Development Of Reservoir Characterization Techniques And

Quantitative reservoir characterization using integrated seismic data and well log data is important in sweet spot identification, well planning, and reservoir development. The process includes building up the relations between rock properties and elastic properties through rock physics modeling, inverting for elastic properties from seismic data, and inverting for rock properties from both seismic data and rock physics models. Many quantitative reservoir characterization techniques have been developed for conventional reservoirs. However, challenges remain when extending these methods to unconventional reservoirs because of their complexity, such as anisotropy, micro-scale fabric, and thin beds issues. This dissertation focuses on developing anisotropic rock physics modeling method and seismic inversion method that are appliable for unconventional reservoir characterization. The micro-scale fabric, including the complex composition, shape and alignment of clay minerals, pore space, and kerogen, significantly influences the anisotropic elastic properties. I developed a comprehensive three-step rock-physics approach to model the anisotropic elastic properties, accounting for the micro-scale fabric. In addition, my method accounts for the different pressure-dependent behaviors of P-waves and S-waves. The modeling provides anisotropic stiffnesses and pseudo logs of anisotropy parameters. The application of this method on the Upper Eagle Ford Shale shows that the clay content kerogen content and porosity decrease the rock stiffness. The anisotropy increases with kerogen content, but the influence of clay content is more complex. Comparing the anisotropy parameter pseudo logs with clay content shows that clay content increases the anisotropy at small concentrations; however, the anisotropy stays constant, or even slightly decreases, as clay content continues to increase. Thin beds and anisotropy are two important limitation of the application of seismic characterization on unconventional reservoirs. I introduced the geostatistics into stochastic seismic inversion. The geostatistical models, based on well log data, simulate small-scale vertical variations that are beyond seismic resolution. This additional information compensates the seismic data for its band-limited nature. I applied this method on the Eagle Ford Shale, using greedy annealing importance sampling as inversion algorithm. The thin Lower Eagle Ford Formation, which cannot be resolved by conventional inversion method, is clearly resolved in the inverted impedance volume using my method. In addition, because anisotropy is accounted for in the forward modeling, the accuracy of inverted S-impedance is significantly improved.

Reservoir Characterization of Tight Gas Sandstones: Exploration and Development is essential reading to help those working in oil and gas exploration (both in industry and academia) deepen their understanding of tight gas reservoirs. Exploration and production of unconventional reservoirs are of prime importance in petroleum industry and one of the top challenges faced. The experts in industry and academia will be updated with the methods of tight gas reservoir modeling and evaluation. As there are very limited published books in the field of tight sandstones, this book will benefit readers through making them familiar with the standard and state of art methods of tight gas sandstones characterization and evaluation. Geological Characterization of Tight Gas Sandstones covers state-of-the-art methodologies for characterization and

evaluation of tight gas sandstones. Features case studies from countries with considerable tight gas sandstones such as the United States, China, Canada, and Australia Includes recent developments in sedimentological, petrophysical, reservoir modeling and fracking technologies of tight gas sandstone reservoirs Covers applications of the methodologies presented in the book for characterization and evaluation of tight sandstones

Petrophysical Characterization and Fluids Transport in Unconventional Reservoirs presents a comprehensive look at these new methods and technologies for the petrophysical characterization of unconventional reservoirs, including recent theoretical advances and modeling on fluids transport in unconventional reservoirs. The book is a valuable tool for geoscientists and engineers working in academia and industry. Many novel technologies and approaches, including petrophysics, multi-scale modelling, rock reconstruction and upscaling approaches are discussed, along with the challenge of the development of unconventional reservoirs and the mechanism of multi-phase/multi-scale flow and transport in these structures. Includes both practical and theoretical research for the characterization of unconventional reservoirs Covers the basic approaches and mechanisms for enhanced recovery techniques in unconventional reservoirs Presents the latest research in the fluid transport processes in unconventional reservoirs

The petroleum geologist and engineer must have a working knowledge of petrophysics in order to find oil reservoirs, devise the best plan for getting it out of the ground, then start drilling. This book offers the engineer and geologist a manual to accomplish these goals, providing much-needed calculations and formulas on fluid flow, rock properties, and many other topics that are encountered every day. New updated material covers topics that have emerged in the petrochemical industry since 1997. Contains information and calculations that the engineer or geologist must use in daily activities to find oil and devise a plan to get it out of the ground Filled with problems and solutions, perfect for use in undergraduate, graduate, or professional courses Covers real-life problems and cases for the practicing engineer

Practical Reservoir Characterization expertly explains key technologies, concepts, methods, and terminology in a way that allows readers in varying roles to appreciate the resulting interpretations and contribute to building reservoir characterization models that improve resource definition and recovery even in the most complex depositional environments. It is the perfect reference for senior reservoir engineers who want to increase their awareness of the latest in best practices, but is also ideal for team members who need to better understand their role in the characterization process. The text focuses on only the most critical areas, including modeling the reservoir unit, predicting well behavior, understanding past reservoir performance, and forecasting future reservoir performance. The text begins with an overview of the methods required for analyzing, characterizing, and developing real reservoirs, then explains the different methodologies and the types and sources of data required to characterize, forecast, and simulate a reservoir. Thoroughly explains the data gathering methods required to characterize, forecast, and simulate a reservoir Provides the fundamental background required to analyze, characterize, and develop real reservoirs in the most complex depositional environments Presents a step-by-step approach for building a one, two, or three-dimensional representation of all reservoir types

Over the past several years, there has been a growing integration of data – geophysical, geological, petrophysical, engineering-related, and production-related – in predicting and determining reservoir properties. As such, geoscientists now must learn the technology, processes, and challenges involved within their specific functions in order to optimize planning for oil field development. Applied Techniques to Integrated Oil and Gas Reservoir Characterization presents challenging questions encountered by geoscientists in their day-to-day work in the exploration and development of oil and gas fields and provides potential solutions from experts. From basin analysis of conventional and unconventional reservoirs, to seismic attributes analysis, NMR for reservoir characterization, amplitude versus offset (AVO), well-to-seismic tie, seismic inversion studies, rock physics, pore pressure prediction, and 4D for reservoir monitoring, the text examines challenges in the industry as well as the techniques used to overcome those challenges. This book includes valuable contributions from global industry experts: Brian Schulte (Schiefer Reservoir Consulting), Dr. Neil W. Craigie (Saudi Aramco), Matthijs van der Molen (Shell International E&P), Dr. Fred W. Schroeder (ExxonMobil, retired), Dr. Tharwat Hassane (Schlumberger & BP, retired), and others. Presents a thorough understanding of the requirements of various disciplines in characterizing a wide spectrum of reservoirs Includes real-life problems and challenging questions encountered by geoscientists in their day-to-day work, along with answers from experts working in the field Provides an integrated approach among different disciplines (geology, geophysics, petrophysics, and petroleum engineering) Offers advice from industry experts to geoscience students, including career guides and interview tips

Authored by one of the world’s hydrocarbon exploration experts, Geophysical Exploration Technology: Applications in Lithological and Stratigraphic Reservoirs presents the latest technological advancements and cutting edge techniques in reservoir theory, research and exploration. Stratigraphic and lithological reservoirs play a critical role in increasing the production from oil reserves and new hydrocarbon sources. Recent resource evaluations indicate that onshore stratigraphic and subtle reservoirs account for as much as 40% of the total remaining hydrocarbon sources globally. As a result, these reservoirs will be the most practical, potential and prevalent fields for long-lasting onshore exploration. Intended as an aid in developing an understanding of the techniques of reservoir exploration, this book presents the latest and most practical methods and technology in oil and gas exploration. It can be used as a training book for lithological stratigraphic exploration and a reference for scientific and technological personnel in the oil and gas industry. Authored by one of the world’s foremost experts in stratigraphic and lithological reservoir exploration who has more than 30 years of experience in research and instruction. Features more than 200 figures, illustrations, and working examples to aid the reader in retaining key concepts Presents the latest technological developments in reservoir exploration techniques Integrates theory and application, arming readers with a rigorous yet practical approach to hydrocarbon exploration in stratigraphic and lithological reservoirs

Development of Volcanic Gas Reservoirs: The Theory, Key Technologies and Practice of Hydrocarbon Development introduces the geological and dynamic characteristics of development in volcanic gas reservoirs, using examples drawn from the practical experience in China of honing volcanic gas reservoir development. The book gives

guidance on how to effectively develop volcanic gas reservoirs and similar complex types of gas reservoir. It introduces basic theories, key technologies and uses practical examples. It is the first book to systematically cover the theories and key technologies of volcanic gas reservoir development. As volcanic gas reservoirs constitute a new research area, the distribution and rules for development still being studied. Difficulties in well deployment and supportive development technology engender further challenges to development. However, in the past decade, research and development in the Songliao and Junggar Basins has led to marked achievements in volcanic gas reservoir development. Introduces the theory, key technologies and practice of volcanic gas reservoir development Provides links between theory and practice, highlighting key technologies for targeted development Offers guidance on complex issues in volcanic gas reservoir development Presents practical evidence from effective development and exploitation of gas reservoirs

Seismic Data Analysis Techniques in Hydrocarbon Exploration explains the fundamental concepts and skills used to acquire seismic data in the oil industry and the step-by-step techniques necessary to extract the sections that trap hydrocarbons as well as seismic data interpretation skills. It enhances the ability to interpret seismic data and use that data for basin evaluation, structural modeling of a fault, reservoir characterization, rock physics analysis, field development, and production studies. Understanding and interpreting seismic data is critical to oil and gas exploration companies. Arming young geoscientists with a reference that covers the key principles of seismic data analysis will enhance their job knowledge, skills and performance. A fundamental grasp of seismic data enhances employability and aids scientists in functioning effectively when working with seismic data in industry. Edited by a team of petroleum geoscientists with more than 30 years of experience in hydrocarbon exploration and data analysis at O&G companies. More than 200 figures, photographs, and illustrations aid in the understanding of the fundamental concepts and techniques used to acquire seismic data Takes an easy-to-follow, step-by-step approach to presenting the techniques and skills used to extract the geologic sections from acquired seismic data. Enhances the geoscientist’s effectiveness when using seismic data for field development and other exploration and production studies

As the shale revolution continues in North America, unconventional resource markets are emerging on every continent. In the next eight to ten years, more than 100,000 wells and one- to two-million hydraulic fracturing stages could be executed, resulting in close to one trillion dollars in industry spending. This growth has prompted professionals experienced in conventional oil and gas exploitation and development to acquire practical knowledge of the unconventional realm. Unconventional Oil and Gas Resources: Exploitation and Development provides a comprehensive understanding of the latest advances in the exploitation and development of unconventional resources. With an emphasis on shale, this book: Addresses all aspects of the exploitation and development process, from data mining and accounting to drilling, completion, stimulation, production, and environmental issues Offers in-depth coverage of sub-surface measurements (geological, geophysical, petrophysical, geochemical, and geomechanical) and their interpretation Discusses the use of microseismic, fiber optic, and tracer reservoir monitoring technologies and JewelSuiteTM reservoir modeling software Presents the viewpoints of internationally respected experts and researchers

from leading exploration and production (E&P) companies and academic institutions Explores future trends in reservoir technologies for unconventional resources development Unconventional Oil and Gas Resources: Exploitation and Development aids geologists, geophysicists, petrophysicists, geomechanic specialists, and drilling, completion, stimulation, production, and reservoir engineers in the environmentally safe exploitation and development of unconventional resources like shale.

Candidates for this course are recommended to attend the following:- 1- A course for carbonate reservoir characterization due its sever heterogeneity. 2- Surface geological field trips for carbonate exposures. 3- To visit sites of recent carbonate (reefs) preferably by a sub marine glass boat to observe the variation in reef distribution and growth within the same locality.

Reservoir Characterization is a collection of papers presented at the Reservoir Characterization Technical Conference, held at the Westin Hotel-Galleria in Dallas on April 29-May 1, 1985. Conference held April 29-May 1, 1985, at the Westin Hotel—Galleria in Dallas. The conference was sponsored by the National Institute for Petroleum and Energy Research, Bartlesville, Oklahoma. Reservoir characterization is a process for quantitatively assigning reservoir properties, recognizing geologic information and uncertainties in spatial variability. This book contains 19 chapters, and begins with the geological characterization of sandstone reservoir, followed by the geological prediction of shale distribution within the Prudhoe Bay field. The subsequent chapters are devoted to determination of reservoir properties, such as porosity, mineral occurrence, and permeability variation estimation. The discussion then shifts to the utility of a Bayesian-type formalism to delineate qualitative ""soft"" information and expert interpretation of reservoir description data. This topic is followed by papers concerning reservoir simulation, parameter assignment, and method of calculation of wetting phase relative permeability. This text also deals with the role of discontinuous vertical flow barriers in reservoir engineering. The last chapters focus on the effect of reservoir heterogeneity on oil reservoir. Petroleum engineers, scientists, and researchers will find this book of great value.

Seismic attributes play a key role in exploration and exploitation of hydrocarbons. In Seismic Attributes for Prospect Identification and Reservoir Characterization (SEG Geophysical Developments No. 11), Satinder Chopra and Kurt J. Marfurt introduce the physical basis, mathematical implementation, and geologic expression of modern volumetric attributes including coherence, dip/azimuth, curvature, amplitude gradients, seismic textures, and spectral decomposition. The authors demonstrate the importance of effective color display and sensitivity to seismic acquisition and processing. Examples from different basins illustrate the attribute expression of tectonic deformation, clastic depositional systems, carbonate depositional systems and diagenesis, drilling hazards, and reservoir characterization. The book is illustrated generously with color figures throughout. "Seismic Attributes" will appeal to seismic interpreters who want to extract more information from data; seismic processors and imagers who want to learn how their efforts impact subtle stratigraphic and fracture plays; sedimentologists, stratigraphers, and structural geologists who use large 3D seismic volumes to interpret their plays within a regional, basinwide context; and reservoir engineers whose work is based on detailed 3D reservoir models. Copublished with EAGE.

For many years, geoscientists and engineers have undertaken research to characterize naturally fractured reservoirs. Geoscientists have focused on understanding the process of fracturing and the subsequent measurement and description of fracture characteristics. Engineers have concentrated on the fluid flow behavior in the fracture-porous media system and the development of models to predict the hydrocarbon production from these complex systems. This research attempts to integrate these two complementary views to develop a quantitative reservoir characterization methodology and flow performance model for naturally fractured reservoirs. The research has focused on estimating naturally fractured reservoir properties from seismic data, predicting fracture characteristics from well logs, and developing a naturally fractured reservoir simulator. It is important to develop techniques that can be applied to estimate the important parameters in predicting the performance of naturally fractured reservoirs. This project proposes a method to relate seismic properties to the elastic compliance and permeability of the reservoir based upon a sugar cube model. In addition, methods are presented to use conventional well logs to estimate localized fracture information for reservoir characterization purposes. The ability to estimate fracture information from conventional well logs is very important in older wells where data are often limited. Finally, a desktop naturally fractured reservoir simulator has been developed for the purpose of predicting the performance of these complex reservoirs. The simulator incorporates vertical and horizontal wellbore models, methods to handle matrix to fracture fluid transfer, and fracture permeability tensors. This research project has developed methods to characterize and study the performance of naturally fractured reservoirs that integrate geoscience and engineering data. This is an important step in developing exploitation strategies for optimizing the recovery from naturally fractured reservoir systems. The next logical extension of this work is to apply the proposed methods to an actual field case study to provide information for verification and modification of the techniques and simulator. This report provides the details of the proposed techniques and summarizes the activities undertaken during the course of this project. Technology transfer activities were highlighted by a two-day technical conference held in Oklahoma City in June 2002. This conference attracted over 90 participants and included the presentation of seventeen technical papers from researchers throughout the United States.

One of the main duties for reservoir engineers is reservoir study, which starts when a reservoir is explored and it continues until the reservoir abandonment. Reservoir study is a continual process and due to various reasons such as complexity at the surface and limited data, there are many uncertainties in reservoir modelling and characterization causing difficulties in reasonable history-matching and prediction phases of study. Experimental Design in Petroleum Reservoir Studies concentrates on experimental design, a trusted method in reservoir management, to analyze and take the guesswork out of the uncertainties surrounding the underdeveloped reservoir. Case studies from the Barnett shale and fractured reservoirs in the Middle East are just some of the practical examples included. Other relevant discussions on uncertainty in PVT, field performance data, and relevant outcomes of experimental design all help you gain insight into how better data can improve measurement tools, your model, and your reservoir assets. Apply the practical knowledge and know-how now with real-world case studies included Gain confidence in deviating uncertain parameters surrounding the

underdeveloped reservoir with a focus on application of experimental design Alleviate some of the guesswork in history-matching and prediction phrases with explanations on uncertainty analysis

Reservoir characterization as a discipline grew out of the recognition that more oil and gas could be extracted from reservoirs if the geology of the reservoir was understood. Prior to that awakening, reservoir development and production were the realm of the petroleum engineer. In fact, geologists of that time would have felt slighted if asked by corporate management to move from an exciting exploration assignment to a more mundane assignment working with an engineer to improve a reservoir's performance. Slowly, reservoir characterization came into its own as a quantitative, multidisciplinary endeavor requiring a vast array of skills and knowledge sets. Perhaps the biggest attractor to becoming a reservoir geologist was the advent of fast computing, followed by visualization programs and theaters, all of which allow young geoscientists to practice their computing skills in a highly technical work environment. Also, the discipline grew in parallel with the evolution of data integration and the advent of asset teams in the petroleum industry. Finally, reservoir characterization flourished with the quantum improvements that have occurred in geophysical acquisition and processing techniques and that allow geophysicists to image internal reservoir complexities. Accurate, high-resolution, three-dimensional (3D) reservoir characterization can provide substantial benefits for effective oilfield management. By doing so, the predictive reliability of reservoir flow models, which are routinely used as the basis for investment decisions involving hundreds of millions of dollars and designed to recover millions of barrels of oil, can be significantly improved. Even a small improvement in incremental recovery for high-value assets can result in important contributions to bottom-line profitability. Today's standard practice for developing a 3D reservoir description is to use seismic inversion techniques. These techniques make use of geostatistics and other stochastic methods to solve the inverse problem, i.e., to iteratively construct a likely geologic model and then upscale and compare its acoustic response to that actually observed in the field. This method has several inherent flaws, such as: (1) The resulting models are highly non-unique; multiple equiprobable realizations are produced, meaning (2) The results define a distribution of possible outcomes; the best they can do is quantify the uncertainty inherent in the modeling process, and (3) Each realization must be run through a flow simulator and history matched to assess it's appropriateness, and therefore (4) The method is labor intensive and requires significant time to complete a field study; thus it is applied to only a small percentage of oil and gas producing assets. A new approach to achieve this objective was first examined in a Department of Energy (DOE) study performed by Advanced Resources International (ARI) in 2000/2001. The goal of that study was to evaluate whether robust relationships between data at vastly different scales of measurement could be established using virtual intelligence (VI) methods. The proposed workflow required that three specific relationships be established through use of artificial neural networks (ANN's): core-to-log, log-to-crosswell seismic, and crosswell-to-surface seismic. One of the key attributes of the approach, which should result in the creation of high resolution reservoir characterization with greater accuracy and with less uncertainty than today's methods, is the inclusion of borehole seismic (such as crosswell and/or vertical seismic profiling--VSP) in the data collection scheme. Borehole seismic fills a critical gap in the

resolution spectrum of reservoir measurements between the well log and surface seismic scales, thus establishing important constraints on characterization outcomes. The results of that initial study showed that it is, in fact, feasible to establish the three critical relationships required, and that use of data at different scales of measurement to create high-resolution reservoir characterization is possible. Based on the results of this feasibility study, in September 2001, the DOE, again through ARI, launched a subsequent two-year government-industry R & D project to further develop and demonstrate the technology. The goals of this project were to: (1) Make improvements to the initial methodology by incorporating additional VI technologies (such as clustering), using core measurements in place of magnetic resonance image (MRI) logs, and streamlining the workflow, among others. (2) Demonstrate the approach in an integrated manner at a single field site, and validate it via reservoir modeling or other statistical methods.

The studies of Earth's history and of the physical and chemical properties of the substances that make up our planet, are of great significance to our understanding both of its past and its future. The geological and other environmental processes on Earth and the composition of the planet are of vital importance in locating and harnessing its resources. This book is primarily written for research scholars, geologists, civil engineers, mining engineers, and environmentalists. Hopefully the text will be used by students, and it will continue to be of value to them throughout their subsequent professional and research careers. This does not mean to infer that the book was written solely or mainly with the student in mind. Indeed from the point of view of the researcher in Earth and Environmental Science it could be argued that this text contains more detail than he will require in his initial studies or research.

Reservoirs described in this volume are located in the Middle East, Asia, West Africa, North and South America. The authors explore historical and alternative approaches to reservoir description, characterization, and management, as well as examining appropriate levels and timing of data gathering, technology applications, evaluation techniques, and management practices in various stages in the life of individual development projects. The giant fields discussed address issues important to reservoir description, characterization, and management from both geologic & engineering perspectives.

The job of any reservoir engineer is to maximize production from a field to obtain the best economic return. To do this, the engineer must study the behavior and characteristics of a petroleum reservoir to determine the course of future development and production that will maximize the profit. Fluid flow, rock properties, water and gas coning, and relative permeability are only a few of the concepts that a reservoir engineer must understand to do the job right, and some of the tools of the trade are water influx calculations, lab tests of reservoir fluids, and oil and gas performance calculations.Two new chapters have been added to the first edition to make this book a complete resource for students and professionals in the petroleum industry: Principles of Waterflooding, Vapor-Liquid Phase Equilibria.

DEVELOPMENT OF RESERVOIR CHARACTERIZATION TECHNIQUES AND PRODUCTION MODELS FOR EXPLOITING NATURALLY FRACTURED RESERVOIRS.

Shared Earth Modeling introduces the reader to the processes and concepts needed to

develop shared earth models. Shared earth modeling is a cutting-edge methodology that offers a synthesis of modeling paradigms to the geoscientist and petroleum engineer to increase reservoir output and profitability and decrease guesswork. Topics range from geology, petrophysics, and geophysics to reservoir engineering, reservoir simulation, and reservoir management. Shared Earth Modeling is a technique for combining the efforts of reservoir engineers, geophysicists, and petroleum geologists to create a simulation of a reservoir. Reservoir engineers, geophysicists, and petroleum geologists can create separate simulations of a reservoir that vary depending on the technology each scientist is using. Shared earth modeling allows these scientists to consolidate their findings and create an integrated simulation. This gives a more realistic picture of what the reservoir actually looks like, and thus can drastically cut the costs of drilling and time spent mapping the reservoir. First comprehensive publication about Shared Earth Modeling Details cutting edge methodology that provides integrated reservoir simulations

The Corps' Hydrologic Engineering Center (HEC) has developed a generalized simulation model capable of analyzing complex river-reservoir systems. The development of the model, 'HEC-5, Simulation of Flood Control and Conservation Systems' (Eichert, 1974, 1975) has been paced by the changing mission of the Corps as well as the evolution of computer systems. HEC-5 development and management, including code development, testing, documentation, training and field application experience, is discussed. (fr).

The Handbook of Borehole Acoustics and Rock Physics for Reservoir Characterization combines in a single useful handbook the multidisciplinary domains of the petroleum industry, including the fundamental concepts of rock physics, acoustic logging, waveform processing, and geophysical application modeling through graphical examples derived from field data. It includes results from core studies, together with graphics that validate and support the modeling process, and explores all possible facets of acoustic applications in reservoir evaluation for hydrocarbon exploration, development, and drilling support. The Handbook of Borehole Acoustics and Rock Physics for Reservoir Characterization serves as a technical guide and research reference for oil and gas professionals, scientists, and students in the multidisciplinary field of reservoir characterization through the use of petrosonics. It overviews the fundamentals of borehole acoustics and rock physics, with a focus on reservoir evaluation applications, explores current advancements through updated research, and identifies areas of future growth. Presents theory, application, and limitations of borehole acoustics and rock physics through field examples and case studies Features "Petrosonic Workflows" for various acoustic applications and evaluations, which can be easily adapted for practical reservoir modeling and interpretation Covers the potential advantages of acoustic-based techniques and summarizes key results for easy geophysical application

Fluvial-deltaic sandstone reservoirs in the United States are being abandoned at high rates, yet they still contain more than 34 billion barrels of unrecovered oil. The mature Oligocene-age fluvial-deltaic reservoirs of the Frio Formation along the Vicksburg Fault Zone in South Texas are typical of this class in that, after more than three decades of production, they still contain 61 percent of the original mobile oil in place, or 1.6 billion barrels. This resource represents a

tremendous target for advanced reservoir characterization studies that integrate geological and engineering analysis to locate untapped and incompletely drained reservoir compartments isolated by stratigraphic heterogeneities. The D and E reservoir intervals of Rincon field, Starr County, South Texas, were selected for detailed study to demonstrate the ability of advanced characterization techniques to identify reservoir compartmentalization and locate specific infield reserve-growth opportunities. Reservoir architecture, determined through high-frequency genetic stratigraphy and facies analysis, was integrated with production history and facies-based petrophysical analysis of individual flow units to identify recompletion and geologically targeted infill drilling opportunities. Estimates of original oil in place versus cumulative production in D and E reservoirs suggest that potential reserve growth exceeds 4.5 million barrels. Comparison of reservoir architecture and the distribution of completions in each flow unit indicates a large number of reserve-growth opportunities. Potential reserves can be assigned to each opportunity by constructing an Sooh map of remaining mobile oil, which is the difference between original oil in place and the volumes drained by past completions.

The FRACSL flow and transport code is under development as part of an effort to improve reservoir characterization techniques. The present version simulates a two-dimensional, isothermal reservoir composed of a global fracture network imbedded in a porous media. FRACSL simulates the hydraulic response of a reservoir to injection or backflow. The code simulates the movement of injected tracers within the reservoir by adding advective and random dispersive motions of discrete particles. FRACSL has been benchmarked against theoretical flow and transport responses in simple systems. It has been used to simulate a benchscale physical model and to correlate flow and dispersion data from the East Mesa Hydrothermal Injection Test Program. Correlation of East Mesa data has provided an estimate of an anisotropic hydraulic conductivity, a natural drift in the reservoir, and dispersivity.

Thanks to technology, fractured carbonate gas reservoirs are becoming more discoverable, but because these assets are more complex and diverse, there is a high level of difficulty in understanding how to plan design and performance analysis. Dynamic Description Technology of Fractured Vuggy Gas Reservoirs delivers a critical reference to reservoir and production engineers on all the basic characteristics of fractured vuggy gas reservoirs and combines both static and dynamic data to improve the reservoir characterization accuracy and development. Based on the full life cycle of well testing and advanced production decline analysis, this reference also details how to apply reservoir dynamic evaluation, reserve estimation, and performance forecasting. Offering one collective location for the latest research on fractured gas reservoirs, the reference also covers: Physical models, analysis examples, and processes 3D numerical well test analysis technology Deconvolution technology of production decline analysis Packed with many calculation examples and more than 100

case studies, Dynamic Description Technology of Fractured Vuggy Gas Reservoirs gives engineers a strong tool to further exploit these complex assets. Gain advanced knowledge in well test and production decline analysis as well as performance forecasting specific to fractured vuggy carbonate gas reservoirs Understand the characteristics, advantages, disadvantages, and current limitations in technology of fractured vuggy carbonate gas reservoirs Bridge from theory to practice by combining static and dynamic data to form more accurate real-world analysis and modelling

Reservoir Characterization II contains the proceedings of the Second International Reservoir Characterization Conference held in Dallas, Texas in June 1989. Contributors focus on the characterization of reservoir processes and cover topics ranging from surface roughness in porous media and reservoir characterization at the mesoscopic scale to shale clast heterogeneities and their effect on fluid flow, permeability patterns in fluvial sandstones, and reservoir management using 3-D seismic data. This book is organized into six sections encompassing 43 chapters. The first 20 chapters deal with reservoir characterization at the microscopic, mesoscopic, and macroscopic scales. Topics include low-contrast resistivity sandstone formations; the use of centrifuge and computer tomography to quantify saturation distribution and capillary pressures; and cross-well seismology as a tool for reservoir geophysics. The chapters that follow deal with reservoir characterization at the megascopic scale; fractal heterogeneity of clastic reservoirs; heterogeneity and effective permeability of porous rocks; and drilling fluid design based on reservoir characterization. A chapter that outlines a procedure for estimating permeability anisotropy with a minipermeameter concludes the book. This book is a valuable resource for students and practitioners of petroleum engineering, geology and geological engineering, petroleum exploration, and geophysics.

This second volume on carbonate reservoirs completes the two-volume treatise on this important topic for petroleum engineers and geologists. Together, the volumes form a complete, modern reference to the properties and production behaviour of carbonate petroleum reservoirs. The book contains valuable glossaries to geologic and petroleum engineering terms providing exact definitions for writers and speakers. Lecturers will find a useful appendix devoted to questions and problems that can be used for teaching assignments as well as a guide for lecture development. In addition, there is a chapter devoted to core analysis of carbonate rocks which is ideal for laboratory instruction. Managers and production engineers will find a review of the latest laboratory technology for carbonate formation evaluation in the chapter on core analysis. The modern classification of carbonate rocks is presented with petroleum production performance and overall characterization using seismic and well test analyses. Separate chapters are devoted to the important naturally fractured and chalk reservoirs. Throughout the book, the emphasis is on formation evaluation and performance. This two-volume work brings together the wide variety of

approaches to the study of carbonate reservoirs and will therefore be of value to managers, engineers, geologists and lecturers.

Domestic fluvial-dominated deltaic (FDD) reservoirs contain more than 30 Billion barrels (Bbbl) of remaining oil, more than any other type of reservoir, approximately one-third of which is in danger of permanent loss through premature field abandonments. The U.S. Department of Energy has placed its highest priority on increasing near-term recovery from FDD reservoirs in order to prevent abandonment of this important strategic resource. To aid in this effort, the Bureau of Economic Geology, The University of Texas at Austin, began a 46-month project in October, 1992, to develop and demonstrate advanced methods of reservoir characterization that would more accurately locate remaining volumes of mobile oil that could then be recovered by recompleting existing wells or drilling geologically targeted infill. wells. Reservoirs in two fields within the Frio Fluvial-Deltaic Sandstone (Vicksburg Fault Zone) oil play of South Texas, a mature play which still contains 1.6 Bbbl of mobile oil after producing 1 Bbbl over four decades, were selected as laboratories for developing and testing reservoir characterization techniques. Advanced methods in geology, geophysics, petrophysics, and engineering were integrated to (1) identify probable reservoir architecture and heterogeneity, (2) determine past fluid-flow history, (3) integrate fluid-flow history with reservoir architecture to identify untapped, incompletely drained, and new pool compartments, and (4) identify specific opportunities for near-term reserve growth. To facilitate the success of operators in applying these methods in the Frio play, geologic and reservoir engineering characteristics of all major reservoirs in the play were documented and statistically analyzed. A quantitative quick-look methodology was developed to prioritize reservoirs in terms of reserve-growth potential.

F. Jerry Lucia, working in America’s main oil-rich state, has produced a work that goes after one of the holy grails of oil prospecting. One main target in petroleum recovery is the description of the three-dimensional distribution of petrophysical properties on the interwell scale in carbonate reservoirs. Doing so would improve performance predictions by means of fluid-flow computer simulations. Lucia’s book focuses on the improvement of geological, petrophysical, and geostatistical methods, describes the basic petrophysical properties, important geology parameters, and rock fabrics from cores, and discusses their spatial distribution. A closing chapter deals with reservoir models as an input into flow simulators.

Reservoir characterization as a discipline grew out of the recognition that more oil and gas could be extracted from reservoirs if the geology of the reservoir was understood. Prior to that awakening, reservoir development and production were the realm of the petroleum engineer. In fact, geologists of that time would have felt slighted if asked by corporate management to move from an exciting exploration assignment to a more mundane assignment working with an engineer to improve a reservoir’s performance. Slowly, reservoir characterization came into its own as a quantitative, multidisciplinary endeavor requiring a vast array of

skills and knowledge sets. Perhaps the biggest attractor to becoming a reservoir geologist was the advent of fast computing, followed by visualization programs and theaters, all of which allow young geoscientists to practice their computing skills in a highly technical work environment. Also, the discipline grew in parallel with the evolution of data integration and the advent of asset teams in the petroleum industry. Finally, reservoir characterization flourished with the quantum improvements that have occurred in geophysical acquisition and processing techniques and that allow geophysicists to image internal reservoir complexities. Practical resource describing different types of sandstone and shale reservoirs Case histories of reservoir studies for easy comparison Applications of standard, new, and emerging technologies

Unconventional Reservoir Rate-Transient Analysis: Volume One, Fundamentals, Analysis Methods and Workflow provides a comprehensive review of RTA methods, helping petroleum engineers and geoscientists understand how to confidently apply RTA to tight reservoirs exhibiting single-phase flow of oil and gas. The book provides practitioners with an overview of the basic concepts used in RTA, including flow-regime identification and application of straight-line analysis, type-curve analysis, and model history-matching approaches that are applicable to low-complexity, tight reservoirs exhibiting single-phase flow of oil and gas. Workflow steps are discussed and illustrated in detail for hydraulically fractured vertical wells and multi-fractured horizontal wells. Supported by many real-world field examples, this comprehensive resource supplies today’s petroleum engineers and geoscientists with an overview of RTA methods as applied to tight reservoirs. A companion text, Unconventional Reservoir Rate-Transient Analysis: Volume Two, Application to Complex Reservoirs, Exploration and Development bridges a critical knowledge gap to help practicing petroleum engineers and geoscientists understand how RTA methods can be adopted and applied to today’s unconventional reservoirs. Reviews key concepts and analysis methods used in modern rate-transient analysis (RTA) as applied to low-permeability ("tight") oil and gas reservoirs Provides a workflow for confident derivation of reservoir/hydraulic fracture properties and hydrocarbon-in-place estimates for wells completed in unconventional reservoirs Includes detailed discussions and illustrations of each step of the workflow using field examples

Volcanic gas reservoirs are the new natural gas frontier. Once thought too complex, too harsh on the drilling bit, and too difficult to characterize, reservoir engineers and petroleum geologists alike now manage more advanced seismic and logging tools, making these "impossible" field developments possible. Bridging meaningful information about these complicated provinces and linking various unconventional methods and techniques, Volcanic Gas Reservoir Characterization: Describes a set of leading-edge integrated volcanic gas reservoir characterization techniques, helping to ensure the effective development of the field Reveals the grade and relationship of volcanic stratigraphic sequence Presents field identification and prediction methods, and interpretation technology of reservoir parameters, relating these to similar complex fields such as shale These innovative approaches and creative methods have been successfully applied to actual development of volcanic gas reservoirs. By sharing the methods and techniques used in this region with reservoir engineers and petroleum geologists all over the world, those with better understanding of these unconventional basins will begin to consider volcanic rock like any other reservoir. Summarizes the research and explains detailed case studies of volcanic gas reservoir developments, showing the latest achievements and lessons learned Supplies knowledge on volcanic gas reservoir basins to provide meaningful insight into similar complex reservoirs such as shale, coal bed methane, and heavy oil basins Contains extensive methodology, strong practicality and high innovation, making this an ideal

book for both the practicing and seasoned reservoir engineer and petroleum geologists working with complex reservoirs

Applied Techniques to Integrated Oil and Gas Reservoir Characterization: A Problem-Solution Discussion with Experts presents challenging questions encountered by geoscientists in their day-to-day work in the exploration and development of oil and gas fields and provides potential solutions from experts working in the field. Covers Amplitude Versus Offset (AVO), well-to-seismic tie, phase of seismic data, seismic inversion studies, pore pressure prediction, rock physics and exploration geological. The text examines challenges in the industry as well as the solutions and techniques used to overcome those challenges. Over the past several years there has been a growing integration of geophysical, geological, and reservoir engineering, production and petrophysical data to predict and determine reservoir properties. This includes reservoir extent and sand development away from the well bore, as well as in unpenetrated prospects, leading to optimization planning for field development. As such, geoscientists now must learn the technology, processes and challenges involved within their specific functions in order to complete day-to-day activities. Presents a thorough understanding of the requirements and issues of various disciplines in characterizing a wide spectrum of reservoirs Includes real-life problems and challenging questions encountered by geoscientists in their day-to-day work, along with answers from experts working in the field Provides an integrated approach among different disciplines (geology, geophysics, petrophysics, and petroleum engineering)

Quantitative Methods in Reservoir Engineering, Second Edition, brings together the critical aspects of the industry to create more accurate models and better financial forecasts for oil and gas assets. Updated to cover more practical applications related to intelligent infill drilling, optimized well pattern arrangement, water flooding with modern wells, and multiphase flow, this new edition helps reservoir engineers better lay the mathematical foundations for analytical or semi-analytical methods in today’s more difficult reservoir engineering applications. Authored by a worldwide expert on computational flow modeling, this reference integrates current mathematical methods to aid in understanding more complex well systems and ultimately guides the engineer to choose the most profitable well path. The book delivers a valuable tool that will keep reservoir engineers up-to-speed in this fast-paced sector of the oil and gas market. Stay competitive with new content on unconventional reservoir simulation Get updated with new material on formation testing and flow simulation for complex well systems and paths Apply methods derived from real-world case studies and calculation examples

"This introduction chapter summarizes our current understandings of volcanic gas reservoirs worldwide and in China. The challenges and their innovative technical solutions presented in this book, as well as the significance of gas reservoir characterization, are summarized based on the authors' real case studies in Chinese volcanic gas fields during the last decade. A flow chart representing the research concepts and approaches that deal with specific difficulties in volcanic gas reservoir characterization provides the readers with an outline of this book"--

Earth science is becoming increasingly quantitative in the digital age. Quantification of geoscience and engineering problems underpins many of the applications of big data and artificial intelligence. This book presents quantitative geosciences in three parts. Part 1 presents data analytics using probability, statistical and machine-learning methods. Part 2 covers reservoir characterization using several geoscience disciplines: including geology, geophysics, petrophysics and geostatistics. Part 3 treats reservoir modeling, resource evaluation and uncertainty analysis using integrated geoscience, engineering and geostatistical methods. As the petroleum industry is heading towards operating oil fields digitally, a multidisciplinary skillset is a must for geoscientists who need to use data analytics to resolve inconsistencies in various sources of data, model reservoir properties, evaluate uncertainties, and quantify risk for decision making. This book intends to serve as a bridge for advancing the multidisciplinary integration for digital fields. The goal is to move beyond using

quantitative methods individually to an integrated descriptive-quantitative analysis. In big data, everything tells us something, but nothing tells us everything. This book emphasizes the integrated, multidisciplinary solutions for practical problems in resource evaluation and field development.

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