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Geophysical Characterization of Gas Hydrates, edited by Michael Riedel, Eleanor C. Willoughby, and Satinder Chopra, ISBN 978-1-56080-218-1, SEG, 392 p.

A collection of 26 individual articles constitutes this recent (published 2010) volume No. 14 in SEG's Geophysical Development Series. Written by leading experts, the articles give the reader an up-to-date overview and a sound starting point for designing geophysical applications in the search for and production of this new unconventional energy resource. The energy potential in gas hydrates is large, and one attractive property regarding energy production is the efficient packing. One volume unit gas hydrate corresponds to about 150 free gas volumes! The book also serves as a reference source of information for those individuals and teams who want to advance geophysical methods which honor key physical and chemical properties of gas hydrates by linking seismic and electromagnetic rock physics to geological processes. A well-written text supported by clear figures makes the articles attractive to read. An extensive reference list makes it easy to guide the reader deeper into all discussed aspects of gas hydrates. An introduction section discusses basic physical and chemical properties and how they qualitatively control the geophysical properties relevant for seismic and electromagnetic acquisition techniques, well-bore logging and core sample laboratory experiments. Information communicated in this section gives the reader a nice introduction to the nature of gas hydrates. Four geophysical topics are discussed in appropriate detail: Seismic Imaging, Geophysical Imaging, Borehole Studies, and Laboratory Studies. Each topic is presented by a set of articles, called chapters. The Seismic Imaging section contains five chapters and deals in an excellent way with seismic offshore and onshore acquisition and data analysis in characterization of gas-hydrate accumulations in shallow buried sediments. The analysis section introduces the reader to the world beyond the well-known seismic BSR (bottom-simulating reflector, separating gas hydrate from underlying free gas section) event. Because of the gas hydrates' shallow presence in the sediment column, geophysicists understand that geophysical techniques will play a key role, but both acquisition and analysis techniques need a "shallow buried" adaption to reveal fully their mapping potential. Therefore, classical techniques like AVO/AVA and inversion are discussed along with the less used attenuation and anisotropic analysis and shear-wave acquisition methods. The latter part is included as they may contribute to reduce uncertainty of the gas hydrate volume, a key indicator for commercial energy utilization. Following the classical seismic application section, six chapters discussing mainly electromagnetic methods, are grouped in a Geophysical Imaging section. Controlled-source EM methods are particularly attractive because of their depth-limited capability to map high-resistive bodies. Used with seismic methods, these methods open up a step-change in resource and production risk reduction, and this in particular applies to the shallow gas hydrates. The reader is introduced in an elegant way to this topic by the articles in this section. Significant rock physics achievements (discussed in the two last sections) need to be made in order to make investments into these nonseismic acquisitions valuable. The two last sections, Borehole Studies and Laboratory Studies, deal with direct measurements of gas hydrates, either in-situ in the formation penetrated by drilling a well or by gas hydrates locked in rock cores under simulated in-situ conditions in a laboratory. Presentation and discussion of physical properties of gas hydrate itself under typical in-situ conditions are needed but are surprisingly not included. Anomalous aspects in well-bore measurement methods and data analysis when applied in formations saturated with gas hydrates are discussed. Three articles in the borehole section focus on key rock (saturated with gas hydrates) properties necessary for calibration to 2D or 3D seismic and electromagnetic data sets. One article gives the reader basics about temperature measurements, heat flux, and transfer, all essential information to understand the extent of the gas hydrate stability zone and how that can be mapped using geophysical methods. A total of seven articles follow an introduction in the laboratory section. Not only by this number of contributions but also by its function is the reader made aware of the importance of rock physics science in quality characterization of gas hydrates. Several rock models are discussed along with laboratory methods that focus on how free gas and gas hydrates in a host medium influence the physical properties. The editors have made a successful compilation, and the effort is appreciated and highly recommended. —Ivar Brevik, Trondheim, Norway