



Petroleum geological atlas of the southern Permian Basin area, edited by H. Doornenbal & A. Stevenson, 2010. EAGE Publications, Houten (order through www.eage.org/bookshop). Hardbound, 342 pp. Price EUR 175.00. ISBN 978-90-73781-61-0. Also available as DVD (pdf format); price EUR 160.00. Atlas + DVD: price EUR 225.00 (all prices exclusive handling and shipping). SPBA GIS maps and database: EUR 10,00.00 for single-site license; EUR 25,000.00 multi-site licence (excl. VAT).

The southern Permian Basin area (sPBa) atlas contains 16 chapters that aim at non-specialist professionals. Each chapter describes the regional geology, including local details to help illustrate specific geological aspects. Reaching consensus in such a geologically complex area is impossible. The atlas therefore does not present a unified view, but the principal arguments are given and appropriate references quoted where diverging views exist. Occasionally the authors provide a preferred interpretation. The almost 150 authors include members from national geological surveys, geoscientists from oil companies, research institutes, universities, licensing authorities and independent experts. All chapters have a principal author and each chapter was reviewed by external referees, most of who work in the petroleum industry. The chief-Editor and the project cartographer were responsible for text and diagram standardisation, consistency of chapter format and final layout. Printing and binding was done by EAGE (the European Association of Geoscientists & Engineers). The sPBa Atlas project was initiated to celebrate the discovery, some 50 years ago, of one of the largest gas fields in Europe, the Groningen gas field, that boosted exploration for gas and oil in Europe. It follows the format of the 2003 "Millennium Atlas: petroleum geology of the central and northern North Sea" which roughly coincides with the northern Permian Basin. Both atlases cover gas and oil provinces that continue to mature. Field sizes are inevitably decreasing. Therefore, the careful data integration and general geoscientific effort to compile these atlases are a great help in discovering new reserves and in augmenting the recovery of the proven reserves. Thus the atlases stimulate the petroleum exploration and production industry to continue their activities in these mature basins

After a general introductory chapter, the chapters can be grouped into four broad sections. Chapters 2 and 3 form together the first section. They provide an overview of the deep-crustal structure and the main structural elements of the sPBa and its sub-basins, their general evolution, and their present-day structural framework. Gravity, magnetic and deep-seismic-reflection data were used to analyse basin development and tectonic evolution from the Proterozoic times to the Present. A series of paleogeographic maps for selected geological time intervals and tectonic-element maps show the main episodes of basin development. Regional seismic sections supplement the maps. The influence of tectonic events on hydrocarbon-trapping mechanisms is also considered.

The second section comprises Chapters 4-12. The first two chapters describe the pre-Carboniferous basin evolution after which the sPBa *sensu stricto* formed and filled, which is analyzed up to the Cenozoic. This forms the main body of the atlas. Chapter divisions, not necessarily coinciding with geological system boundaries, are based on major unconformities or on easily recognisable and commonly used seismic or well-log markers. Each chapter contains

tectonostratigraphic correlation charts, depth and thickness maps, well-correlation panels and seismic profiles. The standardised diagrams add to the standardised maps and provide continuity between the stratigraphic chapters, in particular through the tectonostratigraphic correlations that show relationships between current stratigraphic nomenclatures and obsolete ones with historical significance; well correlations showing the relationships between the principal units across each of the chosen stratigraphic intervals, and seismic lines and geological profiles demonstrate the stratigraphic successions in the prevailing structures.

The text layout is standard throughout these 9 chapters, with an Introduction describing the stratigraphy and outlining the structural, the stratigraphic and the paleogeographic evolution of the sPBa during the relevant geological time interval. The sections on stratigraphy introduce the various units and their depositional environments. Lithostratigraphic descriptions take into account the current nomenclatures of the various countries as well as local variations between sub-basins. In general, the stratigraphy is described from the UK in the West to Poland in the East.

The basin fill as described in Chapters 6-12 comprises a complete first-order global transgressive/regressive sea-level cycle that has been subdivided into a number of transgressive/regressive second- and third-order cycles (3-50 Ma and 0.5-3 Ma, respectively). These are formed by eustatic sea-level changes, tectonic basin movements and changes in base-level. In the sPBa, they have been defined and described as second-order cycles, here referred to as depositional cycles (DC). From the third-order cycles onwards, it is felt that a correspondence exists with base-level fluctuations. That is significant for the continental parts of the basin fill. Nine recognised DCs range in age from a few to 75 million years, and all overlie a major unconformity. DCs 1-3 (Carboniferous-Middle Permian) are volcanic / terrestrial deposits reflecting short-duration tectonics, and DCs 4-9 (Late Permian-Recent) are each composed of a transgressive phase reflecting slow subsidence and post-rift sediment cover with small facies variations over a basal unconformity, a peak transgressive phase with an euxinic deepest-marine facies, and a regressive phase with large facies variations reflecting significant subsidence, rifting, basin inversion and halokinesis. Each sequence ends in a major unconformity.

One may wonder whether this Depositional Cycle approach sufficiently takes into consideration the results of recent research that have put question marks regarding the use of hierarchical sequence orders, as they may suffer from orders overlapping in time and reflecting different driving mechanisms. This seems to be the case in the sPBa. Longer-duration cycles, episodic rather than periodic in nature because they are differently driven, are suspect and the "global-eustacy paradigm" is sometimes referred to as a "revolution in trouble", in particular when used uncalibrated against a global chronostratigraphic correlation.

The final chapter addresses options for the economic use of the subsurface, including gas and CO₂ storage, geothermal-energy recovery and mining of solid-fuel minerals such as coal and lignite. Other options for the use of the subsurface, such as salt, ore and mineral mining, are not addressed, however, as they do not have a direct relationship with petroleum geology. A glossary of selected terms is added as well as a list of maps that are available in GIS format, including a reference to the figure numbers in the atlas. A full listing of hydrocarbon fields is given according to the petroleum provinces described in Chapters 13 and 15. The references cited in each chapter are given in an Appendix.

The printed atlas has maps at a 1: 3,000,000 scale, and the CD text and maps can be read on an interactive pdf format. The maps are also offered in GIS format at an application scale of 1:1,000,000, which greatly increases the usability and accessibility of the maps, and allows

integration with other maps. Thus an invaluable training tool is now available for postgraduate students and new graduates employed by the petroleum industry.

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