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Petroleum and Global Tectonics

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In conclusion, it may be said that the book provides the best available summary of field and laboratory data for metamorphic rocks in spite of numerous typographical errors. It will be particularly useful when used in conjunction with a short text by Dr. Froese on the theoretical aspects of metamorphic petrology that is soon to be published by the Geological Survey.

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Petroleum and Global Tectonics

Edited by A. G. Fischer and S. Judson
Princeton University Press, 1975, 322 p.
$16.50.

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The impact of plate tectonic theory on the search for petroleum was the central theme of the 109th meeting of the Princeton University Conference. Nine papers by contributors from universities and from industry are contained in this volume. Papers form two groups and represent the bulk of the material presented at the conference. The first six papers are concerned with the theory of plate tectonics and basin development. The remaining three papers discuss in detail factors that govern the maturation of petroleum from organic material in sedimentary basins around the world.

An introductory review paper by Edward Bullard delineates the history of plate tectonic theory and explains how the predictive power of plate theory has led to increased public interest and funding for geologically oriented research, particularly towards marine geology.

In an excellent contribution, Jason Morgan demonstrates that much of the heat loss of ocean crust must occur by convection, possibly from thermal springs along the seafloor, rather than by conduction. His arguments are based on the fittings of seafloor heat flow data and seafloor elevation data to mathematical models of heat loss and thermal contraction of oceanic lithosphere. Unfortunately, this paper appears to be the victim of an editorial mistake. It ends rather abruptly on page 42 and Figure 8 on page 41 is not referenced, suggesting that some of the text has been inadvertently left out.

The next four papers are devoted to the description, classification and development of sedimentary basins. Alfred Fischer proposes a genetic plate tectonic classification of basins and discusses, with examples, the interrelated processes involved in the formation of each basin type. Plots of subsidence and sediment accumulation versus time are effective in showing the role of sediment loading in the maintenance of basins. David Kinsman presents an interesting analysis of continental rift basins and of shelf basins flanking rifts. He suggests that erosionally truncated and rifted early continental thermal bulges later subside and become submerged continental terraces after their separation by a juvenile ocean. These terraces are the precursors of Atlantic-type continental shelves. James Lowell and his colleagues follow with a detailed account of the development of the rift zone along the Red Sea between the Nubian and Arabian plates. They suggest that the southern part of the rift zone is formed by two concurrently spreading rifts and show structural and seismic cross-sections with geophysical data to support this view. They consider the porous continental sandstones deposited during pre-rift arching and sealed by overlying salt of the early rifting stage to be among the best potential reservoir facies of the Red Sea Rift. Joseph Curray in the longest contribution to the volume, turns the reader's attention towards the sedimentology of sediments in basins. He emphasizes that sedimentation patterns of the Holocene are atypical because of the rapid post-glacial marine transgression. In particular, most of the world's broad shelf areas were built up by sandy regressive near-shore deposits that have since been drowned.

The final three papers deal specifically with the origin of petroleum. Gordon Erdman discusses known factors such as rates of burial and syndepositional oxidation that influence the abiogenic maturation of organic material to hydrocarbons that form petroleum. He also demonstrates that lipids (i.e., animal fats) are more productive of petroleum hydrocarbons than are the other two major classes of natural organic compounds: proteins and carbohydrates. Erdman might be criticized for using only one analysis of kerobitumen with which to stoichiometrically balance his organic reactions rather than an average of several analyses from different areas. The striking correlation between high geothermal gradients and the occurrence of petroleum in many areas around the world is shown by Douglas

Klemme, particularly for basins bordering continental margins. John Moody concludes the volume with a study of giant fields. He demonstrates a strong preferential post-Hercynian (i.e., post-Triassic) concentration of ages of the world's giant oil field reservoirs which he feels is a clear indication of the importance of the new global tectonics in understanding the origin of most giant oil fields. In a very literal sense the new global tectonics only began in post-Triassic time.

This volume suffers from some defects. The major annoyance from the point of view of the reader is the proliferation of plate tectonic classification schemes of basins. Curray's classification particularly is unnecessarily complex and bears little relation to the bulk of his otherwise informative paper. Also, Erdman's important paper is too short. One would like to know more about the specifics of organic maturation as it relates to heat flow and basin setting. For example, although Erdman shows the striking correlation between the decrease towards unity of the ratio of odd numbered versus even numbered n-alkanes and the occurrence of petroleum in several basins, he does not discuss the origin of this phenomenon. Except for the possibly major editorial lapse in Morgan's article, most editorial mistakes appear to be confined to occasional spelling mistakes. One occurs on Figure 13 (p. 274) of Klemme's article where Florida is misspelled as Flordia. But that's how the natives pronounce it anyway. All things considered, this volume is a worthy contribution to the literature in its synthesis of data and complementary viewpoints from both industry and academia. A list price of $16.50 for this book does not seem excessive in this age of inflation.

MS received December 10, 1975.

Geology of the North-West European Continental Shelf

Graham Trotman Publishers Limited, Publishers

Volume 1
by David Naylor and Nicola Mounteney
157 p., 1975
£6.50 ($15.50)

Volume 2
by Richard Pegrum, Graham Rees and David Naylor
217 p., 1975
£8.50 ($19.95)

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The single title for the two volumes is misleading in that the material covers not only the geology but all aspects of the oil and gas industry. Also, the area treated is beyond the continental shelf to include the continental margin.

The authors state the purpose of the books is to provide for groups outside the industry, such as the banking community, offshore supply industries and generally the non-specialist, timely and important information of developments within the industry.

To this end the first chapter of Volume 1 of 23 pages is an introductory course of geological principles beginning with the globe, types of rocks at its surface, and formation and accumulation of hydrocarbons in the sedimentary layers. The chapter continues with short resumés of the history of the oil industry from its beginning in 1859 in the United States on land to the start of offshore exploration in UK waters. A typical procedural method of an oil company is described, beginning with seismic techniques, operation of an oil rig, types of offshore oil rigs and finally the oil and gas exploratory efforts on the continental shelf of the British Isles. Much of the descriptive material is supplemented at the end of the volume with definition of terms used and illustrated with excellent drawings.

Volume 1 deals with the continental shelf and margin off southern and western British Isles which includes Ireland. Chapter 2 introduces the reader to the concept of plate tectonics or sea floor spreading and shortening in the world. The description and the good illustrations should prove interesting reading.

The succeeding chapters, 3 to 10, discuss the local recognized basins in the offshore of southern and western British Isles. These are Channel Basin, Western Approaches, Celtic Sea, Rockall Plateau and Trough, Porcupine Seabight, Irish Sea Basins, Northern Ireland and South West Scotland, and West Scottish Basins. The information is in sufficient detail to provide a ready reference to geologists who have not concerned themselves with the interpretation of the original data. To the non-specialist the chapters may prove difficult reading. The description is in considerable detail, some names of rock units used are not shown on columnar section, many maps are of poor quality due to missing geographical names, missing lines of sections, and poor reproduction. The bibliography given at the end of each chapter is limited but is adequate for the non-specialist.

Chapter 11 discusses, with authority, the Paleogeography and Evolution of Western Britain.

Finally, in chapter 12, the authors give a comprehensive and up to date account of the History of Oil and Gas Exploration in both east and west coasts of Britain. References are made in the text to the drilled wells to date but the locations are not shown on the maps. The chapter involves a factual description of the licensing system of both Ireland and Britain and discusses the still unsettled median lines and the disputed ownership of the Rockall area.

Volume 2 covers the North Sea: the geology, published data of oil and gas discoveries, economics and reserves, potential production, and government's tax regulations and expected revenue.

The introductory chapter repeats a considerable amount of the first chapter of Volume 1 and includes additional structural information specifically related to the North Sea area. This is followed by chapters 2 to 7 which describe the deposition of sediments and tectonic movements in the periods of geological time, Devonian, Carboniferous, Triassic, Jurassic, Cretaceous and Tertiary. With each period is an excellent map showing