Petroleum Exploration

What is petroleum?

Petroleum is a general term for oil and natural gas. Oil and gas are important fossil fuels formed from the decomposition and pressurisation of algae, plankton and other organisms. This process forms hydrocarbons (compounds of hydrogen and carbon) with small amounts of sulphur, nitrogen and hydrogen, which are powerful combustible fuels.

Oil and gas are found in geological basins that have been filled over tens of millions of years by fragmented material. This material has hardened into sediments, or layers of rocks such as sandstones, shales and coals. Organic material (mostly plankton and algae) accumulate on the floors of low energy basins where they partially decompose forming sapropel, an organic mud. As the sapropel is buried to form black shale it is compressed and heated and petroleum is produced.

A rock in which petroleum forms is known as a *source rock*. Compaction of the source rock during further burial forces the petroleum up towards coarser grained rock where it accumulates in the pore spaces. This coarser grained rock is known as a *reservoir rock.* Sandstone is a good reservoir rock as it is both porous and permeable. A final layer of rock is required to seal the reservoir rock. This is known as a *cap rock*, it needs to be an impermeable rock, such as shale.

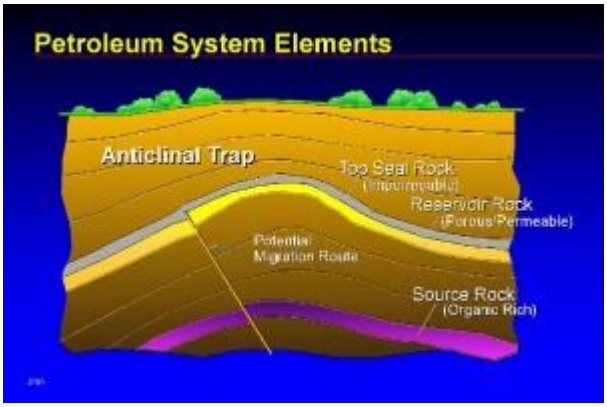

Figure 1: The physical entities of a petroleum system consist of the source rock, migration route, reservoir rock, cap (seal) rock and trap. © Exxonmobile

Figure 2: A reservoir rock is one in which pore space exists for the accumulation of hydrocarbon, and the pore spaces are interconnected (permeability) so the hydrocarbon can move both into and out of the pore spaces. Understanding of diagenetic processes and predicting diagenetic histories within three dimensional reservoir facies is essential for optimal reservoir development strategies. © Exxonmobile

Exploration

Oil and gas explorers begin by examining the local geology. They assess if it is likely to have the kinds of rocks that can produce oil and gas and can form reservoirs that can hold oil and gas. They then use survey technology, such as seismic, gravity and magnetic surveys, to detect whether the rocks are likely to contain oil and gas deposits and how large these deposits are likely to be. Explorers generate seismic (sound) waves and measure the time taken for the waves to travel from the source, reflect off subsurface features and be detected by receivers at the surface. The time taken to travel from the source to the receivers can indicate features such as rock density and the likely presence of fluids or gases. This can help build an image of the subsurface. In onshore operations, seismic is often followed drilling of core samples of rock strata. These samples enable measurements of gas content, rock permeability, thickness of the reservoirs and other information. If interpretation of survey results shows it is likely that oil and gas deposits exist in a particular area, an exploration

Figure 3: Projecting surface observations into the subsurface using remote sensing tools. © Exxonmobile

well can be drilled. But even positive survey results do not guarantee success. During and after the drilling of an exploration well information is acquired in various ways, including:

- acquiring core (rock) samples
- examining rock cuttings brought to the surface in the circulating drilling fluid
- lowering specialised logging tools into the wellbore
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These tests give a clearer picture of whether oil or gas is present and if it can be commercially recovered.

Exploration Geologists

Exploration geologists are employed by companies, consultants and contractors working within the natural resources extraction industry. They are responsible for identifying and assessing the location, quantity and quality of deposits, ascertaining extraction risks, preparing reports and maps, analysing geological data using specialist computer applications and advising managerial, technical and engineering staff. Their work can be office based, although fieldwork is necessary to collect and test site/borehole samples. Typical duties include:

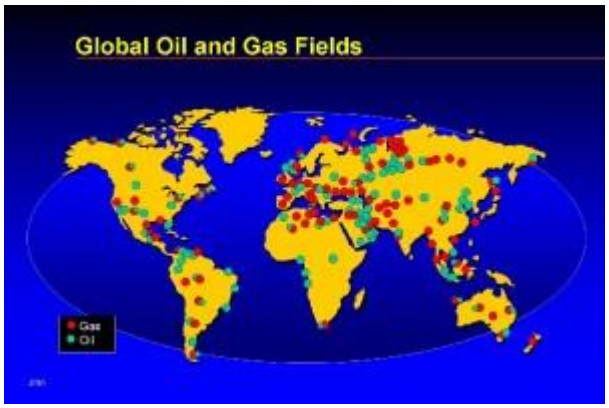

Figure 2: The worlds known petroleum comes from a widely distributed number of areas, but the largest reserves are concentrated in the Middle East, Western Siberia, and Venezuela. © Exxonmobile

- investigating the structure and evolution of the earth and its natural resources
- planning programmes for exploration of sites for oil, gas, water, minerals, etc
- surveying and mapping geologically promising sites
- collecting, recording and analysing samples and data from test sites
- advising on the development of reserves

Absence from home for long periods of time is common as international work is often necessary. Long hours, shift and weekend work are also regularly required.

A degree in geology is often the minimum academic requirement for entry; some employers also expect a relevant postgraduate qualification.

The job carries a high level of responsibility, as the employee must ensure the accuracy of forecasts – initiating extraction processes is often very expensive and mistakes can be costly. Consequently, training is an important feature of the job. New recruits normally receive a period of intensive training shadowing experienced employees and on-the-job training as required.

Key skills for exploration geologists:

- Knowledge of a range of sciences and their applications
- Ability to work within a multidisciplinary team of scientists and engineers
- Good organisational skills
- Computer literacy and ability to analyse numerical and graphical data
- Good written and verbal communication skills

Uses of Petroleum

Natural gas is also known as methane. It is found in several different types of rocks, including sandstone, coal seams and shales. Gas is used to generate electricity and to power appliances such as heaters and

stoves. It is also important in many industrial processes, including making fertilisers, glass, steel, plastics, paint, fabrics and many other products.

Oil refining produces transport fuels, such as petrol, diesel and jet fuel, as well as heating oils such as kerosene. By-products from oil refining are used in the production of plastics and chemicals, as well as many lubricants, waxes, tars and asphalts. Nearly all pesticides and many fertilisers are made from oil or oil byproducts.

The Petroleum Exploration Society of Great Britain

The objective of the Society is to promote, for the public benefit, education in the scientific and technical aspects of petroleum exploration. This is achieved by variety of means:

Monthly lectures held both in London and Aberdeen Conferences & Seminars held throughout the year and cover topical issues within the industry.

Field Trips. The first field trip was in 1965 and investigated the prospects of the English Channel. This was the first of over 100 field trips ran by the Society ranging from local evening excursions to full international field courses covering several days.

Monthly Newsletter which contains all the up to date Society information as well as topical articles. The Newsletter is only available to member.

Regional branches. The first regional branch was established in Aberdeen in 1985 and over the following years the Society has introduced other regional branches in the North West of England, Surrey and Ireland. These groups hold regular local lecture meetings and other educational activities. The largest of the regional branches is Aberdeen which has its own President and President Elect Special Interest Groups. These are groups of members who share a particular interest. These also arrange meetings and other educational activities.

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