

BOOK REVIEW

GEOLOGY OF PETROLIFEROUS BASINS OF INDIA by P.L. Zutshi and M.S. Panwar, KDMIPE-ONGC, Dehra Dun, First Edition, 1997)

As a part of its sustained drive across four decades to find more oil for the nation, ONGC's Keshav Dev Malaviya Institute of Petroleum Exploration (KDMIPE), recognized and classified 26 sedimentary basins as well as hydrocarbon presence ranging from commercial to insignificant in 1996. This prospectivity classification was naturally a process and not a status, since the basins could be upgraded or downgraded on the basis of oilfield data obtained by drilling and production. Nevertheless, it was a useful starting point for oil exploration in the country.

In a later classification (1979), the emphasis was placed on tectonic style. India's sedimentary basins occur in a widespread of geological settings ranging from foreland fold and thrust belts (e.g. Tripura-Cachar, Assam-Arakan), to interior rifts (e.g. Cambay, Gondwana) to passive margins (east and west coasts). Their evolutionary history would undoubtedly have played a significant role in hydrocarbon genesis and entrapment.

The next obvious step was to synthesise the two classifications so as to arrive at a better road map for exploration. This was done in the classifications carried out in 1982, 1983, 1995 with each refinement bringing in new insights into an overall understanding of the prevalent petroleum systems. For the sake of completeness, mention may be made of a classification suggested in 1997 (i.e. the year of publication of the present book) by two distinguished

ex-geoscientists of ONGC, V.V. Sastri and D.N. Avasthi in the Proceedings of Petrotech-97. They defined 8 basin categories with 10 parameters as a quantitative measure of 'the combined effect of hydrocarbon potential and the exploratory effort required in them due to the complexity of other factors'. The importance of all such work in rapidly deciding upon block selection in licence rounds under the Government of India's liberalized New Exploration Licence Policy (NELP), needs hardly be emphasised.

Against this background, the publication under review describes the basinal geology and hydrocarbon potential of 12 fairly well explored basins. It is a clear, cogent and comprehensive compilation of stratigraphic, structural and oilfield data for ready reference by the oil explorer. It is also of educative value in respect of the subsurface geology of vast tracts of India. The fact that this review is being undertaken four years after the publication of the report, should not detract from its value, except that some of the statistics are out-of-date and that new tools of measurements and interpretation that have since emerged may modify some of the conclusions drawn.

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MICROTECTONICS (CD-ROM) by C.W. Passchier and R.A.J. Trouw, 2000. Springer-Verlag.

This book on a CD comes as a boon for every teacher who conducts a course in Structural Geology. Rocks preserve within them, in the form of microstructures, very important information about deformation mechanisms and processes, sense of shear, flow types, stress and strain. "Microtectonics", as rightly stated by the authors in their introduction, "is a state-of-the-art description of microstructures and their interpretation".

The book contains 11 chapters. In the initial chapters

(1 and 2), the fundamental principles that are useful in understanding microstructures are discussed. These include description of concepts such as flow, deformation, strain, use of reference frames, vorticity and spin, fabric attractor and rheology. Chapter 3 is devoted exclusively to deformation mechanisms wherein details of mechanisms such as cataclastic flow, pressure solution, intracrystalline deformation, twinning, recovery, recrystallization, creep, superplasticity, grain boundary area reduction and static

recrystallization are discussed at length. The microstructures that can be used to identify each deformation mechanism are described along with excellent photographs, videos and animations. For example, in one of the videos, a dynamically recrystallized aggregate of grains is shown to undergo straightening of grain boundaries, coarsening and resultant reduction in surface energy by the process of grain boundary area reduction. Such animations are extremely useful in visualizing microstructural processes and also for teaching. An exhaustive description of types of foliations and lineations, their morphology and mechanisms of development comprises Chapter 4. It also includes a section on lattice preferred orientation (LPO), its origin and application in interpreting the sense of shear. LPO patterns that develop in quartz under different temperature conditions and types of flow (coaxial/non-coaxial) are described in detail along with a brief review of patterns in other minerals like calcite, plagioclase, olivine, clinopyroxene, ortho-pyroxene and amphibole. Chapter 5 entitled Shear Zones includes a description of sheared rocks that occur in brittle and ductile shear zones, their classification, microstructures and their application in determining the sense of shear. The genesis, classification and application of fibrous veins, strain shadows, strain fringes and boudins in kinematic studies comprises Chapter 6. It includes several animation video films that show development of structures such as fringes and tension gashes during progressive simple shear. Chapter 7 is entitled Porphyroblasts and Reaction Rims. Amongst other concepts, this chapter deals with the fundamentals of establishing time relationship between crystallization and deformation using the porphyroblast-matrix relations; this topic is generally a part of every structural geology course in the teaching institutes of India. There are several videos that show the development of pre-, syn-, inter- and post-tectonic porphyroblasts which will leave a lasting impression on students and help them understand the concept better. Chapter 8 entitled Microgauges deals with different

structures that can be used to gauge strain, vorticity, palaeostress, strain rate etc. Chapter 9 discusses the different techniques that are useful for microstructural studies e.g. cathodoluminescence, fluid inclusions, electron microscopy and image analysis. A separate section on lattice preferred orientations, giving a brief account of different methods e.g. universal stage, computer-integrated polarisation microscopy (CIP method) and texture goniometers that are useful to measure LPO is also included. Moreover, this chapter also contains a section entitled Analogue Modelling that deals with the emerging technique of synkinematic microscopy using which rock analogues like norcamphor, paraffin wax or ice can be deformed in the laboratory to directly demonstrate the development of microstructures. There are videos in this section that show recrystallization of rock analogues. When used in conjunction with thin sections, these videos of see-through experiments will enable students to have a better insight of microstructural processes. Chapter 10 deals with collection of samples and preparation of thin sections. It gives a good guideline for thin section preparation depending upon the type of problem to be solved. Chapter 11 contains exercises in the form of several photomicrographs that show different microstructures. Every photograph contains a question which the reader is asked to solve. The solutions to problems are also included.

The book is very well written and well presented, and in the form of a CD is user-friendly. An exhaustive glossary of the terms that are presently being used in microtectonics is also included which enhances its usefulness for teaching. The cost of the CD makes it affordable for libraries to have at least one copy in their possession. The book is highly recommended for students, teachers and researchers who are interested in microstructures.

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