Geology of Siliciclastic Shelf Seas

Geological Society Special Publications
Series Editor A. J. FLEET

GEOLOGICAL SOCIETY SPECIAL PUBLICATION NO. 117

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1996
Published by
The Geological Society
London

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Published by The Geological Society from:
The Geological Society Publishing House
Unit 7, Brassmill Enterprise Centre
Brassmill Lane
Bath BA1 3JN
UK
(*Orders*: Tel. 01225 445046
Fax 01225 442836)

First published 1996

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library.

ISBN 1-897799-67-5
ISSN 0305-8719

Typeset by Aarontype Limited,
Easton, Bristol, UK

Printed by The Alden Press,
Osney Mead, Oxford, UK

Distributors

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AAPG Bookstore
PO Box 979
Tulsa
OK 74101-0979
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(*Orders*: Tel. (918) 584-2555
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Preface

Continental shelves separate the continents from the world's oceans, and if humans are to further exploit or make sensible use, or eventually inhabit, the Earth's oceans and seas, the continental shelves are the places to start from. A good knowledge of the structural and stratigraphical geology of these shelves will help in the prediction of *loci* of potential exploitable resources (gravel and sand accumulations, shelf sand bodies and incised valley fills as modern analogues for hydrocarbon reservoirs, marine placers...). It will also allow prediction of the short-, medium- and possibly even long-term behaviour and stability of the shelves, and applications related to offshore construction, harbour or recreational development projects. Better insight into the sediment and morphodynamical processes acting on shelves in relation to meteo-oceanographical factors will allow prediction of coastal evolution and the fates of major transportation routes and of fishing areas, and the definition of major sediment transport pathways. Problems related to geotechnical and environmental issues have become increasingly relevant for the continental shelf environment and have initiated new pulses of technological development.

In this volume, we have aimed to present a selection of some of the recent research activities and developments in the field of continental shelf geology. Most papers are European, and often reflect cooperative research work carried out in the framework of the EC-financed Marine Science and Technology Program (MAST), but there are also contributions from the US, Canada and South America.

The chapters in this volume are organised around four major themes: 1, stratigraphy and sedimentary geology of siliciclastic shelves; 2, modern siliciclastic shelves; 3, nearshore and coastal environments; 4, new techniques in continental shelf research.

Stratigraphy and sedimentary geology of siliciclastic shelves

This section addresses the reconstruction from the geological record of sedimentary and geological processes which affect continental shelves.

The first three papers in this section essentially discuss the same concept of the complex facies and sequence architecture in epicontinental basins – in a so-called ramp-type setting – taking examples from the North Sea Basin. **Michelsen & Danielsen** use multi-channel seismic and well-log data to establish a sequence stratigraphical model for the Oligocene deposits in the Danish North Sea, and clearly illustrate the resolution-related limitations of the seismic tools, the usefulness of the well-log data and the characteristic facies pattern within this type of deposits. The strata post-dating the mid-Miocene in the Danish North Sea are discussed by **Konradi**, who uses biostratigraphical arguments to reconstruct the evolution of the sedimentary environment through time. **Jacobs & De Batist** integrate high-resolution seismic and core data to develop a sequence stratigraphical and geometrical model for the Eocene deposits in the southernmost North Sea Basin, thereby highlighting some characteristic facies patterns occurring in these ramp-type shelf deposits.

Mellere & Steel present a detailed analysis of sedimentary facies associations within the Mid-Jurassic Bearreraig Sandstone Formation (Scotland), which they use to reconstruct the tectonically complex palaeogeographic setting of this shallow-marine environment. The sedimentary facies of Late Cretaceous to Early Tertiary deposits from Patagonia (Argentina) are analysed by **Spalletti**, and used to reconstruct the evolution of the depositional environment.

Modern siliciclastic shelves: architecture, sea level, tectonics and sediment supply

This section addresses the architecture and recent evolution of siliciclastic shelves as related to changes in sea level, tectonic evolution and sediment supply. A wide range of continental shelf environments, both tectonically active and passive and with different depositional regimes, are considered in this section.

Anderson *et al.* present a compilation of a large amount of high-resolution seismic and core data from the East Texas shelf to illustrate the relative role of sediment supply, rapid changes in sea level, shelf gradient and tectonics, and of autocyclic phenomena in controlling the overall packaging of facies into systems tracts for the Pleistocene to Recent evolution of the area. **Ercilla & Alonso** and **Hernandez-Molina *et al.*** present integrated continental shelf and margin studies of the Spanish Mediterranean realm, highlighting the influence of tectonic style of the margin, of the typical rapid changes in sea level during the Quaternary, and of sediment supply on the evolution of the considered margin segments. **Correggiari *et al.*** discuss the Late Quaternary evolution of the epicontinental Adriatic Sea and how large bedforms can be used to deduce changes in the oceanographical regime of the area in relation to changes in sea

level. Two papers focus on the evolution of continental shelves and margins in high-latitude settings. **Bart & Anderson** clearly point out the complexity of the stratigraphical record of glacial activity on the Antarctic Peninsula continental shelf, and how this record should be investigated and interpreted for reconstructing glacial history. **Sejrup *et al.*** investigate the sediment fluxes – as well as the processes accounting for these fluxes and their timing – which pass from the Norwegian continental shelf, through fjords and the Norwegian Channel, towards the North Sea Fan. **Lericolais *et al.*** revises the tectonic and depositional setting of the Hurd Deep in the English Channel, using a variety of advanced geophysical investigation techniques.

Nearshore and coastal environments

This section deals mostly with sediment transport agents and processes and on coastal evolution studies in various settings. **Dominguez** discusses the relative importance of the processes shaping the depositional system off the São Francisco river in Brasil and uses his findings to comment on the classical delta classification systems. **Barrie & Conway** address the evolution of a nearshore macrotidal sand transport system in Canada and discuss in this context the importance of tectonic uplift. **Cleary *et al.*** present a well-documented study of the influence of the inherited geological framework, upon the evolution of shoreface system off the coast of North Carolina. A detailed study of the sediment transport processes affecting one of the beaches of the island of Norderney (Germany) is presented by **Eitner *et al.***

New techniques in continental shelf research

In this section, a number of new approaches and techniques are presented whose development has been triggered by the increasing interest in continental shelf studies. **De Meijer *et al.*** present the promising results of radiometrical techniques for the assessment of the selective transport of heavy and light minerals in coastal sands. Results of an integrated geophysical, geotechnical and geological study for determining the physical parameters of shallow-marine sediments from the Baltic Sea are presented by **Missiaen *et al.*** **Davis** reviews the role of various geophysical techniques for offshore site investigations, and comments on the advances and developments that these techniques have undergone in the past years.

Acknowledgements: This volume emanated from a three-day conference hosted by the Renard Centre of Marine Geology of the University of Gent on 24–26 May 1994. Exactly a hundred scientists from various European countries, from the US and from South America participated in this conference at which 47 talks and 28 posters were presented. Some of the presenters were invited to contribute to this special publication and we solicited further contributions to extend the coverage of the volume. Neither the conference nor this special publication would have been possible without the financial, logistic and moral support of the Geological Society of London and its Publishing House (D. Ogden, A. Hills), the Belgian National Fund for Scientific Research, GEOLAB, ASLK, the Instituut voor Zee Wetenschappelijk Onderzoek (IZWO) and the Management Unit of the Mathematical Model of the North Sea and the Scheldt Estuary (MUMM). We also wish to thank the following referees who devoted part of their valuable time to reviewing the manuscripts: J. R. L. Allen, J. B. Anderson, D. Ardus, S. Berné, G. Boillot, M. Collins, R. W. Dalrymple, A. Davis, R. A. Davis, G. De Moor, J. F. Donoghue, B. W. Flemming, P. Gayes, J. P. Henriet, E. C. Kosters, J. Luternauer, A. Maldonado, T. F. Moslow, M. Paul, G. Postma, H. Roberts, D. Rubin, R. Steel, E. Steurbaut, M. Stoker, J. P. M. Syvitski, J. Terwindt, B. Tessier, F. Trincardi, P. R. Vail, N. Vandenberghe, J. Verbeek, T. Vorren, R. G. Walker, J. Wehmiller and J. Wells.

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January 1996