
Hans Doornenbal and Alan Stevenson (editors)
BGS – British Geological Survey

Founded in 1835, the British Geological Survey (BGS) is the world’s oldest national Geological Survey and the United Kingdom’s premier centre for earth science information and expertise. The BGS client base is drawn from the public and private sector both in the UK and internationally. The BGS strategy is to focus its activities on key issues related to energy and environmental change and to address the short- and medium-term, including carbon capture and storage, radioactive waste management, natural hazards, resource security and environmental protection. BGS plays a major role in the delivery of the Natural Environment Research Council (NERC) strategy – Next Generation Science for Planet Earth and the ‘Living With Environmental Change’ (LWEC) programme. BGS enhances its culture of commercial innovation to ensure that its knowledge is shared and exploited to deliver societal and economic impacts and benefits. BGS currently employs about 715 staff, most of whom are based at its headquarters in Keyworth, Nottingham and in Edinburgh. The BGS website can be found at www.bgs.ac.uk.

Geological Survey of Belgium

The Geological Survey of Belgium (GISB) was founded in 1886 with the dual mission of data repository for the Belgian subsoil and the evaluation of its natural resources. Since 2003, the GISB has become a department of the Royal Belgian Institute of Natural Sciences with the combined mission to conduct research and provide advice. GISB has a full-time staff of about 30, 20 of whom are statutory and contractual geologists. GISB produces a range of products including maps, books and databases and acts as a resource centre and project partner in many aspects of Belgian geology, including climate change and contribution to its mitigation. The GISB website can be found at www.naturalsciences.be/geology.

TNO Geological Survey of the Netherlands

TNO Geological Survey of the Netherlands was formed in 1997 through a merger between the Geological Survey of the Netherlands (NGI) and the TNO-GG department and is the Netherlands’ central geoscientific information and research centre for the sustainable management and use of the subsurface and the natural resources found there. TNO Geological Survey of the Netherlands has a staff of about 300 geoscientists and is a public centre that provides an independent, objective and authoritative opinion on all geoscientific aspects of these activities. Examples of TNO research topics are geohazards, such as induced ground movement and CO2 storage. The TNO Geological Survey of the Netherlands website can be found at www.tno.nl.

Geological Survey of Denmark and Greenland

The Geological Survey of Denmark and Greenland (GEUS) was founded in 1893 through a merger between the independent Geological Survey of Denmark (established in 1888) and Greenland (established in 1944). It is a research and advisory institute in the Ministry of Climate and Energy and is governed by an independent board. GEUS’s main tasks are geological mapping, data collection and storage, carrying out research projects, providing advice to the relevant authorities, and furthering the understanding and knowledge of the geology of the country for practical use in the national economy and in environmental protection, geological mapping, data and information collection, processing and storage. GEUS also provides expertise and advice on a wide array of geological issues to relevant authorities. The main areas of PGi work are concerned with the country’s security in mineral resources, including groundwaters, monitoring of the geological environment, and warning against natural hazards. PGi is entrusted with the tasks of the Polish Geological Survey and the Polish Hydrogeological Survey. PGi’s main tasks are comprehensive studies of the geological structure of the country for practical use in the national economy and in environmental protection, geological mapping, data and information collection, processing and storage. PGi also provides expertise and advice on a wide array of geological issues to relevant authorities. The main areas of PGi work are concerned with the country’s security in mineral resources, including groundwaters, monitoring of the geological environment, and warning against natural hazards. PGi is the custodian of the great majority of the country’s geoscience information. PGi has five regional branches and a staff of about 750, of which more than 20 percent have PhD’s. The PGi website can be found at www.pgi.gov.pl.

Federal Institute for Geosciences and Natural Resources

The Federal Institute for Geosciences and Natural Resources (BGR) was founded in 1958. It is the centre for geoscience information and expertise of the Federal Republic of Germany. The BGR advises the Federal Government in all questions on the regional and quantitative availability of energy resources worldwide, provides it with mineral resources research and is breaking new ground in the use of geothermal energy. It is involved in multinational projects researching marine and polar regions, and in researching and protecting water and soil resources. The BGR records earthquake activity throughout the world and monitors compliance with the international nuclear test-ban treaty. It helps geologically vulnerable countries with geohazard management, assesses geoscientific data and makes it expertise available in international projects. The BGR examines radioactive waste and investigates the possibilities of storing CO2 to help protect the environment. There are 726 scientific, technical and administrative staff at the BGR. The BGR website can be found at www.bgr.bund.de.

Polish Geological Institute – National Research Institute

The Polish Geological Institute (PGI) was founded in 1919 on the strength of the Resolution of Parliament of the Republic of Poland. It is a state R&D institute under the general supervision of the Ministry of the Environment. In 2009, the Council of Ministers bestowed on PGI the status of a National Research Institute. PGI is entrusted with the tasks of the Polish Geological Survey and the Polish Hydrogeological Survey. PGI’s main tasks are comprehensive studies of the geological structure of the country for practical use in the national economy and in environmental protection, geological mapping, data and information collection, processing and storage. PGI also provides expertise and advice on a wide array of geological issues to relevant authorities. The main areas of PGI work are concerned with the country’s security in mineral resources, including groundwaters, monitoring of the geological environment, and warning against natural hazards. PGI is the custodian of the great majority of the country’s geoscience information. PGI has five regional branches and a staff of about 750, of which more than 20 percent have PhD’s. The PGI website can be found at www.pgi.gov.pl.
Foreword

Petroleum Geological Atlas of the Southern Permian Basin Area; quite a mouthful, but an apt and accurate title. What exactly is the Southern Permian Basin? It comprises the area between eastern England and about the eastern border of Poland, with flanking areas within Denmark and the southern Baltic Sea in the north and theugled areas of Belgium and Germany to the south. Within this area, reservoir rocks of Permian age are by far the most important in terms of their commercial production of hydrocarbons; hence the Atlas title.

The SPBA Atlas can be considered as a national resource to the very successful Millennium Atlas, published in 2003, covering the petroleum geology of the Central and Northern North Sea, which in turn received its inspiration from a similar atlas of the western plains of Canada (Moosap, G. & Shetson, I. 1994).

Petroleum, in the form of oil seeps, has been known in western Europe for many centuries at places like Fournouillers in the Rhone Graham, while Neolithic people along the shores of Lake Neuchatel, Switzerland, used asphalt as an adhesive to fasten flint implements to handles of bone or wood. It was early evident that petroleum was ‘to the syneron’, as modern explorers like to think.

The establishment of the first economically viable oil industry in Europe can be considered to date from 1851, when the Scot James ‘Paraffin’ Young began to distil oil from a Lower Carboniferous (Visean) organic-rich shale at Broxburn in central Scotland (Butt, 1983).

Meanwhile, in south-east Poland, oil, lifted in wooden buckets from pits and dog wells some 50 to 60 m deep, was reported in 1853 from what is now known to be Czarnowice to Eocene sandstones of the Biskra-Bogd field. Rather like Young in Scotland, early experiments in distillation by a pharmacist, Ignacy Lukasiewicz, led in that same year to the use of oil lamps in the operating theatre of a hospital in Lwow, and Young even sold the oil to the doctor in Gliwice. 1853 is accepted as the start of a Polish industry involving oil and its products of distillation, which were distributed to Galicia, Vienna, Budapest, Prague and Berlin; and even Baku in Azerbaijan (probably John D (1839-1917), founder of Standard Oil) sent his agents to Galicia to learn from Lukasiewicz (Kennedy, 1998).

In Germany, oil-bearing sands were found near the town of Breslau in 1854 and two years later was well drilled at Matar (see Figure 1.2).

These events preceded by a few years what many people consider the founding of the modern oil industry: the discovery in 1859 of oil at a depth of 8.8 ft (265 m) near Ceylon, Trinidad, with a daily production of 25 barrels. Oil had in fact been known in the area for some time as a contaminant of asphalt used as an adhesive to fasten flint implements to handles of bone or wood. It was early evident that petroleum was ‘to the syneron’, as modern explorers like to think.

The idea of a Southern Permian Basin Atlas (SPBA) was initiated at the XVth International Congress on Sedimentology. Likewise, the Millennium Atlas, the British Geological Survey provided the services of Alan Stevenson as Chief Editor of the SPBA. With a chapter organization similar to that of the Millennium Atlas, these key appointments led to logical planning of the SPBA, the appointment of ‘Country Co-ordinators’ (typically important in the oil industry, the only country where subsurface information remains confidential from the date of acquisition, perhaps 100 years earlier; whereas one discoverer in multiple ownership is still sufficient to prevent any release of data), and of chapter Principal Authors, who had to co-ordinate contributions from their international teams.

Like the Millennium Atlas, the SPBA Atlas is planned to sell at well below cost in order to make it available to as many users as possible. In keeping with this aim, the cost of nearly all work on the Atlas is covered by individual contributing organizations.

Kenneth Glennie

April 2010

References


Lokhorst et al., 1998. NW European Gas Atlas. CD Rom. BGR, BGS, GEUS, NITG-TNO & PGI.


References


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ConocoPhillips

ConocoPhillips is an international, integrated energy company. It is the third-largest integrated energy company in the United States based on market capitalization, as well as proved reserves and production of oil and natural gas, and the second-largest refiner in the United States. Worldwide, oil-refining and -marketing controlled companies, ConocoPhillips is the seventh-largest holder of proved reserves and the fourth-largest refiner. Headquartered in Houston, Texas, ConocoPhillips operates in more than 30 countries. As of 31 December 2008, the company had approximately 13,000 employees worldwide and assets of US$46 billion. Website: www.conocophillips.com.

Energie Beheer Nederland B.V. (EBN)

EBN is an independent company with the Dutch State as its sole shareholder. The company advises the Minister of Economic Affairs on Dutch energy policy and on issues relating in particular to the stewardship of Dutch oil and gas resources. EBN does not maintain any financial reserves. The entire net result is paid out to the State. EBN plays a central role in the exploration, production and sale of Dutch natural gas and is also active in oil exploration and production. By participating in a large number of joint ventures with oil and gas companies, EBN contributes to the exploration and development of gas and oil reserves in an economically sound manner. EBN is also involved in the sale of Dutch natural gas via an interest in the gas sales company GasTerra. EBN also promotes the development of the Dutch gas hub by, for example, contributing to the realisation of gas storage facilities. Website: www.ebn.nl.

E.ON Ruhrugas E&P GMBH

E.ON Ruhrugas is a wholly owned subsidiary of E.ON AG. The E.ON Group employs 91,500 people and is one of the world’s largest investor-owned power and gas companies. As the upstream arm of E.ON, E.ON Ruhrugas E&P GMBH is responsible for all exploration and production activities in the E.ON Group. Established in 2001, E.ON Ruhrugas E&P have already gained a strong foothold in the market and have rapidly grown their exploration and production portfolio. The focus areas are the North Sea, Russia and Northern Africa. The company acts as an operator in the UK, Norway and Algeria and follows a strong growth path. Website: www.eon-ruhrugas-ep.com.

GDF SUEZ

In 2008, Gaz de France and Suez merged to create a new world leader in energy, GDF SUEZ. GDF SUEZ is present from the top to the bottom of the energy chain, in electricity and natural gas, both upstream and downstream. GDF SUEZ is structured around six business lines: five active in energy and one active in environment. In 2006, the Exploration & Production Business Unit was created to diversify upstream and downstream. GDF SUEZ E&P is focusing on a number of key issues: increasing the security of the Group’s supply through diversification of resource across markets; completing the Group’s presence along the entire gas chain to help balance its overall margin risk; reinstating the position of GDF SUEZ as a purchaser of gas and enabling new partnerships with traditional gas suppliers. Website: www.gdfsuez.com.

Maersk Oil

Maersk Oil is a global oil and gas company with production in Denmark, the UK, Qatar, Algeria and Kazakhstan plus exploration activities in several other countries. Daily operated production is some 750,000 barrels of oil equivalent. Maersk Oil and its subsidiary companies are part of the A.P. Moller-Maersk Group and was founded in 1962 when the Danish Concession was awarded to A.P. Moller. Since the early 1990s, international activities have gained momentum starting with the Al Shuwaikh Field development in Qatar. Website: www.maersk Oil.

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The Petroleum Exploration Society of Great Britain (PESGB)

Founded in 1846, the PESGB is a registered charity and non-profit making organisation with a membership of over 1300. The Executive Council runs the Society on a voluntary basis and is annually elected from its membership. The object of the Society is to promote, for the public benefit, education in the scientific and technical aspects of petroleum exploration. To achieve this goal it holds various events and activities including monthly lectures, issues a monthly newsletter to members, holds conferences and exhibitions, seminars, courses and field trips.

The PESGB supports other activities relevant to its objectives by sponsoring various projects within the industry and academia and runs a scholarship award scheme for postgraduate students. Website: www.pesgb.org.uk.

RWE Dea

RWE Dea is headquartered in Hamburg (Germany) and is a top-performing company for the exploration and production of natural gas and crude oil, operating on an international scale. Geodetical expertise, state-of-the-art drilling and production technologies, and a diverse range of professional experiences and know-how acquired in 111 years of corporate history, make RWE Dea a powerful company engaged in numerous operations at home and abroad. Website: www.rwe.de.

Shell

With around 102,000 employees in 100 countries and territories, Shell helps to meet the world’s growing demand for energy in responsible ways. Shell’s Upstream International and Upstream Americas businesses search for, recover and produce crude oil and natural gas. The natural gas is liquefied and transported to customers across the world to provide clean-burning fuels. Shell are also developers of wind power to generate electricity. Downstream businesses make, move and sell a range of petroleum-based products for domestic, industrial and transport use. With around 44,000 service stations, Shell has the world’s largest single-branded fuel retail network. Website: www.shell.com.

Total

Total is one of the world’s major oil and gas groups, with activities in more than 130 countries. Its 97,000 employees put their expertise to work in every part of the industry: exploration and production of oil and natural gas, refining and marketing, gas trading and electricity. Total is working to keep the world supplied with energy, both today and tomorrow. The Group is also a front runner in chemicals. Website: www.total.com.

Wintershall

Wintershall is a wholly owned subsidiary of BASF, which is based in Ludwigshafen, Germany. Wintershall is active in various regions of the world in the exploration and production of crude oil and natural gas. In Europe, the BASF subsidiary trades and sells natural gas. The company also markets storage capacities for oil and gas, transportation capacities for gas as well as optic fibre capacities. Wintershall has been active in the exploration and production of oil and gas for more than 75 years, and with its headquarters in Kassel, it is now Germany’s largest producer of crude oil and natural gas. In its exploration and production activities, Wintershall deliberately focuses on selected core regions where the company possesses a wealth of regional and technological expertise. These regions include Europe, North Africa, South America as well as Russia and the Caspian Sea region. In addition, these operations are complemented by the company’s growing exploration activities in the Arabian Gulf. The company is actively pursuing a policy of ongoing investment in the development of new deposits and the expansion of existing fields. While doing so, Wintershall attaches the same importance to stringent environmental protection and work safety requirements as it does to its economic targets. Website: www.wintershall.com.

The idea for the Southern Permian Basin Atlas came from a geologist who has been described as a legend in his field, namely Ron Gessner. He, Romney Professor in Petroleum Geology at the University of Aberdeen, and the EAGE’s Alfred Wegener Award winner in 2000. While attending the 18th International Congress on Continental Stratigraphy in August 2001 at the University of Utrecht, Professor Glennie suggested to Hans Doornenbal (SPBA Project Manager) and others at TNO that the Southern Permian Basin deserved the same coverage as the Willenian Atlas on the petroleum geology of the central and northern North Sea, which had just been published in 2003. A few e-mails were exchanged to clarify the concept and a first meeting with oil companies willing to lend their support to the project took place in September 2003, with TNO in charge of the undertaking. The following 18 months involved meetings with potential financial sponsors and National Geological Surveys to develop the project plan and to prepare the contracts for this huge project.

Organisation and acknowledgements

The SPBA Project was established consisting mainly of representatives from the National Geological Surveys and the E&P industry sponsors. TNO was given responsibility for overall project management, including all technical, commercial and financial aspects, and the British Geological Survey (BGS) was asked to supervise the editing of the Atlas. During the first year, the project team developed the structure of the Atlas and the teams of authors for each chapter were formed. In the second to fourth years, the regional maps were prepared at the National Geological Surveys and about 150 authors were brought together to write the text. The fourth and fifth years were mainly engaged in drafting, editing and reviewing the Atlas content. The European Association of Geoscientists & Engineers (EAGE) was selected as the Atlas publisher, and are responsible not only for the printing and binding the Atlas, but also the marketing and the sales service.

The publication of the Atlas was initially planned for June 2009 to coincide with the 60th anniversary of the discovery of the giant Groningen gasfield in 1959, which effectively launched the oil and gas era off the north-west European Continental Shelf. In the end, the Atlas took one year longer, and was published in 2010.

The project Steering Committee was established at the kick-off meeting in Utrecht in March 2005. The committee was composed of members from the main participants; representatives from all of the E&P industry A-sponsors, the National Geological Surveys and Licensing Authorities, and new main data providers. The Steering Committee then appointed the project teams: Hans Doornenbal (Project Manager), Alan Stevenson (Chief Editor), Erik Simmelink (GIS/Mapping Co-ordinator, succeeded in January 2007 by Hans Vollkoord) and the Country Co-ordinators from the National Geological Surveys: Graham Litt (UK), Michael Dine (Belgium), Ed Bous (the Netherlands), Anders Mattissen (Denmark), Peer Nørth (Germany) and Tealveyn Peret (Poland). The Steering Committee also selected the Principal Authors for each of the 16 chapter teams.

The Steering Committee met every 6 months during the main phase of the project to review progress and to provide the project with guidance and drive it through to completion. The Project Manager prepared the documentation for each meeting and both he and the Chief Editor attended all Steering Committee meetings.

The SPBA Project has benefited the project immensely:

- A-level: multinationals with a high level of involvement in the Southern Permian Basin area, who supported the Atlas as a Patron by sponsoring the project for the sum of €125 000: ConocoPhillips, EOG, E.ON, BG, TOTAL, Maersk, PEMEX, EAGE, Shell, Total and Wintershall. The company logos and corporate logos of these Patrons are shown on pages iv and v.
- B-level: companies active in one of the participating countries, who contributed €15 000 to the SPBA Project: BP, Chinees Energia, EDI Brenners, Petro-Canada, Shell, CNOOC, Total and Venkata Energy.
- C-level: companies with a relatively low, but important, level of involvement in the Southern Permian Basin area, or sponsorship of less than €15 000: ESRF, Basinik Hydrocarbons, Unravel Manas Energy and Venkata Energy.

In addition to these financial sponsors, the project relied on the input of the authors, many of whom gave freely of their time, data suppliers and extra staff resources from National Geological Surveys and other project participants. The National Geological Surveys have contributed a substantial amount of their own funding to the Project, estimated to be more than €1.5 million, in order to finance the owner staff resources needed for editing, mapping and chapter authorship.

The following organisations provided data for the use of all authors in the project:

- companies active in one of the participating countries, who contributed €15 000 to the SPBA Project: BP, Chinees Energia, EDI Brenners, Petro-Canada, Shell, CNOOC, Total and Venkata Energy.
- companies with a relatively low, but important, level of involvement in the Southern Permian Basin area, or sponsorship of less than €15 000: ESRF, Basinik Hydrocarbons, Unravel Manas Energy and Venkata Energy.

In total, the SPBA Project received data from more than 100 different companies, universities and research institutes.

Project management

A budget of €1.8 million was raised from sponsorship, mainly from E&P companies. Multi-sponsor agreements were signed between TNO and these financial sponsors.

A number of sponsorship levels were determined, reflecting the financial contribution and activity levels of the various companies or agencies:

- A-level: multinationals with a high level of involvement in the Southern Permian Basin area, who supported the Atlas as a Patron by sponsoring the project for the sum of €125 000: ConocoPhillips, EOG, E.ON, BG, TOTAL, Maersk, PEMEX, EAGE, Shell, Total and Wintershall. The company logos and corporate logos of these Patrons are shown on pages iv and v.
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In total, the SPBA Project received data from more than 100 different companies, universities and research institutes.
The Backbone of any scientific volume is the authors. The Atlas authors, major contributors and their affiliations are named at the start of each chapter, and further individual acknowledgements are included at the end of some chapters. Many of the authors worked long hours both in the office and at home, some with strong support from their employers, others with only an indomitable urge to contribute. Their contributions are greatly appreciated.

Editorial procedure

Guidance Notes to Authors were prepared at the start of the project to outline the chapter contents and provide a framework for the style and content of the diagrams. It was originally envisaged that each chapter would comprise no more than about 8000 words and consist of some 20 diagrams, excluding well-mentation panels. As the reader will see, the vast amount of information available within the Atlas means that in most cases these guidelines were exceeded.

Most of the chapter authors were nominated at the start of the SPBA Project by the contributing partners, whereas others joined during the production of the Atlas through contacts on an enthusiastic basis. The final authorship, their order, and the relative status of authors versus contributors, were all decided whereas others joined during the production of the Atlas through contacts or an enthusiasm to contribute. Most of the chapter authors were nominated at the start of the SPBA Project by the contributing partners, whereas others joined during the production of the Atlas through contacts or an enthusiasm to contribute.

The Atlas was printed by De Groot Drukkerij, Goudriaan, the Netherlands (www.vanmierlobinders.nl) and bound by Boekbinderij Van Mierlo, Nijmegen, the Netherlands (www.vormgevingrietstap.nl). The Netherlands W 3990 DB Houten E eage@eage.org

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Other contributors

During production of the Atlas, about 15 technical meetings were attended by most of the authors. The meetings were held mainly at the offices of the National Geological Surveys in Edinburgh, Amsterdam, Utrecht, Copenhagen, Berlin, Hansove, Warsaw and Kraków. Geological excursions to some of the classic outcrops within the SPBA area were sometimes included in the agenda; photographs from these excursions are featured in several of the cover pages for the stratigraphic chapters (e.g. Chapter 3). We would like to thank the hosts at the geological institution, the Country Co-ordinators and all other contributors for making these meetings and excursions a great success.

The project team is grateful for the help of their colleagues at TNO and BGS. At TNO, we especially thank Jeremy Metcalfe and Carla Elmers, who put a huge amount of effort into producing the GIS maps, and Hans Veldkamp for compiling the project databases, particularly the hydrocarbon-field database, which was a major undertaking. Irresistible support was also provided by Nera Mitran in finalising and checking several of the figures and maps. We would also like to express our special gratitude to Henk Kroonkamp for his contribution throughout the project in finalising the hydrocarbon-field database and stratigraphic charts, and for compiling and checking the references. At BGS, we thank Sheila Jones and Sandy Henderson for providing support to the Chief Editor, and to the staff of the BGS Geo2GIS group who drafted some of the figures for the hydrocarbon-field example sections, especially Woodhead and Stuart Herbaugh. We also thank the many people who were involved in the early stages of the project when funding was being sought, in particular Howard Johnson at BGS and Henk Peeper at TNO.

Thanks also go to the many other people in the National Geological Surveys, oil companies, Licensing Authorities, research institutes and universities who have provided small, but important, contributions to the project.

Hans Deenen and Alan Stevenson would like to thank their families (especially their wives Janny and Julia) for their support and patience during the long hours spent on the SPBA project.

Sadly, one of the authors who contributed to Chapter 2, Stanislaw Skompski, died in 2009. We especially acknowledge Stanislaw’s contribution to our geological knowledge of the Southern Permian Basin. He will be missed by his friends and colleagues who worked with him during the project.

The editors have worked mainly with the Principal Authors for each chapter. The Principal Authors submitted drafts to the editors for comment and amendment prior to peer review. Following which each chapter was revised accordingly. During the final phase of the project, the text and diagrams were laid out in the final A2 paper format to decide on the best arrangement. The authors were then given an opportunity to check and comment on the format before final submission to the publisher. The Chief Editor and the editorial team have attempted to unify as far as possible the style and terminology of the Atlas, although this has not always been possible. An obvious example is the quantification of petroleum volumes, for which a range of statistics may be gleaned from the literature. The final layout of the Atlas was decided by the editorial team.

Editors

The European Association of Geoscientists & Engineers (EAGE) is the Atlas publisher. EAGE is a European-based professional association for geoscientists and engineers, with a worldwide membership that provides a global network of commercial and academic professionals. The association is truly multi-disciplinary and international in form and pursuits. All members of the EAGE are professionally involved in (or studying) geophysics, petroleum exploration, geology, reservoir engineering, mining and civil engineering. EAGE organises a wide variety of conferences, workshops and educational activities for its members and is a renowned publisher of leading geoscience publications.

Other contributors

During production of the Atlas, about 15 technical meetings were attended by most of the authors. The meetings were held mainly at the offices of the National Geological Surveys in Edinburgh, Amsterdam, Utrecht, Copenhagen, Berlin, Hanover, Warsaw and Krakow. Geological excursions to some of the classic outcrops within the SPBA area were sometimes included in the agenda; photographs from these excursions are featured in several of the cover pages for the stratigraphic chapters (e.g. Chapter 3). We would like to thank the hosts at the geological institution, the Country Co-ordinators and all other contributors for making these meetings and excursions a great success.

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The editors have worked mainly with the Principal Authors for each chapter. The Principal Authors submitted drafts to the editors for comment and amendment prior to peer review. Following which each chapter was revised accordingly. During the final phase of the project, the text and diagrams were laid out in the final A2 paper format to decide on the best arrangement. The authors were then given an opportunity to check and comment on the format before final submission to the publisher. The Chief Editor and the editorial team have attempted to unify as far as possible the style and terminology of the Atlas, although this has not always been possible. An obvious example is the quantification of petroleum volumes, for which a range of statistics may be gleaned from the literature. The final layout of the Atlas was decided by the editorial team.

Editors
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