Petroleum Geological Atlas
of the
Southern Permian Basin Area

Hans Doornenbal and Alan Stevenson (editors)

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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 sectors 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 complex environmental challenges requiring decisions in 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 725 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*.

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Geological Survey of Belgium

The Geological Survey of Belgium (GSB) was founded in 1896 with the dual mission of data repository for the Belgian subsoil and the valorization of its natural resources. Since 2002, the GSB has become a department of the Royal Belgian Institute of Natural Sciences with the combined mission to conduct research and provide advice. GSB has a full-time staff of about 30, 20 of whom are statutory and contractual geologists. GSB 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 GSB website can be found at *www.naturalsciences.be/geology*.

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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 (RGD) 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 CO_2 storage. The TNO Geological Survey of the Netherlands website can be found at *www.tno.nl*.

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Geological Survey of Denmark and Greenland

The Geological Survey of Denmark and Greenland (GEUS) was formed in 1995 through a merger between the independent Geological Surveys of Denmark (established in 1888) and Greenland (established in 1946). 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 Denmark and Greenland. One of its main areas of work is in the field of national energy resources, and GEUS maintains and develops a comprehensive knowledge of North Sea and North Atlantic geology in order to fulfill this aspect of its mission. GEUS's staff number a total of 330 full-time specialists, technicians and administrative staff. The GEUS website can be found at *www.geus.dk*.

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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, administers geoscientific databases and makes its expertise available in international projects. The BGR examines the geological security of potential final storage locations for radioactive waste and investigates the possibilities of storing CO_2 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*.

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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 geoscientific 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*.

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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 the upland 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 natural successor 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 (Mossop, G.D. & Shetson, I. 1994).

Petroleum, in the form of oil seeps, has been known in western Europe for many centuries at places like Péchelbronn in the Rhine Graben, while Neolithic people along the shores of Lake Neuchatel, Switzerland, used asphalt as an adhesive to fasten flint implements to handles of horn or wood. It was early evident that petroleum was 'in the system', 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 dug wells some 15 to 60 m deep, was reported in 1853 from what is now known to be Cretaceous to Eocene sandstones of the Bóbrka-Rogi 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, which is now just over the border in Ukraine. 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 Rockefeller (probably John D (1839-1937), founder of Standard Oil) sent his experts to Galicia to learn from Lukasiewicz (Karnkowski, 1999). In Germany, oil-bearing sands were found near the town of Heide in 1856 and two years later a well was drilled at Wietze (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 69.5 feet (24 m) near Oil Creek, Titusville, Pennsylvania with a daily production of 25 barrels. Oil had in fact been known in the area for some time as a contaminant of what was then the more prized mineral salt. However, the well drilled the year before at Wietze (completed in 1859) reached a total depth of 35.5 m to test for the presence of coal, but found oil that flowed at a rate of one and a half buckets per day for the next twelve months. A second well drilled in 1860 with the aim of finding oil produced a rather heavy tar. Wietze became the centre of Germany's oil industry; by the early 20th century it had an annual production of up to 90 000 tonnes and eventually produced over 19 million barrels of oil. With other fields elsewhere, Germany was the centre of Europe's oil industry until after World War II.

Exploration had continued in western Germany throughout the war and, under political pressure extended into the eastern Netherlands with the discovery in 1943, close to the German border, of the Cretaceous Schoonebeek oilfield, which did not get into production until the war was over. Much further east on the south side of the Baltic Sea in Poland, 38 small oilfields and 5 gasfields were already known by the end of World War II.

The name 'Paraffin' Young reminds us that, in the days before internal combustion engines, most people were interested in paraffin wax for candles and liquid paraffin (kerosene) as a fuel for lanterns. Young devised and patented the basic rules by which, ever since, oil has been refined by differential distillation. The Scottish oil-shale industry, however, was killed-off in the later 1950s by a combination of the low price of imported mineral oil and the imposition of a tax on the use in the retorts of waste gases from BP's Kincardine refinery (which otherwise was being flared); this, at a time when the country was desperately short of foreign currency. One of the by-products of the Scottish shale-oil industry had been ammonia-based fertilizers for agricultural use; these now had to be imported at great expense from Chile. Oil had been discovered at Eakring in eastern England in 1939, and other small fields followed during the war years. Again, adverse fiscal changes at the end of 1964, coupled with cheap imports from the Middle East, brought this exploration phase to a close (Kent, 1985).

In 1952, a wildcat in the Groningen area of northern Netherlands found 180 m of water-bearing Permian Rotliegend sandstone. Four years later, a little gas was discovered in overlying Zechstein dolomites at Ten Boer. In 1959, however, the Slochteren-1 well found the Rotliegend fully gas bearing. At that time, Slochteren was thought to be part of a field of perhaps some 2.5×10^{12} cubic feet (tcf); no one wanted this gas as almost every small town had its own coal-gas plant. More seismic interpretation and the drilling of three more appraisal wells led to the realisation that the gas had a common water table with an area of almost 1000 km^2 at a depth of about 2900 m; this was confirmed when the Ten Boer well was deepened to the base Rotliegend in 1963. With an ultimate recovery apparently of some 58 tcf of gas (now known to be nearer 100 tcf), this giant field, named after the provincial capital Groningen, contained enough gas to alter the fuel economy of the whole of north-west Europe; in the Netherlands, every small coal-gas plant could be bought up and, as I well remember, every domestic gas stove could have its jets replaced with smaller ones to cope with the higher thermal value of natural gas relative to coal gas; and if the stove was old, it too was replaced free of charge.

Foresets within Rotliegend cores dipped mostly to the west, thereby indicating a possible reservoir extension beneath the North Sea. And on the far side of the North Sea, Permian dune sands were known in East Yorkshire and especially County Durham ('Yellow Sands'). Once each participating country had signed The Continental Shelf Convention (Paris) of 1958 and published its own rules for governing the award of offshore concession areas, exploration could begin. Offshore drilling in the shallow waters of the UK southern North Sea began in December 1964, using jack-up rigs. The largest structure in the area (Mid North Sea High) proved to be dry (no Rotliegend reservoir), but over the next two years there was a string of successes (West Sole, Viking, Leman, Indefatigable, Hewett – the last had a Lower Triassic reservoir) although their combined ultimate recoverable reserves (~500 bcm) was only about one third of those then thought to be in the Groningen field (~1600 bcm; to date, the Groningen field has produced ~1750 bcm). The gas source was found to be Carboniferous coals and the seal Upper Permian Zechstein salt. Thus there was vertical migration from source to reservoir with an excellent (almost perfect) top seal.

With their giant onshore Groningen gasfield to develop, there was no hurry in the Netherlands to move offshore, which they did with the 1968 gas discoveries within their K and L quadrants and, in 1970, their F18 oilfield. This latter had a Jurassic source rock (Posidonienschiefer) and Lower Cretaceous reservoir of continental sandstone.

In the UK sector of the North Sea, all gas had to be sold to the State, effectively British Gas, at a price of their choosing. As the first discovery, BP's West Sole field provided all that British Gas could cope with at the time. The other producers were offered much poorer prices until the early 1980s, when British Gas realised that it would soon be unable to carry out its commitments unless more gas was discovered; the price rose for new gas and exploration recommenced in the UK Southern North Sea.

Apart from 'commitment' wells, exploration drilling had ground to a halt in the late 1960s. Seismic ships now became available at low cost, and exploration moved into the central and northern North Sea. In 1966, non-commercial oil had already been found in a Chalk reservoir in the small Danish Anne (now Kraka) field. Major billion-barrel discoveries were soon to be made, again in Chalk at Ekofisk (1969), in Paleocene turbidites at Forties (1970), and in Middle Jurassic coastal sands at Brent (1971) leading to exceptional offshore exploration activity and field development over the next 20 or more years. Those events of petroleum history are recorded in the Millennium Atlas as well as in many other publications.

The idea of a Southern Permian Basin Atlas (SPBA) was initiated at the XVth International Congress on Carboniferous and Permian Stratigraphy, held in Utrecht, The Netherlands, in 2003. Many senior delegates from oil companies, geological surveys and universities were present from those countries now involved in the SPBA. Most had already seen the Millenium Atlas (which, in any case, was available for viewing in the nearby TNO offices). When approached about a potential SPBA, support was almost solid, especially from the representatives of oil companies, who realised that between them they would have to provide most of its funding. Everyone knew that the sum of knowledge likely to be available in the Atlas would far outweigh any individual contribution. Thus the hope was that, as with any atlas, the user would have available a wide range of modern geological information (tectonic evolution and structural framework as well as stratigraphical development) under one cover, and that its compilation would lead to new ways of viewing that data and, hopefully, of finding more hydrocarbons.

The Netherlands Institute of Applied Geoscience TNO immediately offered their services to co-ordinate the development of the Atlas, and proposed Hans Doornenbal as Project Manager. Andrew Armour (Initiator) and Dan Evans (Chief Editor) of the Millennium Atlas freely offered their advice. Following their editorship of the Millennium Atlas, the British Geological Survey provided the services of Alan Stevenson as Chief Editor of the SPBA. With a chapter organisation similar to that of the Millennium Atlas, these key appointments led to logical planning of the SPBA, the appointment of 'Country Co-ordinators' (specially important in Germany, the only country where subsurface information remains confidential from the date of acquisition, perhaps 100 years earlier; where one dissenter 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 organisations.

Kenneth Glennie

April 2010

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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 capitalisation, as well as proved reserves and production of oil and natural gas, and the second-largest refiner in the United States. Worldwide, of nongovernment-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 33,800 employees worldwide and assets of $143 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 promote the development of the Dutch gas hub by, for example, contributing to the realisation of gas-storage facilities. Website: *www.ebn.nl*.

E.ON Ruhrgas E&P GMBH

E.ON Ruhrgas is a wholly owned subsidiary of E.ON AG. The E.ON Group employs 93 500 people and is one of the world's largest investor-owned power and gas companies.

As the upstream arm of E.ON, E.ON Ruhrgas E&P GMBH is responsible for all exploration and production activities in the E.ON Group. Established in 2003, E.ON Ruhrgas 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-ruhrgas-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 2000, the Exploration & Production Business Unit was created to diversify and secure natural gas resources for the Group. The Unit employs over 1300 people throughout the world, most of whom are based in France, UK, the Netherlands, Germany, Norway and Egypt. GDF SUEZ E&P is focusing on a number of key issues: increasing the security of the Group's supply through diversification of resource access methods; completing the Group's presence along the entire gas chain to help balance its overall margin risk; reinforcing 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. Møller-Maersk Group and was founded in 1962 when the Danish Concession was awarded to A.P. Møller. Since the early 1990s, international activities have gained momentum starting with the Al Shaheen Field development in Qatar. Website: *www.maerskoil.com*.

The Petroleum Exploration Society of Great Britain (PESGB)

Founded in 1964, the PESGB is a registered charity and non-profit making organisation with a membership of over 5300. 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. Geological expertise, state-of-the-art drilling and production technologies, and a diverse range of professional experience 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.rwedea.com*.

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 liquified and transported to customers across the world to provide cleaner-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 first rank player 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*.

Sponsors

A-Sponsors

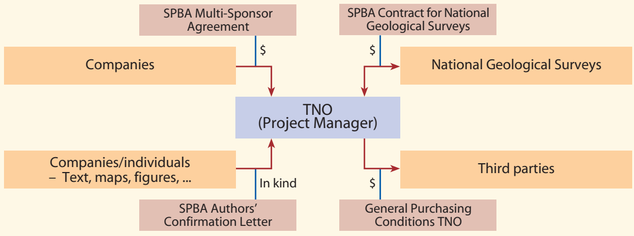
B-Sponsors

C-Sponsors

Data providers

Organisation and acknowledgements

The idea for the Southern Permian Basin Atlas came from a geologist who has been described as a legend in his field, namely Ken Glennie, ex-Shell, Honorary Professor in Petroleum Geology at the University of Aberdeen, and the EAGE's Alfred Wegener Award winner in 2000. While attending the XVth International Congress on Carboniferous and Permian Stratigraphy in August 2003 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 Millennium 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.



SPBA contracting setup.

The Southern Permian Basin Atlas (SPBA) Project officially started on March 2, 2005, when a Steering Committee 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, secretarial 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 almost 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 50th anniversary of the discovery of the giant Groningen gasfield in the Netherlands 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, as the book was 1.5 times larger than originally envisaged (and contains twice as many maps and diagrams).

Compilation and production of the Atlas has involved many individuals and organisations in a number of roles including the SPBA Project owners, authors, mappers, draftsmen, contractors, data suppliers, reviewers, Steering Committee members and financial sponsors (see page v). An immense debt of thanks is due to all these parties, many of whom are mentioned below.

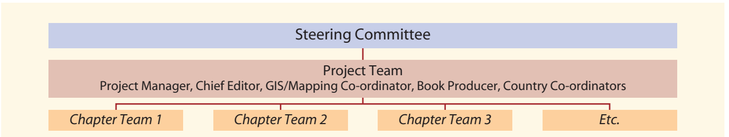
Owners

The SPBA Project is a joint effort between the National Geological Surveys of the UK, Belgium, the Netherlands, Denmark, Germany and Poland, and is supported by a wide range of E&P companies, Government Licensing Authorities, universities and research institutes.

Steering Committee and project team

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 one main data provider. The Steering Committee then appointed the project team: Hans Doornenbal (Project Manager), Alan Stevenson (Chief Editor), Erik Simmelink (GIS/Mapping Co-ordinator; succeeded in January 2007 by Hans Veldkamp) and the Country Co-ordinators from the National Geological Surveys: Graham Lott (UK), Michiel Dusar (Belgium), Ed Duin (the Netherlands), Anders Mathiesen (Denmark), Peer Hoth (Germany) and Tadeusz Peryt (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.



Simplified organisation chart of the SPBA Project.

The advice and dedication of the following members (and alternate members) of the Steering Committee has benefited the project immensely:

A-sponsors (see description of levels of sponsorship below)

- Heather Auld and Hugh Riches (ConocoPhillips)
- Fokko van Hulten and Peter Rozenkranz (EBN)
- Steve Corbin and Gregor Hollmann (E.ON Ruhrgas)
- Franz Nieberding, Youri Poslawsky and Natalie Fernandes (GDF SUEZ)
- Rene Thomsen, Helle Krabbe and Johan Andersen (Maersk)
- Jon Gluyas and Marian Scutt (PESGB)
- Andreas Brandt, Jens Thiessen (Chairman, 4th year) and Barbara Becker (RWE Dea)
- John Mabillard (Chairman 1st year) and Sander Kabel (Shell)
- Christian Mathieu (Chairman, 3rd year) and Philippe Lays (Total)
- Peter Veenhof (Chairman 2nd year), Bert de Wijn and Folke Smulders (Wintershall)

National Geological Surveys / Licensing Authorities / Data suppliers

- Michael Kosinowski, Peer Hoth and Thomas Pletsch (BGR, Germany)
- Robert Gatliff and Alan Stevenson (British Geological Survey)
- Chris te Stroet (Steering Committee Secretary) and Henk Pagnier (TNO)
- Pieter Jongerius (Ministry of Economic Affairs of the Netherlands)
- Jen Brzozowska and Toni Harvey (UK Department of Energy & Climate Change)
- Marek Hoffmann and Paweł Jagosiak (Polish Oil and Gas Company, POGC)

Honorary member

- Kenneth Glennie (project initiator)

Project management

Overall project management was provided by TNO, who appointed Hans Doornenbal as the SPBA Project Manager. The Project Manager carried out the day-to-day management, organisation and execution of the project. He was also responsible for raising initial sponsorship pledges, establishing offers of authorship from companies and individuals, selecting peer reviewers, and for locating and organising databases and access to information. The Project Manager prepared all contracts with sponsors, executing parties, drafting service provider and the publisher, and prepared and/or chaired all technical meetings, Steering Committee meetings and editorial team meetings. Finally, he was involved in editing the atlas during the last phase of the project.

Sponsors

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

- A-level: multinational companies 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, EBN, E.ON Ruhrgas, GDF SUEZ, Maersk, PESGB, RWE Dea, Shell, Total and Wintershall. The company profiles 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 €50 000 to the SPBA Project: BP, Chesapeake Energy, EOG Resources, Petro-Canada, StatoilHydro, Tullow Oil and XTO Energy Inc. The corporate logos of these sponsors are also shown on page v, with an honourable mention of the company name.
- C-level: companies with a relatively low, but important, level of involvement in the Southern Permian Basin area, or sponsorship of less than €50 000: EWE, Hansa Hydrocarbons, Oranje Nassau Energie and Vermilion 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, to finance some of the staff resources needed for editing, mapping/GIS and chapter authorship.

Data suppliers

All data used by the authors and displayed in the Atlas were generously provided free of charge. This contribution is gratefully acknowledged, for without it the production of the Atlas would not have been possible. The National Geological Surveys, Licensing Authorities and universities, who employed the majority of the authors, have contributed their work and data in kind. The oil and service companies and research institutes, for whom several authors work, have also provided the bulk of the proprietary data.

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

FugroRobertson	North Sea reports
IGI	Geochemical software and data
IHS Energy	Hydrocarbon-field related data, creaming curves
Lithuanian Geological Survey	Depth grids and hydrocarbon-field related data
PGS	Seismic interpretation data
POGC	Hydrocarbon-field related data, seismic and well data, depth grids
TGSNopec	Seismic data for interpretation and display
Oil companies and other institutes	Hydrocarbon-field attributes, geochemical data and information used to describe the 35 hydrocarbon field examples.

Other specific data contributions are noted as appropriate in the chapters.

Contractors

Contracts were agreed between TNO and the other participating National Geological Surveys: the British Geological Survey (BGS), Geological Survey of Belgium (GSB), Geological Survey of Denmark and Greenland (GEUS), Federal Institute for Geosciences and Natural Resources (BGR) and the Polish Geological Institute (PGI). The National Geological Surveys provided personnel to compile maps from data provided by the sponsors (supplemented by additional data from the National Geological Surveys), prepared data for the SPBA Project Database and GIS maps, and contributed to the chapters. The British Geological Survey provided the Chief Editor, Alan Stevenson, who was responsible for organising the authors' input, contacting peer reviewers, liaising with the project draftsman and editing the final product.

Drafting of the figures and the desk-top publishing of the Atlas was provided by Jos Rietstap Vormgeving, a small graphic design agency that provides products such as leaflets, brochures, posters, banners, annual reports, websites, magazines, books, logos and corporate designs. The agency has extensive experience in producing infographics, especially for geoscientific purposes.

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Authors and contributors

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-correlation panels. As the reader will see, the vast amount of information available within the Atlas area meant 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 or an enthusiasm to contribute. The final authorship, their order, and the relative status of authors versus contributors, were all decided by the authors themselves.

The editors have worked mainly with the Principal Authors for each chapter. The Principal Authors submitted drafts to the editor 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 publishers. The Chief Editor and the editorial team have attempted to unify as far as possible the style, content 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.

Reviewers

All parts of the Atlas have been peer reviewed, an essential step in ensuring the quality and scientific standing of the volume. Unless anonymity was requested, referees are either named in the appropriate chapter acknowledgements or in the full list provided below. Special permission to publish this Atlas was required from the Geoscience Committee of the Wirtschaftsverband Erdöl- und Erdgasgewinnung e. V. (WEG) of Germany.

The project team would like to express its appreciation to the following for giving their time to review the chapters, which has been of enormous benefit to the Atlas: Martin Baum, Andreas Brandt, Jen Brzozowska, Steve Corbin, Jan De Jager, Steve Dorobek, Dan Evans, Nigel Evans, Susan Henderson, Helen Hichens, Jens Hornung, Jean-Pierre Houzay, John Karlo, Pawel Karnkowski, Wim Kouwe, Salamon Kroonenberg, Poul Henrik Larsen, Michael Lines, John Marshall, Manfred Menning, Youri Poslawsky, Paul Pratsides, Karl-Heinz Ribbert, Karsten Schütz, Stanislaw Skompski, Guido Stahmer, Rene Thomsen, Klaus Werner Tietze, John Underhill, Jo Van Buggenum, Wolfgang Weiss and Peter Ziegler.

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, Hannover, 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 institutes, the Country Co-ordinators and all other contributors for making these meetings and excursions a great success.

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Sadly, one of the authors who contributed to Chapter 2, Stanislaw Wybraniec, 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.

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