a valid data or evidence

The book contains a detailed reference and the author has provided an useful subject index There are 228 figures in the text and 6 maps in the pouch A list of plates would have been helpful

The author has provided a vast data and a whole range of information on major aspects of foreland Cenozoic sedimentation If would have added some more meaning if he had included palaeontological aspects of these sediments

There is a proliferation of chapters particularly pertaining to structure and tectonics which could have been combined and that would have helped in focussing the attention of the readers on his main theme

The energy sequence adds useful dimension to the study of sedimentation but they can not displace litho-stratigraphy which is fundamental in any geological mapping and interpretations Energy sequence can be an additional but useful tool in understanding the various sedimentary processes and dynamic movements

It is however, a commendable effort on the part of the author to have consolidated his work and he has abundantly displayed his total involvement in his research in Cenozoic foreland zone This book is a useful contribution to our knowledge and should have a place in all earthscience libraries

Geological Society of India S V SRIKANTIA
Bangalore - 560 019
***Email:** gsocind@bgl vsnl net in*

ANNOUNCEMENTS

PROPOSALS FOR FINANCIAL SUPPORT UNDER THE SCHEME OF "DST SCHOOLS ON MATHEMATICAL MODELLING IN EARTH SYSTEM SCIENCES". DST has launched a new programme called **"DST Schools on Mathematical Modelling in Earth System Sciences"** under the umbrella of its Earth System Science Division (ESSD) The main thrust of the programme is to develop manpower in mathematical modelling and computer simulation for better understanding of processes and phenomena in Earth System Sciences (Earth, Atmospheric and Oceanic Sciences) Details of the same are available on website http / /dst gov in For further details, please contact D R Ram, Earth System Science Division, Department of Science & Technology, Technology Bhavan, New Mehrauli Road, New Delhi - 110 016 **Email:** dram@alpha nic in **Phone:** 26962819, 26567373/2134/5285 Ext 462 (O)

CONFERENCE ON GROUNDWATER POLLUTION FROM NATURAL SOURCES OF ARSENIC AND FLUORIDE – A QUANTITATIVE ASSESSMENT, HEALTH HAZARD AND REMEDIAL MEASURES: This conference is organised by Institute of Geoexploration and Environment, Patna, during 23-24 December, 2004 For further details, please contact Dr Ashok Kumar, Co-convener, Remote Sensing Application Centre, IGSC Planetarium Complex, Patna - 800 001 **Phone:** 91-612-2235264 (O), 2689001 (R), 91-94310-36588 (mobile) **Fax:** 91 612-2230432 **Email:** groundwater@indiatimes com

INTERNATIONAL CONFERENCE ON COASTAL HAZARDS: Under the auspices of the SASTRA Deemed University Thanjavur, and the Indian Geological Congress, Roorkee, this International Conference is being organized at Thanjavur from 9-11 February, 2005 For further details, please contact Prof G V Rajamanickam, Convenor, International Conference, Head Department of Disaster Management, SASTRA Deemed University, Thanjavur - 613 402 **Phone:** 04362-264346, **Fax:** 04362-264346, **Email:** vrajamanickam@yahoo com or Prof A K Awasthi, Secretary, Indian Geological Congress, P B No 114 35A, Civil Lines Roorkee - 247 667, Uttaranchal **Phone:** 01332-277827, **Fax:** 01332-277827, **Email:** indiangeocong@sancharnet in opvairaigcriiki@yahoo com

TRAINING WORKSHOP ON GROUNDWATER DYNAMICS IN HARD ROCK AQUIFERS: This workshop is sponsored by UNESCO and organised by the Indo-French Centre for Groundwater Research (BRGM) and NGRI is scheduled for June 17-21, 2004 at Hyderabad For further details, please contact Dr Shakeel Ahmed, Indo-French Centre for Groundwater Research (IFCGR), National Geophysical Research Institute, Hyderabad - 500 007, India **Phone:** +91 40 23434657, 23434700 ext 2329 (O), **Fax:** +91 4- 23434651, 27171564, **Email:** shakeelahmed@ngri res in, shakeelahmed@satyam net in

TRAINING PROGRAMME ON HYDROGEOLOGY AND GROUNDWATER MODELLING: Department of Geology, University of Rajasthan, Jaipur is organising a five week training programme on this topic under DST Schools on Mathematical Modelling in Earth System Sciences during 28 June to 31 July, 2004 for young lecturers and research scholars belonging to Earth System Science Selected participants will be paid TA/DA as per rules Further details can be obtained from Dr A K Sinha, Prof and Head **Telefax:** 0141-2711572, **Phone** 0141-2397947 (R), **Email** sinhaaa@sancharnet in or Sinha_1415@hotmail com