Preface and Introduction

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This book records some of the recent advances that biostratigraphy has made in production and development geology. It serves to illustrate to non-biostratigraphers the potential applicability of biostratigraphy in this arena, and to encourage biostratigraphers to further explore and evaluate this potential.

In the production as opposed to the exploration arena, biostratigraphic and related techniques are employed to address reservoir-scale problems such as detailed correlation (often utilizing local, but nonetheless extremely useful, marker events), interpretation of depositional environment, geometry, connectivity and compartmentalization, and reserves estimation and optimization of recovery. This involves the biostratigrapher working as a member of an integrated multidisciplinary reservoir team alongside sedimentologists, petrophysicists, development geophysicists and geologists and engineers, and being familiar with core, wireline log, seismic and other data. It also involves maintaining a high level of specialist biostratigraphic knowledge and the capability to undertake analyses as appropriate across a wide range of geographies, stratigraphies and reservoir depositional environments and/or to be an ‘informed buyer’ (and interpreter) of vendor/contractor analytical data.

High-resolution and quantitative biostratigraphy and integrated reservoir description are among the comparatively novel techniques employed. Biostratigraphic steering (bio-steering) of wells at well-site, enabling optimal penetration of reservoir sections, has become an exceedingly important application (and one bringing significant benefits to the operator in terms of saving time and money).

These sorts of applications are likely to become increasingly important in a future in which the oil companies are likely to continue to focus on enhancing recovery from producing fields rather than exploring for new ones.

Introduction

In this volume, case histories of applications of biostratigraphic and related techniques in the North Sea are given first, and case histories of applications in the international arena (Euramerica, Borneo, Venezuela, Nigeria and the Gulf of Mexico) second. The overall representation of different geographies, stratigraphies and reservoir depositional environments is wide, although the North Sea is particularly well represented, reflecting the fact that it was here that many of the techniques, notably bio-steering (in Chalk reservoirs) were first practised.

In the first of the North Sea contributions, Payne et al. discuss the role and value of ‘high-impact’ biostratigraphy in reservoir appraisal and development, with worked examples of applications in the Donan, Andrew and Forties Fields in the UK Sector (Late Palaeocene submarine fan reservoirs).

Duxbury et al. then discuss the sequence stratigraphic subdivision of the Humber Group (Late Oxfordian to Ryazanian) of the Outer Moray Firth area of the UK Sector, with worked examples of applications in the Tartan, Highlander and Petronella Fields. Morris et al. continue the Mesozoic theme with a contribution on the micropalaeontological biostratigraphy of the Magnus Sandstone Member (Kimmeridgian–Early Volgian) of the Magnus Field, emphasizing its role in integrated reservoir description and reservoir management (extending production life).

Roar, Skjold, Svend, Tyra and Valdemar). Bergen & Sikora and Sikora et al., respectively, discuss diachronism and depositional interpretation and the implications thereof for the Chalk Fields of the Norwegian Sector.

Bidgood et al. describe the stratigraphic potential of diatoms in the Late Palaeocene–Early Eocene of the North Sea (together with some of the taxonomic problems that require to be addressed before this potential can be fully realized), with an example of an application from the 29/25-1 well (just south of the Auk and Fulmar Fields) in the UK Sector.

Holmes resumes the bio-steering theme with examples of contrasting applications in the Andrew Formation (Late Palaeocene) of the Joanne and Andrew Fields of the UK Sector. In the case of the Andrew Field, an innovative form of microfacies analysis was used to derive interpretations of the depositional environment (whether turbiditic or interturbiditic) and likely extent of mudstones within the reservoir section, and their likely effects on fluid flow (whether barriers or baffles). These interpretations were in turn used to maximize production through appropriate well placement and stand-off from oil–water and gas–oil contacts (using barrier shales as ‘umbrellas’ to protect wells from gas invasion).

Mangerud et al. discuss the high-resolution biostratigraphy and sequence stratigraphy of the Palaeocene succession in the Grane Field in the Norwegian Sector and the implications thereof, including the resolution of heterogeneities in reservoir architecture (and consequences for fluid flow) not revealed by early models based solely on wireline log correlations.

In the last of the North Sea contributions, Jones attempts to demonstrate the value of historical micropalaeontological data in integrated reservoir description, with an example from the Forties Field (Late Palaeocene submarine fan reservoir).

In the first of the contributions from the international arena, McLean & Davies present an exhaustive discussion on constraints on the application of palynology to the correlation of Eurafrican Late Carboniferous clastic reservoirs.

The remainder of the contributions from the international arena deal with Neogene–Pleistocene fluvial, paralic, peri-deltaic and submarine fan clastic reservoirs in low to moderate latitudes (Borneo, Venezuela, Nigeria, Gulf of Mexico).

Simmons et al. describe the use of microfossil assemblages (both foraminifera and palynomorphs) to determine the precise depositional setting of reservoir sands in the Neogene successions of northwest Borneo. Outcrop analogues of reservoir sands in a variety of depositional settings (from fluvial, through paralic and peri-deltaic to submarine fan) have been identified and an empirical observation of the variations in microfossil assemblages made. When applied to the subsurface, this ability to precisely identify depositional setting should allow for optimal production strategies to be applied.

Jones et al. discuss the reservoir biostratigraphy of the Pedernales Field in the Eastern Venezuelan Basin (Late Miocene–Early Pliocene peri-deltaic to submarine fan reservoirs), emphasizing its role in integrated (biostratigraphic, sedimentological, seismic, wireline log) reservoir description.

Armentront et al. discuss the integrated high-resolution sequence stratigraphy of the peri-deltaic reservoir of the Oso Field, Nigeria. In this case, high-resolution biostratigraphy contributed significantly to the characterization of the reservoir, and thus indirectly to the infill and enhanced recovery-drilling programmes based on this characterization and designed to maximize cost-effectiveness in the field development strategy.

Van der Zwan & Brugman describe ‘biosignals’ from the EA Field, also in Nigeria. This new high-resolution (essentially climatostratigraphic) tool provided a detailed biostratigraphic subdivision within the existing biozonation and enabled easier correlation of reservoir units across growth-faults and recognition of fault cut-offs.

Finally, O’Neill et al. discuss uses of applied biostratigraphy in the Gulf of Mexico, with examples of applications from the Bonnie discovery well in Eugene Island Block 95 and from Mars Field in Mississippi Canyon Blocks 763, 806 and 807. In the latter example, biostratigraphy helped to resolve stratigraphic and structural relationships poorly imaged by seismic and thus to appraise reserves estimates.
refereeing manuscripts (the remainder of the refereeing was undertaken by the editors).

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