INTEGRATION OF GEOPHYSICAL TECHNOLOGIES IN THE PETROLEUM INDUSTRY

The most utilised technique for exploring the earth's subsurface for petroleum is reflection seismology. However, a sole focus on reflection seismology often misses opportunities to integrate other geophysical techniques such as gravity, magnetic, resistivity and other seismicity techniques, which have tended to be used in isolation and by specialist teams. There is now growing appreciation that these technologies used *in combination with* reflection seismology can produce more accurate images of the subsurface. This book describes how these different field techniques can be used individually and in combination with each other and with seismic reflection data. World leading experts present chapters covering different techniques and describe when, where and how to apply them to improve petroleum exploration and production. It also explores the use of such techniques in monitoring CO_2 storage reservoirs. Including case studies throughout, it will be an invaluable resource for petroleum industry professionals, advanced students and researchers.

HAMISH WILSON started his career with BP before forming his own consulting company Paras Ltd, focusing on exploration strategy and process. Wilson's key specialism is in helping companies develop and implement exploration-led growth strategies. He has worked at a senior executive level for most of the world's leading exploration-led oil companies. He has now formed BluEnergy focused on carbon capture and storage.

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CAMBRIDGE
UNIVERSITY PRESS

CAMBRIDGE
UNIVERSITY PRESS

University Printing House, Cambridge CB2 8BS, United Kingdom

One Liberty Plaza, 20th Floor, New York, NY 10006, USA

477 Williamstown Road, Port Melbourne, VIC 3207, Australia

314–321, 3rd Floor, Plot 3, Splendor Forum, Jasola District Centre, New Delhi – 110025, India

103 Penang Road, #05–06/07, Visioncrest Commercial, Singapore 238467

Cambridge University Press is part of the University of Cambridge.

It furthers the University's mission by disseminating knowledge in the pursuit of education, learning, and research at the highest international levels of excellence.

www.cambridge.org
Information on this title: www.cambridge.org/9781108842884
DOI: 10.1017/9781108913256

First published 2021

Printed in the United Kingdom by TJ Books Limited, Padstow Cornwall

A catalogue record for this publication is available from the British Library.

ISBN 978-1-108-84288-4 Hardback

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Ian Jack is a Physics graduate from the University of St Andrews, Scotland. He began his geophysical career in 1968 as a field engineer, and subsequently as a seismic processor, before moving to software development in Dallas, Texas. He joined BP Exploration in London in 1978 and became manager of their geophysical operations in 1982. Other assignments included subsurface R&D manager, and

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Matt Luheshi is a geoscientist by profession with more than 40 years of experience in oil and gas exploration (mostly with BP). His experience included project management and leadership positions including new opportunity access, technical evaluations and technology development. His global experience encompasses most of the major petroleum basins of the world (including the Middle East, North-West Europe, North America, North Africa, South-East Asia and East Siberia). Following retirement from BP he has worked as an independent consultant (Director at Leptis E&P Ltd) with a number of major and independent oil companies as well as government oil organisations.

Lucy M. MacGregor is Chief Technology Officer at Edinburgh Geoscience Advisors Ltd. She is an accomplished research scientist with more than 20 years of experience in geophysics, multi-physics reservoir characterization and data analysis. She has expertise in innovative workflow and algorithm development to solve technical challenges, as well as significant international experience, both technical and commercial. MacGregor has extensive experience in all legal aspects of intellectual property portfolio management and strategy. She is skilled in managing technical teams made up of specialists with a diverse range of skills to ensure successful project outcomes. MacGregor has 25 years of experience in marine electromagnetic surveying and multiphysics analysis and its application to the detection and characterisation of fluids in the earth. She cofounded OHM in 2002 to commercialize marine electromagnetics in the hydrocarbon industry and spent 16 years as Chief Technology Officer. She was the 2016 SEG Honorary Lecturer for Europe and will serve as the 2021 SEG Distinguished Lecturer.

Jannis Makris was a Professor of Geophysics at the Institute of Geophysics, Hamburg University, from 1978 to 2002, Professor Emeritus from 2002 and

Managing Director of GeoPro GmbH Hamburg. He is currently Managing Director of Geosyn Geophysics. He was an establishing member of the Centre of Marine Research and Climatology at the University of Hamburg and a member of the Board of Directors for more than 20 years. Throughout his long career he has developed marine seismographs for Wide Aperture Reflection/Refraction Profiling (WARRP) for passive and active seismic studies and developed techniques in gravity, magnetics and seismicity. He has organized and coordinated more than 100 geophysical projects in many parts of the world, both onshore and offshore, and published more than 150 papers on crustal seismology, gravity and magnetics, as well as microseismicity. He was Vice President of the UNESCO IOC Commission for the preparation and publication of the geophysical overlay sheets of all the countries in the Mediterranean Sea. For more than a decade he was President and Vice President of the Geophysics and Geology section of Community Integrated Earth System Model (CIESM). He also acted as coordinator of the JOULE Geophysical Project of the European Commission for 5 years. For 20 years he was a member of the International Gravity Commission of the International Union of Geodesy and Geophysics (IUGG).

Keith Nunn is a geophysicist by profession with more than 40 years of experience in oil and gas exploration (mostly with BP). Prior to joining BP he was a lecturer in geophysics at the University of Birmingham for 10 years, during which his research interests included a wide range of seismic topics from shallow reflection seismology to large-scale crustal seismic studies; he organised and participated in several crustal seismic projects in the United Kingdom and other European countries and was a member of the Royal Society Explosion Seismology Working Group. He joined BP as a research geophysicist and spent 25 years mainly in technical leadership roles leading seismic processing, analysis and acquisition teams, and at the end of his tenure served as Distinguished Adviser Geophysics with responsibility for BP's global seismic activities. He has been involved with exploration and production in most of the major petroleum basins of the world. Following retirement from BP he has worked as an independent consultant (Managing Director at Nunngeo Consulting Ltd) for a number of independent oil companies as well as government oil organisations.

Alan B. Reid is a director of Reid Geophysics Ltd and honorary research fellow, School of Earth & Environment, University of Leeds. He specialises in potential field surveys (mainly airborne) used in mineral and petroleum exploration, specifically: designing geophysical surveys to solve geological problems; QC of airborne surveys; advanced processing of geophysical data to display geological structure to best advantage; and interpreting such enhanced data in geologically reasonable ways, consistent with other geological or geophysical information.

Hamish Wilson started his career with BP before forming his own consulting company focusing on exploration strategy and process. Hamish's key specialism is in helping companies develop and implement exploration led growth strategies.

Integrated geoscience focussed on articulating risk and value, is central to Hamish's approach to exploration. He has implemented and peer reviewed exploration strategy and processes in most of the world's major oil companies. An understanding of how oil companies make decisions has led to projects advising governments on attracting exploration investments. Hamish has led influential projects in the UK, Ireland and Canada that have had major impacts on subsequent exploration activity in these countries.

Access to data and the application of appropriate software has been an important part of the exploration and production process. To support the exploration consulting service, Hamish has also previously assembled and led a team of leading experts in the field of petro-technical information technology.

Alongside Hamish's career in oil and gas, he has led a renewable energy start up through to investment funding. The insights gained from advising on oil company capital allocation processes, combined with a deep understanding of renewable energy risk and reward profiles, give Hamish unique perspective on how to succeed in the transition to a low carbon future. He has formed a second consulting company focussed on helping oil companies with the energy transition.

Hamish has presented at most of the major E&P conferences and is a well-regarded opinion leader in his field. He has also served as president of the Petroleum Exploration Society of Great Britain, a charity that represents the exploration community in the UK.