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Book Reviews / Critique

Book Reviews

Reflection Seismology: A Tool for Energy Resource Exploration

By Kenneth H. Waters
John Wiley and Sons,
453 p., 1981, Second Edition
$44.95

Reviewed by Richard Hastings-James
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This book grew out of a work intended for internal use within a major oil company, where the author was director of geophysical research. Perhaps as a result, the author achieves in the text an excellent balance between theory and practice, leading to a very well rounded introduction to the seismic method and its applications in exploration. Approximately 250 pages of the 450 page book contain one or more figures. Seismic section examples are sprinkled liberally throughout the book.

The book starts with an excellent introductory treatment of subsurface wave propagation, followed by the analysis of a variety of seismic sources and receivers for land and marine application, as well as their incorporation into array configurations. Notably complete coverage is given to the popular VIBROSEIS method. The book continues with basic field procedures for obtaining required subsurface coverage, and the use of auxiliary measurements for near-surface control.

Good coverage is given to the calculation of synthetic seismograms using velocities and densities derived from appropriate well logs. Examples using real data are included.

The book surveys most of the basic seismic processing techniques in current use. However, the treatment is probably too concise for the non-informed reader: as a reference for the practicing explorationist, there is much useful information in a compact and readily accessible form.

In preparation for more detailed exploration work, the author next explores the relationship of velocity and attenuation parameters derived from a seismic section to rock type, porosity and the presence of water and hydrocarbons.

In general, the chapter dealing with the resolving power of seismic data is not up to the standards of the rest of the book. Inadequate treatment is given in *8.3* to *Vertical Seismic Resolution*, perhaps because the subject is so muddled in the literature. A mass of data is presented, but the reader is left with no tools to relate the limits of thin-bed resolution to the frequency content of the data. Clarification in this area is forthcoming in a paper to appear in *Geophysics* (Kallweit and Wood, July 1982). Although the book provides a good non-mathematical introduction to migration in general, there is no specific reference to the potential improvements that migration can yield in lateral resolution over the Fresnel zone limit of non-migrated data.

The latter part of the book is particularly successful in placing into an overall exploration perspective the techniques developed earlier.

It would be unrealistic to expect a single book of limited extent to provide a uniform and complete coverage of all of the aspects of seismic exploration. This book is particularly strong in the area of acoustic wave propagation, rock properties, and the practical aspects of exploration in general. An example of the best is *7.3 Effect of Pore Fluids on Rock Velocities*. In just five pages, the reader is made familiar with the various theoretical studies on the effects on elastic wave velocities of different pore-filling fluids, beginning with the earliest (and unrealistic) study known as Wyllie's time average equation, and ending with the current Biot-Geertsma-Gassman equation and the supporting work of Domenico.

There is no doubt that the book succeeds as a general reference work for the practicing explorationist, or for use as a course text in a guided environment. The mathematical treatment will appeal to the Explorationist who has little time or patience for wading through derivations and proofs. The book celebrates the description and usefulness of mathematical end products, that is, the final equations relating down-to-earth parameters. Many of the derivations leading up to these relationships are left for appendices, or else covered in the ample references provided at the end of each chapter. Judged on an overall basis, this book can be highly recommended.

MS received January 26, 1982.

Kimberlites and Their Xenoliths

By J. B. Dawson
Springer-Verlag, 252 p. 1980
$47.25

Reviewed by Roger H. Mitchell
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Dawson's book attempts to cover a great deal of ground by incorporating into one volume a review of recent developments in the petrology of mantle-derived ultrabasic xenoliths (lherzolites, eclogites) and their host kimberlite. The book is divided into ten chapters as follows: 1) introduction, 2) distribution and tectonic setting of kimberlite, 3) geology of kimberlite intrusions, 4-6) petrography, geochemistry and mineralogy of kimberlites respectively, 7) xenoliths in kimberlite, 8) the megacryst suite, 9) the subcontinental mantle and crust-evidence from kimberlite xenoliths, 10) kimberlite genesis.

Coverage within each chapter is variable in depth and quality and the reader is left with the impression that a longer and more detailed version of the book was

originally considered and that this idea was abandoned due to editorial constraints and/or deadlines. Therefore, some sections of the book are very detailed whilst others are very brief. For example the petrology and geochemistry of ilmenite is described in great detail, yet spinels, which are of equal petrological importance are given a treatment which is at best cursory. Dawson is aware of the many recent detailed studies of these minerals, yet for some reason has chosen to ignore them.

The most useful chapters from the point of view of the neophyte in this field are Chapters 3, 5, 6, 7, and 8, as these provide a useful introduction to the basic features of kimberlite and xenolith petrology. The non-specialist reader will find these chapters informative, especially Chapter 7 on the ultrabasic xenolith suite. The other chapters however leave much to be desired. Chapter 1, only three pages long, simply retells the discovery of diamond and kimberlite in South Africa and presents a very brief résumé of the course of kimberlite studies since that time. Chapter 2 is inadequate with respect to kimberlite occurrences in parts of the world other than South Africa and is best read (as hinted at by Dawson himself in the Preface) in conjunction with Bardet's *Geologie du Diamant*. Chapter 4 is very disappointing; the non-specialist will not learn a great deal about kimberlite petrography and certainly will not be able to use this text as an aid in describing kimberlites. Particularly lacking are microphotographs of the textures found in the various mineralogical varieties of kimberlite.

The book's major shortcomings lie in the lack of synthesis of the assembled facts, together with some significant omissions. The reader will look in vain for a summary of modern experimental studies of carbonated natural and synthetic upper mantle and other volatile-bearing systems relevant to the kimberlite petrogenesis. Phase diagrams are noticeably absent from this book. A discussion of the pros and cons of the various methods of geothermobarometry is also lacking and its omission is particularly important with respect to Chapter 9 as the upper mantle stratigraphy presented is vitally dependent upon these methods.

I would in summary, recommend this book to those who wish to gain some insight into recent work on the petrology of kimberlite and the upper mantle. The book will be of most use to undergraduate students, the non-specialist professional and the practising exploration geologist. The book is an advance beyond existing compilations in this field and the references provide a useful starting point for further reading. However, the user should be aware that the reference list is not exhaustive; Russian works are noticeably poorly represented and most of the published proceedings of the Second International Kimberlite conference are not included except for some curiously selective choices. This edition of the book would have also been improved by more diligent proofreading of the galleys.

MS received January 11, 1982.

Scientific Basis for Nuclear Waste Management

Volume 2
Edited by C.J.M. Northrup Jr.
Plenum Press, 936 p., 1980
U.S. $65.00

Volume 3
Edited by J.G. Moore
Plenum Press, 632 p., 1981

Reviewed by M. Gascoyne,
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These volumes are the proceedings of the Second and Third International Symposia on the Scientific Basis for Nuclear Waste Management held in Boston, Mass., in November 1979 and 1980, respectively. Both volumes are structured in a similar manner, in sections describing: 1) overviews of various waste programs with examples of potential geologic repositories and their characteristics, 2) types of waste forms and their stability with respect to radiation, heat and solutional attack, 3) container and barrier forms, 4) natural geologic analogues of repositories and waste forms, 5) influence of radiation and heat on the host rock, with examples of radionuclide migration, and 6) modeling assessment.

Many papers stem from the U.S. research programme but good insight is also given into approaches used by European countries and the USSR, Japan, Australia and Canada. Although both volumes contain many papers that are principally of interest to engineers and chemists, there is a significant geological content in some that should prompt geologists to take an interest. This is especially true of the sections which consider the types of engineered waste from (e.g., glass, ceramic, concrete) and their long term stability with respect to radiation, dissolution and heat. For instance, the crystalline waste form 'SYNROC' consists mainly of the metal-titanium oxides, hollandite, zirconolite and perovskite and, in order to show that these forms are resistant to radiation damage and alteration, naturally-occuring examples of these minerals were found to give concordant U-Pb and Pb-Pb ages for 2,500 Ma samples, in spite of their fully metamict character. A similar procedure was used to test the suitability of a repository in bedded evaporites in southeastern New Mexico. K-Ar and Rb-Sr dates on polyhalites and anhydrite samples gave generally concordant ages (about 215 Ma), wth initial $^{87}Sr/^{86}Sr$ ratios close to values for Permian sea water, therefore indicating that the evaporites have remained closed to migration of these elements since this time.

Other papers which contain comparisons between proposed waste forms or repository types and geologic analogues include investigations of obsidian hydration rates and of lanthanide-rich minerals (mainly monazite), smectite clays, and zeolites. One of the more fascinating analogues, however, is the study of fission product migration from the natural reactor at Oklo, in Gabon, Africa. Comparison of abundances and isotopic ratios of several elements in and around reactor zones with local rock samples has given valuable information on the movement of fission products and the timescale of this migration. For instance, ^{99}Tc, Ru, Cs and Pb were found to be fractionated from uranium by amounts depending on their individual mobility and isotope half-lives.

A good geologic analogy to the thermal effects of waste on the host rock is presented in Volume 3 by the analysis of the migration of naturally-occuring actinides and lanthanides from lamprophyre dikes intruding the evaporite sequences in New Mexico. Several geologists also sound warnings to alert those studying pure chemical systems to the need to match conditions found in the natural environment. Examples given include the varying solubility of amorphous silica versus quartz, the fact that obsidian hydration rates in the natural environment may be greater than laboratory simulations predict, and the necessity of matching the thermodynamic stability of backfill and repository materials with waste form, rather than simply measuring the kinetics of leach rate in pure water.

There is an urgent need for more geologic analogues to waste forms and

repositories, together with closer examination of existing ones. These volumes go some way towards this and are a worthwhile addition to the geological literature.

MS received February 9, 1982

The Arctic Ocean

Edited by Alan E.M. Nairn, Michael Churkin Jr. and Francis Stehli
(Volume 5 of "The Ocean Basins and Margins")
Plenum Press, 672 p., 1981
$55.00

Reviewed by Dirk Tempelman-Kluit
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This volume contains a series of papers, many by the masters of Arctic geology. The book is the fifth volume in what will be a set of seven when completed: each volume concerns one of the earth's ocean basins. Brevity precludes a summary of the contributions, but the book contains a dozen chapters of which the first is an introduction, the next eight concern the diverse flanking regions and the last three discuss the continental margin off northern Alaska, The Greenland-Iceland-Norway ocean region and finally the Amerasian Basin.

The papers emphasize that there was no single magic moment when the entire Arctic Ocean was born and that it did not evolve from one long-lived ridge. Instead the Arctic Ocean seems more of an accident resulting perhaps from initial rifting along a now abandoned spreading axis in the Canada Basin during the Early Jurassic and opening of that Basin in the Cretaceous. Later spreading may have centered on a new axis, the Alpha Ridge in the Early Tertiary, and this ridge was itself abandoned in favour of the Nansen or Gakkel Ridge later in Tertiary time. While the early spreading shows no links with the opening Atlantic the Tertiary events are connected directly with that ocean as seen in rifting of the Canadian Arctic Islands and in the Greenland-Iceland-Norway triangle.

The long, diverse prehistory to the Arctic Ocean is recorded in the surrounding fold belts and the intervening platforms. Some thirty terranes, each characterized by unique stratigraphy, are considered in detail. The deformed zones include the well known Innuitian foldbelt and its continuation, the North Greenland belt, the East Greenland foldbelt, which along with the geology of Svalbard, is a part of the Caledonides, the Brooks Range of Alaska and the Northern Cordillera. As well there are the unfamiliar (for me) Urals, Verkhoyansk, Cherskiy, Penzhina and Yuzhniy Anyuy foldbelts. There are outlines of the northern parts of the Fennoscandian Shield, the Russian Platform, Siberian Platform and Canadian Shield. The Arctic Ocean truncates most of these deformed belts and cratonic regions abruptly and only locally were old structures reactivated or extended to create the ocean margin.

The contrast in the amount and detail of data for on-land geology of the borderlands and the relative paucity of information for the ocean basin emphasizes the problem of getting the underwater data in this icebound ocean. Nor is the coverage of the land based geology balanced. While the North American, Greenland, Svalbard and Eastern Soviet Arctic are treated authoritatively and in detail the largest single region, that of the Soviet Arctic, representing a third of the sector surrounding the ocean is synthesized from the literature by authors without first hand familiarity. Three papers promised originally by the Soviet Institute of Arctic Geology failed to materialize.

This superb volume does much more than give us the latest on the Arctic Ocean. It contains comprehensive, detailed and current syntheses of regions whose geology is diverse and exciting. For some readers the wealth of data on geology related to the Arctic Ocean only by the tenous thread of proximity may destroy the focus. This very detail however provides the time perspective from which to view the ocean for the relative upstart it is. The articles are arranged logically, the work is well edited and proofread, and the volume is cleanly produced with an abundance of fine diagrams. Every geologist interested in the Arctic region will want to read it, read in it, or acquire a copy.

MS received January 27, 1982

Clays and the Resource Geologist

Edited by F.J. Longstaffe
Mineralogical Association of Canada Short Course Handbook, 199 p., 1981
$12.00

Reviewed by R. Hesse
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This very well attended short course was held in conjunction with the GAC/MAC 1981 joint annual meeting at Calgary, May 14-16, 1981. The title is a little presumptuous since the course only dealt with clay mineralogical problems faced by the *petroleum* geologist but did not touch on the role of clays for mineralization or energy resources other than fossil hydrocarbons.

The book contains six articles of a more general nature (on topics such as structures and chemical composition of clay minerals, their X-ray identification, shale diagenesis, effects of clay diagenesis on sandstone cementation, thermodynamics) and three papers dealing directly with the application of clay mineralogical studies to reservoir management and hydrocarbon production. The opening two chapters by George W. Brindley on "Structures and chemical compositions of clay minerals" and "X-ray identification (with ancillary techniques) of clay minerals" are short versions of a more extensive treatment of these subjects in the second edition of "Crystal structures of clay minerals and their X-ray identification" published by the Mineralogical Society of London (1980, G.W. Brindley and G. Brown, eds.). Written in the same masterly style as they were presented during the course they serve their purpose as introduction to the subject very well. As to the state of automated X-ray analysis of clays, Brindley's cautious view ("A big gap has still to be bridged before the experienced clay mineralogist can be replaced by fully automated equipment") appears quite adequate, even if certain industry laboratories such as in the cement industry have managed to handle successfully very large numbers of samples by automation. One has to keep in mind, however, that their sample material usually covers a narrow range of compositional variation.

John Hower, talking on the "X-ray identification of mixed-layer clay minerals", used smectite/illite and smectite/

chlorite, the two most important groups of mixed-layer clays, to show the effects of random vs ordered interlayering and to predict peak positions and intensities. He expertly demonstrated the use of image recognition on powder-diffractograms for identifying the scheme of interlayering and estimating the proportion and compositions of the mixed-layer constituents. His second paper ("Shale diagenesis") reviews the X-ray evidence for systematic diagenetic changes in clay-mineral assemblages with progressive burial. The smectite-to-illite transformation still poses an open question as to whether the reaction occurs on an Al_2O^{m}-constant basis (Boles and Franks, 1979) or requires an external source of Al (e.g., the breakdown of feldspars, Perry and Hower, 1970, 1972). The disappearance of K-feldspar in the same temperature interval in which the marked reduction in the percentage of smectite layers occurs would seem to favor the latter mechanism. However, Hower seems to lean favorably towards the model of Boles and Franks, which would account for the liberation of significantly mroe silica that would then be available for sandstone cementation. If one had expected to find something new in this volume on the catalytical role of clay minerals for hydrocarbon generation or migration, the search remains in vain.

The articles by Almon and Davies on "Formation damage and the crystal chemistry of clays" and by Thomas on ". . . Diagenesis of clay minerals in tight gas sandstones . . ." examine the relationship between clay mineralogy (both detrital and diagenetic) of sandstones and the reservoir quality and production characteristics. The design schemes proposed for drilling and completion fluids appear to be straightforward in the light of the chemical and physical behaviour of the different clay mineral groups; however, this does not seem to be common knowledge in day-to-day field practise. Certainly, this side of applied clay mineralogy will see rapid advances in the future.

Almon's paper on the "Depositional environment and diagenesis of Permian Rotliegend sandstones in the Dutch sector of the southern North Sea" analyzes regional diagenetic trends affecting porosity and permeability development as a function of: 1) variations in depositional environments (difference between wadi sediments and eolian deposits reflected by early diagenetic cements), and 2) the facies distribution in the overlying Zechstein sediments (middle and late diagenesis).

In his paper on "Clay diagenesis and effects on sandstone cementation" in the Gulf Coast Tertiary, Boles adds new data for the Oligocene Frio Sandstone to the previously published material for the Eocene Wilcox (Boles and Franks, 1979). His burial diagenetic sequences, which cover a subsurface depth range from less than 1000 m to more than 4600 m, are among the better documented diagenetic case-histories. Unfortunately, pore-fluid data are not available and the effects of abnormal pore-fluid pressures, whose presence is noted, on middle diagenetic reactions are not assessed.

In the final chapter, Ian Hutcheon introduces "Applications of thermodynamics to clay minerals and authigenic mineral equilibria". Using thermodynamic data and subsurface information on mineral assemblages and pore-fluid compositions he calculates phase diagrams for authigenic minerals that are helpful for interpretations and predictions. Perhaps not all of his proposed reactions are realistic, e.g., the one on the conversion of smectite to albite in the presence of quartz and sodium-rich pore fluid. Others certainly are, particularly the release of CO_2 by the reaction between carbonates and clay minerals as has been corroborated by fluid inclusion studies elsewhere.

The ground covered by the course is respectable considering the available time, and the prevailing feeling among participants seemed to be one of satisfaction, both with lectures and discussions.

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MS received February 18, 1982

Sedimentary Petrology: An Introduction

By M.E. Tucker
John Wiley and Sons, 252 p., 1981
$29.95 (soft cover)

Reviewed by Alan C. Kendall
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This book is the latest aspirant to the growing ranks of sedimentology textbooks written with the undergraduate student in mind. Tucker writes that it is an attempt to provide a concise, up-to-date account of sedimentary petrology and emphasis is deliberately placed on the rocks themselves, rather than upon depositional environments or facies - because other recently published texts cover this ground. Literature cited is purposefully modern (almost 60% of papers quoted were published between 1970 and 1981; only 4% are pre-1960) because "student require up-to-date information, the latest ideas, and reviews". Thus, even in the preface, the basic strengths and weaknesses of the book are outlined.

An introductory chapter (basic concepts and methods) is followed by nine that deal with each major rock grouping in turn. Composition, petrography, sedimentary structures and diagenesis are stressed but each chapter concludes with a synopsis of depositional environments. Because of the petrographic slant given to the whole book, it is weakest on Recent sediments and stratigraphic relationships are almost ignored. Provenance and paleocurrent patterns are given scant treatment and the process-oriented approach adopted by many other sedimentology textbooks is not employed. Illustrations are plentiful but commonly are on the small side. Photomicrographs, in particular, appear to have been carefully selected and their reproduction is excellent.

Whereas some sedimentological texts (Reading 1978, *Sedimentary Environments and Facies;* Walker, 1979, *Facies Models)* require supplementing with a more descriptively-oriented text (such as the present work) it is also true that there are other books on the market that are more comprehensive (Friedman and Sanders, 1978, *Principles of Sedimentology; Blatt, Middleton and Murray, 1980, Origin of Sedimentary Rocks).* The claim that there is a need for a book dealing primarily with rocks is thus a weak one. This reviewer remains unconvinced that

de-emphasising sedimentary environments and processes is a correct approach. Almost all undergraduate courses in sedimentary processes given in North America stress depositional environments and sedimentary processes simply because these approaches provide syntheses of the mass of descriptive detail available and give to that detail some meaning. With Tucker's book the reader is sometimes not informed as to the significance or relevance of the petrographic data.

The text is often stilted or reads stacato and I suspect that much of it is rewritten lecture notes. This conciseness may appeal to many students but it means that few topics are dealt with to any depth or with any great rigor. The book is probably best used therefore as an introduction to the current literature. At almost 12 cents per page this is an expensive introduction!

The only advantage this book has over others of its type is that the author has taken conspicuous care to be as up-to-date as possible. This has emphasized the rapid growth of the subject but also has divorced it from its roots. I am suspicious, and somewhat saddened, by a textbook that does not see the need to quote from Sorby, Krynine or Cayeux. An even more questionable feature is the almost complete lack of non-English references. Only five German papers are quoted (out of nearly 600) and readers may be led to assume (incorrectly) that French, Russian, Italian and Spanish sedimentologists have produced little of note. Not a single foreign-language textbook is quoted.

Although the author (and reviewer) will pick his own list of essential references I was surprised to discover how many absentees there are in this book. A partial listing includes: Schmidt and McDonald's work on secondary porosity in sandstones; Murray and Lucia's study on dolomite selectivity; Ginsburg and Lowenstam's classic on organism control of sedimentation; Logan and Semeniuk's controversal study of limestone structures, and Maiklem and Glaister's classification of anhydrite; amongst many others.

Sedimentary Petrology, an Introduction will probably find most use as a supplement to other, more comprehensive, textbooks. However, its exorbitant price, insubstantial binding (the cover of my copy began to disintegrate the first day of use) and different emphasis will probably restrict its use.

MS received February 15, 1982

Geology and Water: An Introduction to Fluid Mechanics for Geologists

By Richard E. Chapman
Martinus Nijhoff/Dr. W. Junk Publishers, 228 p., 1981
85 Dfl

Reviewed by G.V. Middleton
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This book joins a small group of those that attempt to explain physical processes for geologists. The title is somewhat misleading: relatively little of what is conventionally called fluid mechanics will be found in this book. For example, there is no discussion of the equations of motion for fluids, ideal or viscous; there is no discussion of boundary layers and turbulent flows, nor of such applications as fluid drag. There is a brief introduction to fluid statics, with a rather full and interesting discussion of buoyancy. Bernouilli's theorem is derived from energy considerations. There is a brief (too brief) discussion of dimensional analysis, which is then applied to flow in pipes and settling of spheres. After these matters have been disposed of in the first two chapters, the author settles down to the real subject matter of the book: the flow of fluids through porous rocks and the role of pore fluids in geological phenomena such as compaction, gravitational sliding, and the formation of geological structures.

The overall format of the book and the style of writing suggest, at first, that it has been written as a text for students. It is not a text, however, that conforms closely to North American conventions, and I suspect that it will appeal more to professional geologists than to students in training. Although the author does not attempt to expound the basic theoretical apparatus of fluid mechanics (no reader will have to struggle with vectors, tensors or differential equations), this is by no means an unsophisticated book. For most of the topics discussed, the author has read the early literature, and he often chooses to discuss the physical principles as exemplified by the classic experiments or field observations. Examples include: Terzaghi's concept of neutral and effective stress, Reynolds' experiments on pipe flow, Poiseille's experiments on flow through capillaries, and Darcy's experiments on flow through sand. There is a careful analysis of the coefficient of permeability in Darcy's law (the hydraulic conductivity), with an illuminating discussion of tortuosity and the so-called Kozeny relationship between porosity and permeability. Detailed discussion of field phenomena include: the underground flow of Danube water to the Rhine basin (via the Aach spring), flow in the Great Artesian Basin of Australia, and the structure of western Papua New Guinea, considered as an example of large-scale lubricated sliding.

In summary, this is a well-written, scholarly book that discussed the movement of water in porous rocks, and some of its geological consequences. I recommend it to geologists with an interest in groundwater, petroleum geology, and structural geology, and more generally to any geologist who enjoys wide-ranging discussions with a man of a scholarly yet original frame of mind.

MS received December 15, 1981

Giant Oil and Gas Fields of the Decade: 1968-1978

Edited by M.T. Halbouty
AAPG Memoir 30, 596 p., 1980
$24.00 (members), $28.00 (non-members)

J.W. Porter
Canadian Superior Oil Ltd.
Three Calgary Place, 355 Fourth Ave. S.W.
Calgary, Alberta T2P 0J3

This is the second book on giant oil and gas fields to be published by The American Association of Petroleum Geologists in their memoir series and is an unquestionable credit to Michel Halbouty, the editor of both volumes. *Giant Oil and Gas Fields of the Decade: 1968-1978* contains 30 papers which in total document 44 different fields comprising six giant gas and 38 giant oil. In an historic perspective it reveals a greater utilization of seismic and geochemical data over its predecessor Geology of Giant Petroleum Fields (Memoir 14), published in 1970. As a consequence, the integration of these data along with stratigraphic and structural components collectively manifest a better understanding of the habitat of hydrocarbons in both time and space. Where virtually no seismic or geochemistry was incorporated in the 27 papers comprising the earlier volume, in Memoir 30 some 19 papers contain seismic profiles depicting trapping mechanisms and 12 papers included text on the geochemical and/or geothermal history of the source rocks. Over 42 per cent of the fields described are located in an offshore environment. Many of the maps, cross sections and seismic profiles are printed in color.

The geographic representation of giant oil and gas fields in this volume, based on the world's major petroleum provinces, is understandably somewhat imbalanced, due in part, to the east-west block political schism. The North Sea basin accounts for six papers whereas the continents of South America and Africa each account for one paper. Other significant giant fields discovered in the 1968-1978 decade notably in the Ecuador/Peru Oriente province (i.e., Sacha and Auca fields) and Gulf of Suez basin (July and Ramadan fields) may have been solicited for authorship. Likewise the Drake or Hecla giant gas fields of Canada's Sverdrup basin were potential candidates. Notwithstanding, some 17 fields associated with nine new giant petroleum provices were described. Two of these provinces; namely, the Chiapas-Tabasco of the Southern Zone, Mexico and Lena-Tunguska Province of Eastern Siberia rank as a mega province and a potential mega province respectively.

A consideration of trapping mechanisms reveals there is a preponderance of some 18 fields whose structure is related to synsedimentary tectonics induced either by halokinesis, lutokinesis or gravity sliding. Seventeen other papers describe extensional tectonics, two to compressional tectonics, four to sub-unconformity stratigraphic wedges and four to biogenetic or reef traps. Principal reservoir ages are top heavy for the Tertiary which accounts for 23 fields, 13 for the Mesozoics, five for the Paleozoic and three for the Proterozoic. Seventy-five per cent of the reservoirs are clastic rocks and the remainder are carbonate. The range of papers represent all categroies of basin types, trapping mechanisms and for the most part, reservoir ages with the exception of the Ordovician and Silurian.

In terms of the plate tectonics, some 35 of the fields described in this volume are associated with divergent regimes, seven to cratonic platform regimes and two to compressional regimes. This is evidenced by the shift of exploration from interior platform basins to continental margins in the past two decades.

The most informative paper in this volume is *Geology and Petroleum Fields in Proterozoic and Lower Cambrian Strata, Lena-Tunguska Petroleum Province, Eastern Siberia, U.S.S.R.* by A.A. Meyerhoff. His assessment focuses attention on the potential of lower Paleozoic and Proterozoic belts in other areas of the world and cites Canada's Northwest Territories where a stratigraphic analog to the Lena-Tunguska Petroleum Province may exist.

The utilization of seismic profiles in the early delineation of field boundaries is borne out in two papers contained in this volume. The Nembe Creek field, Nigeria, is a complex-faulted growth structure containing stacked and erratic sand reservoirs while the Messla field is a simple homoclinal sand wedge against the basement. In both fields the actual limits of the oil accumulation have been seismically defined. Seismic events were tied to lithologies through the comparison of synthetic well logs with seismic profiles.

Michel Halbouty as editor of this volume also contributed a paper entitled *Geologic Significance of Landsat Data for 15 Giant Oil and Gas Fields.* His case histories demonstrate that the use of satellite imagery and remote sensing data will become an increasingly important reconnaissance tool in hydrocarbon exploration.

The seismic profile shown above Figure 5 caption on page 257 should be substituted for the seismic profile above Figure 5 caption on page 390 and visa verasa.

The two-fold definition of a giant oil field (i.e., "100 million bbl or more of conventional oil except in the Middle East, North Africa and Asiatic Russia, where 500 million bbl or more is required for giant status.") as prefaced in T.A. Fitzgerald's paper, *Giant Oil Discoveries 1968-1978: An Overview* is somewhat misleading. For the sake of clarity it may be preferable to qualify through the use of a prefix "super" or "mega" giant. Formerly, a field greater than 100 million bbl but less than 500 million bbl has been classified as a major.

Finally, *Giant Oil and Gas Fields of the Decade: 1968-1978* is an invaluable source of information pertaining to the habitat of hydrocarbons not only to the petroleum geologist but to the student as well.

MS received February 18, 1982