

## Book Reviews

**DEEP SEISMIC SOUNDING AND CRUSTAL TECTONICS.** K. L. Kaila and A. C. Tewari (Eds.). Association of Exploration Geophysicists, Hyderabad.

This book is a collection of 14 articles based on papers presented at the International Symposium on Deep Seismic Sounding Traverses organised by AEG in India during November, 1985. One of the articles describes DSS instrumentation while five report on crustal structure determined by seismic soundings. Six articles attempt to integrate the seismic results into a broader interpretation. Finally, there are two contributions with marginal involvement of DSS.

As a participant in the Indian DSS effort during its first decade, the reviewer misses an essay on what is DSS, what it can do and, equally importantly, what it possibly can't. The effect of various processing steps on the final product (the section) is not trivial. Resolution, non-uniqueness of the models, separation of subjective and objective steps in the interpretation etc. are topics that need elaboration. Nature of deep faults requires discussion in a volume on tectonics. Geologists and other fellow earth scientists should be told not to take a seismic section as undisputed truth, but rather to appreciate its strengths and weaknesses. A considerable part of the book is concerned with basin- and basement-configuration. BSS – for basement seismic studies – may be a suitable acronym, instead of herding everything under the jargon DSS.

The contribution # 13 about the DSS data-acquisition system is useful, although there are inaccuracies. In the introduction, controlled source seismology is equated to explosion seismology – what about vibrators, air-guns etc.? In the same page, it is claimed that shot-moment is simultaneously recorded on both paper and mag-tape; monitor photographic records were being used earlier by NGRI for shot-moment transfer to save magnetic tape, especially for long distance recordings. Now that DFS-V has been chosen to be the digital DSS system by NGRI, the community will be eagerly awaiting the results.

The contribution # 5 is a case-history of a sponsored work. On pp. 44-45 it is stated that 'The Narmada river passes through Deccan Trap formations in approximately eastward direction' – is that what is meant? There is no reference for the geologic history of the Narmada valley (p. 45). The group interval (200 m, p. 47) does not seem to be small enough for basement (shallow) studies. The difference in the deep crustal structure from that obtained from a parallel profile 80 km away is significant, and needs explanation.

The following article (# 6) contains results from 1-D ray-tracing. Problems of what constitutes 'best match' (p. 65) remain, but it is notable that none of the 18 shot-points show a crustal low-velocity layer (LVL). The section looks intriguingly different from usual DSS sections and should have been compared to the one obtained by the standard analysis.

The next contribution (# 7) summarises existing data and results and suggests yet another evolutionary scenario for the Qinghai-Tibet plateau. Based mainly on the velocity structure, the northern part (Qaidam Basin) is associated with the Eurasian plate, whereas the southern part is taken to have been a part of Gondwanaland till the Neo-Tethys opened.

The article (#9) about the digitization of analog DSS records (Koyna II) was long-awaited and shows the well-known advantages of digital processing. In the absence of true amplitude vs distance information, the authors were limited to modelling the relative amplitudes at a given receiver location but were able to establish the existence of an upper crustal LVL. This is an important result. The reflection data should now be reprocessed using this function.

The last contribution in the results category is about Central Asia (#10). The authors' affiliations are unknown, but the heavy jargon in the article (MRTTDM, DSS-MRWE etc.) should have been explained. The waveguide layer pointed out in the section corresponds to a LVL but it seems to continue laterally on to a normal velocity part in the region with a raised Moho (p. 124).

The first four articles in the book and two others (#s 8 and 14) are welcome attempts to integrate seismic information with other available data, although the extents differ. The use of basement configuration information to constrain Mahanadi on-shore section is not clear in contribution #1. Contributions 2 and 3 both try modelling of the Cuddapahs. The former presents improved gravity models and detects the presence of high velocity (6.9 km/s) material at a shallow depth near Parnapalle. The latter uses more geology, but the actual modelling done, if any, is not clearly presented. Contribution #4 collates available crustal velocity, gravity and structural data from Peninsular India and detects significant departures from uniform, typical conditions. The editors are to be congratulated for including contribution #8. It brings up the question of reconciling shallow refraction basement mapping vis-a-vis gravity and surface geological control. These questions have to be discussed, debated and resolved both from the methodological and user point of view. Some of the discrepancies pointed out (estimated trap thickness - p. 92, detection of Lametas - p. 95) need urgent resolution and stress the imperative need for a joint interpretation by geologists and geophysicists. Contribution #14 is an attempt to relate the mega-lineaments of Sri Lanka and Southern India.

Contributions 11 and 12 should not probably have been included in a volume that is supposed to '... provide a bird's eye-view of the studies relating to crustal tectonics of various regions in India and the neighbouring countries...' (editors' note). The first article is a nice tutorial about modelling of amplitude spectra from LVLs, but makes only a passing reference to DSS data (p. 133). While the approach is sound, the source spectrum centered at 6 Hz and a Q value of 100 does not make the results very relevant for DSS. The extent of the PMP response for the model M1 at 80 km (Fig. 9) is surprising. The second article reviews occurrence of upper and lower crustal LVLs from different disturbed intra-cratonic areas around the world. The relevant Indian part was also discussed in an earlier article (#9). LVLs may well be present in Basin and Range province of US, below Rhinegraben in West Germany and in the Koyna region, but one must remember the ambiguities inherent in the refraction interpretation on which they are based. Having gotten over a 2-layer sial-over-sima crust one should be warned against its 4-layer (normal-LVL-normal-LVL) cousin. Continental crust is complex, and exhibits a varied structure resulting from its evolutionary history.

In the articles reporting DSS results one expected to see evolutionary scenarios in addition to statements about layer thicknesses; geosists should probably participate more actively in this effort. Similarly, although 1-D calculations are a welcome beginning, 2-D modelling is now quite common elsewhere.

There is a fair amount of spelling mistakes and usage of loose or non-standard terminology; printing has rendered some figures almost undecipherable (p. 106). Finally, the price will probably put it out of reach of the personal shelves of most Indian earth scientists, although libraries will be well advised to get it in their collection.

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**CARBONATE PETROLEUM RESERVOIRS.** Edited by Perry O. Roehl and Philip W. Choquette (Eds.), Springer-Verlag, New York-Berlin-Heidelberg-Tokyo, 1985, pp. 622, DM. 220.

Carbonate rocks have assumed importance in recent years owing to their association with the majority of the world's giant oil and gas fields. The study of carbonate rocks, therefore, experienced a quantum jump after World War II. In India, with the discovery of the giant oil and gas fields in Bombay offshore with its main reservoirs in Miocene Limestones, the study of carbonate rocks has become important. Reservoir petrography is one of the main aspects of studies of carbonate rocks. A very large information base is often required to elucidate the important characteristics of carbonate reservoirs. Such information base can be crucial for the design of adequate supplemental recovery programmes. The book under review provides such an information base.

The book presents case histories from 35 different oil fields from different parts of the world. Various types of carbonate reservoirs formed in diverse environments from deep sea to supra-tidal, have been chronologically documented. The book is unique in its style of presentation and selection of papers.

Eight carbonate reservoir types have been classified, viz., (a) sub-unconformity dolomites and limestone (sub-aerial diagenetic terrain), (b) dolomites (subtidal-supratidal regimes), (c) carbonate sands on shelves and ramps, (d) biogenic and reef mounds, (e) debris deposits, (f) pelagic chalks, (g) fractured basinal to shelf sands, and (h) others. The generalisations that have been made on reviewing the case histories in the Introductory Chapter provide leads for exploration. A large majority of carbonate reservoirs developed their present pore-system during diagenesis near or at the earth's surface clearly underscores the importance of regional unconformities. It has been pointed out at the end of the chapter that future studies in reservoir geology of carbonate rocks will have the obvious implication in understanding recovery efficiencies based on primary production drive. A correlation between porosity, permeability and recovery factors may have to be found out by 'careful post-mortem studies long after initial field discovery'. The article by Perry O. Roehl on Depositional and Diagenetic Controls on Reservoirs Development and Petrophysics in Silurian Tidalites, Montana, is a pioneering work in this direction. The treatment of fractured shale reservoirs of Miocene Monterey Formation of West Canyon Oil field, Santa Maria Valley, California, is another good paper which focusses attention on the fractured reservoirs—the latest target in exploration.

Origin of the Miocene Carbonate Reservoir Rocks, Fukubezawa Oil Field, NE Honshu, Japan, is another interesting paper by Koichi Aoyagi which brings out diagenetically converted carbonate rocks from volcano-siliciclastic sediments in bathyal environment as a reservoir rock in deep sea basins, a frontier area of exploration today.