Geological Prospecting of Petroleum

By Heinz Beckmann
A Halsted Press Book,
John Wiley & Sons,
Toronto and New York, 183 p., 1976.
$6.95.

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In a concise paperback, originally published by Ferdinand Enke Verlag of Stuttgart, West Germany, the ins and outs of the exploration business are covered very expertly for both novice and stranger to the trade. The booklet addresses itself, however, mainly to the budding wellsite geologist and his team partners, the geophysicists, drillers and production engineers. After an introductory note on historical, energy, war, pollution, medical and religious aspects of petroleum, the book covers in one chapter the origin, migration and accumulation of hydrocarbons, types of reservoirs, chemistry and technical properties of crude oil. A brief discussion of the structure of an average oil producing company is followed by six chapters on surface exploration methods, drilling procedures, mud gas logging, the use of cutting, cores, mechanical logs and drillstem tests, as well as on well completions. An extensive, but not exhaustive literature completes the account.

This pocket book is written from a practical point of view and is illustrated in a most instructive manner. Some topics, such as measuring driller's depth by adding up the lengths of pipe stands, collecting lost circulation samples on a waffle board, Pitot tube or pressure gauge measurements of gas blowing through the pipe organ of a drillstem test or geological aspects of whipstocking, directional drilling surveys and fishing jobs appear to have been left out intentionally. Even so the book offers a very comprehensive coverage of wellsite geology.

Although extremely lucidly written, European nomenclature crops up on frequent occasions with some significant detriment, such as ape board for monkey board in North American usage, self-erecting for jack-knife or cantilever derrick, drillometer for penetration rate recorder, rolling for drilling ahead, balcony for anticlinal nose, elliptical anticline for doubly plunging anticline, ramifying for branching faults, primer and causal reservoirs for those with structural-stratigraphic traps or those related to diapirs, reefs and buried mounds. What could have been an excellent classroom text, has lost much in translation.

Most North American texts dealing on this level with petroleum exploration practices are now dated and this little volume fills a much needed gap in the literature available to those interested in a bird's eye view on hydrocarbon exploration methods. Its readability more than makes up for the author's reluctance to cover within this volume also theroretical aspects of petroleum geology. The volume can be useful to all those needing a quick introduction into the workings of oil and gas exploration. It is unfortunate that it was not proofread by an oil company geologist operating in the North Sea Theatre, to catch typographical errors, omitted spacing between words and slips in translation of oilfield parlance.

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Petroleum Engineering

By Alfred Mayer-Gurr
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This booklet appears as Volume 3 in a series on the Geology of Petroleum edited by Heinz Beckmann and continues the practical guides to phases of hydrocarbon exploration and production started by the Ferdinand Enke Verlag of Stuttgart, West Germany. The volume deals first with hydrocarbon reservoir properties and their determination, such as porosity, pore compressibility, permeability, saturation, pressure, temperature and volume, and the driving forces in a reservoir. Another chapter deals with fluid flow, the material balance and reservoir modelling. A further chapter is devoted to well testing and monitoring methods and a final chapter covers reserve estimation, recovery factors, well spacing and field development. Some comprehensive texts on petroleum engineering are listed at the end and additional literature references follow each chapter. Fifteen appendices provide formulae and practical hints for various common oil-field calculations.

The book is limited in its coverage to reservoir engineering and treats this field essentially in a non-mathematical way, as it is mainly directed to the non-specialist. Secondary and tertiary recovery methods are omitted as well as the effects on rates of production of development well completion techniques, such as acidizing and fracturing or the rationale of various modes of spacing injection wells. For reservoir pressure readings, a Hügel bomb is not very common outside Germany, the more widely used Amerada bomb and its successor models could have been mentioned.

The text is very readable, but one does find the occasional slip in translation, e.g., the use of offtake in lieu of cumulative recovery, of petrostatic instead of lithostatic pressure. A profuse use of illustrative graphs, sketches and tables facilitates the understanding of a complex subject. The book can be recommended to anyone wishing a quick insight into methods of reservoir engineering, treated in an up-to-date fashion on a level addressed to the non-specialist.

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Random Processes in Geology

Edited by Daniel F. Merriam
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$20.00

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Geologic processes are dynamic, evolutionary phenomena. At any geologic time, each observation is a function of both a strictly deterministic component and a random term ascribable to local components, measurement error, or sampling variation. The local components are usually assumed to be independent of one another for different observations. However, this assumption may not be valid if observations are made in a spatial pattern. In the case of no deterministic component, the model becomes a random model. The theory of random processes (synonymous with stochastic processes) is based on the concept that a process will develop in time and space in a manner controlled by probabilistic laws. This means that one cannot predict its future behaviours with certainty; the most that we can do is to attach probabilities to the various possible future states. The random process is a statistical technique useful in understanding how geologic process develops in time and space.

The book, *Random Processes in Geology*, consists of an introduction and 10 papers. These papers investigate various random processes in geologic phenomena. The introduction states that probabilistic methods are used by an increasing number of geoscientists. Communication between geologists and probabilists should increase, so that findings in the theory of random processes could be developed. Paper 1 summarizes the results of geometric probability theory that could be applied to tectonic features observable on earth and other planets. No example is given to demonstrate the applications of the theory. Based on the priniciple of topologic randomness, paper 2 summarizes properties of link magnitude that comprise channel networks and network channels. Due to the presence of probabilistic elements, paper 3 emphasizes the importance of a probabilistic model in geology. A generalized flowsheet of geologic modelling is also given. Paper 4 discusses how to use a random walk model to simulate an alluvial-fan deposition. The probability of water flow in any given direction is proportional to the gradient in that direction. Once a flow is established in a given direction, it will tend to continue in that same direction. Due to the complexity of grain-pore relationship, paper 5 regards the description of porous materials as a realization of a stochastic process in order to predict the average grain-pore geometry. Paper 6 analyzes a series of observations on volcanic earthquakes derived from the Japanese volcano Asamayama. It states that the past activity of Asamayama displays a trend. Prediction from the model is not discussed in the paper. Paper 7 adopts the renewal process (one of random processes) as a random sedimentation model. The concept and usefulness of a random sedimentation model are clearly discussed in this paper. It seems to me that the most valuable result obtained from a simulation model study is to know what kinds of field and experimental data are required, and also how to collect field data. Joint probability distribution function for link lengths and drainage areas is useful in the analysis of structures of drainage areas. Paper 8 reviews the properties of the function. Paper 9 states that spatial geologic patterns may be regarded as a realization of random processes. Thus, statistical correlation or dependence between sampling points should be considered in the case of reconstruction of the actual pattern of variation. Paper 10 uses Markov models for the repose-period pattern of volcanoes.

Justification of a random geologic model are: 1) The geologic phemonena are complex, no cause-effect relationship can be established, 2) The underlying mechanism is random in nature. This justification is based on geologic reasoning rather than on a statistical random test.

Geologic modelling is a young science, but it is a promising approach to understanding the complexity of geologic phenomena. However, one of its merits is to guide user in the collection of relevant information.