Seismic Amplitude

An Interpreter's Handbook

The oil and gas industries now routinely use seismic amplitudes in exploration and production as they yield key information on lithology and fluid fill, enabling interpretation of reservoir quality and likelihood of hydrocarbon presence. The modern seismic interpreter must be able to deploy a whole range of sophisticated geophysical techniques, such as seismic inversion, AVO (amplitude variation with offset) and rock physics modelling, as well as integrating information from other geophysical techniques and well data.

This accessible yet authoritative book provides a complete framework for seismic amplitude interpretation and analysis, in a practical manner that allows easy application – independent of any commercial software products. Springing from the authors' extensive industry expertise and experience of delivering practical courses on the subject, it guides the interpreter through each step, introducing techniques with practical observations and helping to evaluate interpretation confidence.

Seismic Amplitude is an invaluable day-to-day tool for graduate students and industry professionals in geology, geophysics, petrophysics, reservoir engineering and all subsurface disciplines making regular use of seismic data.

Rob Simm is a Senior Geophysical Adviser for Cairn Energy PLC, and has worked in the oil and gas industry since 1985. He spent the early part of his career working as a seismic interpreter for British independent oil companies including Britoil, Tricentrol and Enterprise Oil. After working in exploration, production and field equity teams, Dr Simm established his own consultancy (Rock Physics Associates Ltd) in 1999, providing project and training services to oil and gas companies. He runs an internationally renowned training course on 'The Essentials of Rock Physics for Seismic Amplitude Interpretation'.

Mike Bacon is a Principal Geoscientist for Ikon Science Ltd, having worked for 30 years in the oil industry with Shell, Petro-Canada and Ikon Science. During that time he has interpreted seismic data from various basins around the world, with particular emphasis on extracting useful information from seismic amplitudes. Dr Bacon has served as Publications Officer of the EAGE (European Association of Geoscientists and Engineers), chairing the editorial board of the journal First Break. He has also co-authored a number of practical texts, including, with Rob Simm and Terry Redshaw, *3-D Seismic Interpretation* (Cambridge University Press, 2003).

'This will be a welcome addition to the library of any geoscientist wanting a firm foundation in state-of-the-art seismic reservoir characterisation. Simm and Bacon cover all of the important topics, in a style that is not overly mathematical, and also illustrate each method with well thought-out and illustrated geological examples from around the world. I highly recommend this book to anyone wishing to understand this important area of geoscience.'

Dr Brian Russell, *Vice President, Hampson-Russell Software: A CGG Company*

'The authors have provided a coherent, comprehensive and, above all, practical guide for interpreters to exploit the information contained in the amplitudes of seismic data. They compare different approaches, highlighting advantages and potential pitfalls, and also explain the terminology. This book will be an invaluable guide for both beginners and experienced professionals and I'd recommend it for all geoscientists working with seismic data.'

Mr Patrick Connolly, *Senior Advisor, Geophysical Analysis, BP*

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Preface

The past twenty years have witnessed significant developments in the way that seismic data are used in oil and gas exploration and production. Arguably the most important has been the use of 3D seismic, not only to map structures in detail but also to infer reservoir properties from an analysis of seismic amplitude and other attributes. Improvements in seismic fidelity coupled with advances in the understanding and application of rock physics have made quantitative description of the reservoir and risk evaluation based on seismic amplitude not only a possibility but an expectation in certain geological contexts. It is probably no exaggeration to say that the interpreter has entered a new era in which rock physics is the medium not only for the interpretation of seismic amplitude but also for the integration of geology, geophysics, petrophysics and reservoir engineering. For conventional oil and gas reservoirs, the technology has reached a sufficient state of maturity that it is possible to describe effective generic approaches to working with amplitudes, and documenting this is the purpose of this book.

The inter-disciplinary nature of 'Seismic Rock Physics' presents a challenge for interpreters (both old and new) who need to develop the appropriate knowledge and skills but it is equally challenging for the asset team as a whole, who need to understand how information derived from seismic might be incorporated into project evaluations. This book provides a practical introduction to the subject and a frame of reference upon which to develop a more detailed appreciation. It is written with the seismic interpreter in mind as well as students and other oil and gas professionals. Mathematics is kept to a minimum with the express intention of demonstrating the creative mind-set required for seismic interpretation. To a large extent the book is complementary to other Cambridge University Press publications such as *3-D Seismic Interpretation* by Bacon *et al.* (2003), *Exploration Seismology* by Sheriff and Geldart (1995), *The Rock Physics Handbook* by Mavko *et al.* (1998) and *Quantitative Seismic Interpretation* by Avseth *et al.* (2005).

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