

# Onshore UK hydrocarbon prospectivity

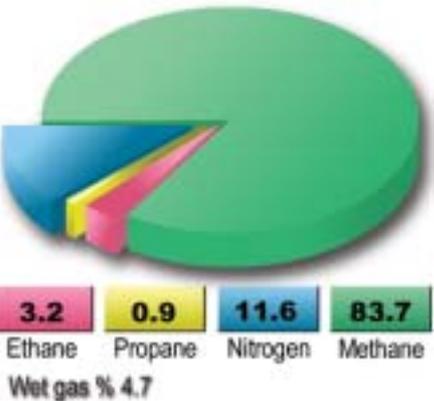
## A small but significant resource

by Nigel Smith, Keyworth

**O**nshore UK hydrocarbon exploration has been episodic and low-profile, with perhaps seven phases of increasingly technical sophistication:

- Since about 1787, excavations in Coalport Tar Tunnel, Shropshire, and limited oil collection from accidental discoveries in coal mines led to increasing production. Dr James Young experimented on obtaining oil from torbanite (a type of coal) in Scotland and the oil shale mining industry began there in 1862.
- Early 1900s: two small companies were active in focused, prospective areas (limited gas production at Heathfield in Sussex) and additional, rare opportunistic drilling (Calvert in Buckinghamshire).
- 1917–22: A war-driven, American-advised exploration on surface anticlines in Carboniferous rocks in northern England and Scotland resulted in the Hardstoft discovery.
- 1936–1960s: D'Arcy and Esso dominated exploration, initially on surface anticlines (Midlothian field). Successes at Formby and East Midlands' fields before and during the Second World War were on sub-surface geophysically-mapped structures. Discoveries as late as the 1950s (Kimmeridge and Cousland) were on surface anticlines.
- 1960s–1980, after North Sea discoveries, was a period of increased

drilling. Wytch Farm's discovery well was drilled on the southern margin of the Tertiary Hampshire Basin and resulted from a detailed structural inversion and migration model based on existing wells. The lower, Sherwood Sandstone, reservoir was targeted later, after a revised model indicated migration into older reservoirs was possible. Some wells were still drilled without seismic control,



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*Nooks Farm gas composition, showing a relatively low wet gas content. Dry gases, containing mostly methane, especially with high nitrogen content, indicate derivation from Westphalian coals. Wet gases with higher proportions of higher hydrocarbon gases (ethane, propane etc.) indicate derivation from oil-prone source rocks.*

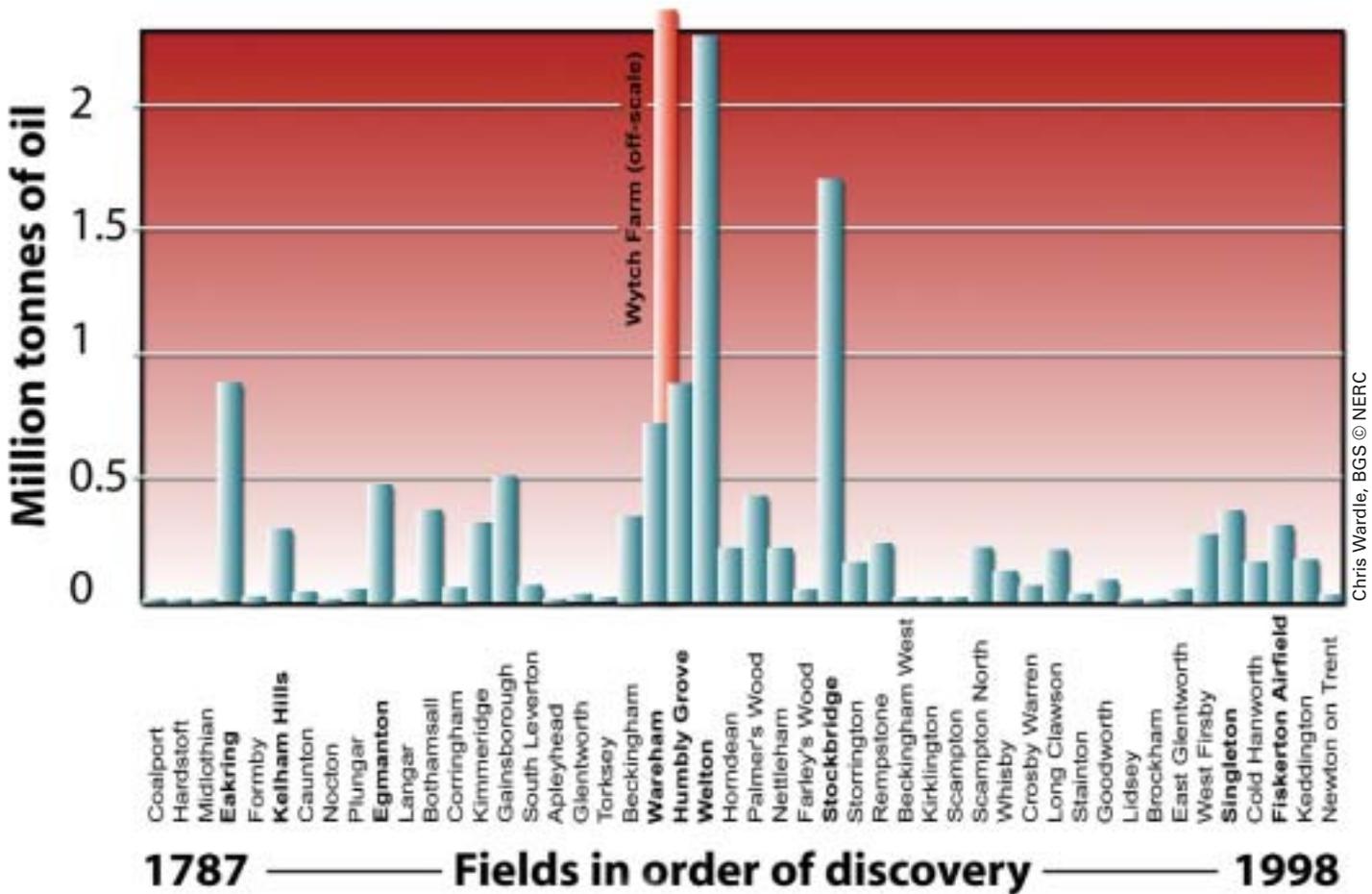
such as those on the North Sea coast and in East Anglia.

- 1980–91: modern seismic-based exploration with BP, Shell, Amoco, Conoco and smaller companies, one of which, Carless, made several Weald discoveries.



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*'Nodding donkey' type beam pumps at the Long Clawson oil production site in Leicestershire. This field was discovered in 1986 and has been in operation since 1991. The field has recoverable reserves of approximately 200 000 tonnes of oil.*



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United Kingdom oil fields showing recoverable reserves for each field in order of discovery. The most significant fields were discovered between 1970 and 1985. By far the largest discovery, Wytch Farm, has recoverable reserves of 62 million tonnes of oil.

- 1991–present: BP sold its smaller production and data, and other large companies abandoned the onshore; smaller companies now dominate and have made further discoveries including the largest onshore gasfield (Saltfleetby).

### What can we learn about past exploration?

Exploration has been tinged with pessimism. Some geologists offered to drink any oil discovered during the First World War drilling campaign, despite limited production of oil in the UK for at least a century. The first discovery in the East Midlands province (Hardstoft) found oil in the Carboniferous Limestone. The discovery is located west of the surviving hydrocarbon kitchen. Both these characteristics are atypical, based on BP's later discoveries.

Based on hydrocarbon shows in boreholes, J Ford (of Oilfields of England Ltd, who supervised the Kelham drilling in 1920) predicted discovery of oilfields in the East Midlands subsurface in a published debate in 1917. I can find no published reference to him by D'Arcy and later BP geologists. The Kelham Hills oilfield was discovered in 1941, by D'Arcy, about four kilometres from Ford's Kelham wells.

What is the youngest reservoir? Glacial sands overlying the Formby oilfield (1939 discovery) had hydrocarbon shows and were allegedly productive in one well. Several discoveries, off the north coast of Wales, west from Formby, were made by Hamilton during the early 1990s.

The fields discovered have been small (average about 0.3 million tonnes of oil), except Wytch Farm, which contains 61.96 million tonnes of oil.

BP had two phases of unsuccessful drilling in the Weald before Carless's discoveries there. Shell had just one, uneconomic discovery (Nooks Farm) from more than 20 wells.

Located between the East Midlands oil province and the productive East Irish Sea Basin is the Cheshire Basin. Very small, but perhaps significant, production in its vicinity is from older rocks surrounding the Permo-Triassic basin. A number of wells have tested Carboniferous levels but the latest, unsuccessful, exploration was directed at the shallow Helsby Sandstone Formation, expecting an analogue of the East Irish Sea Basin petroleum system. If history teaches us anything, this basin deserves another attempt.

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