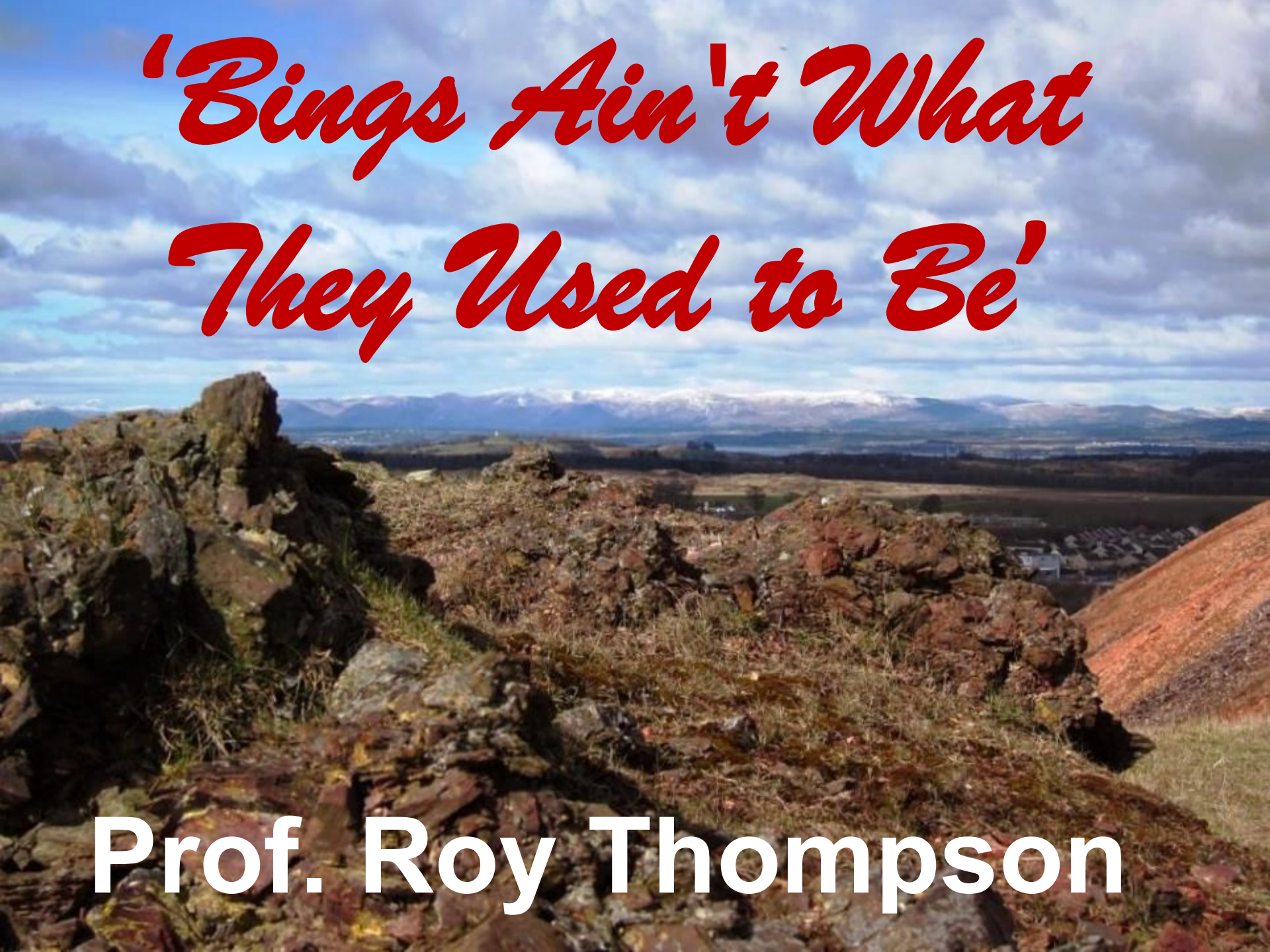
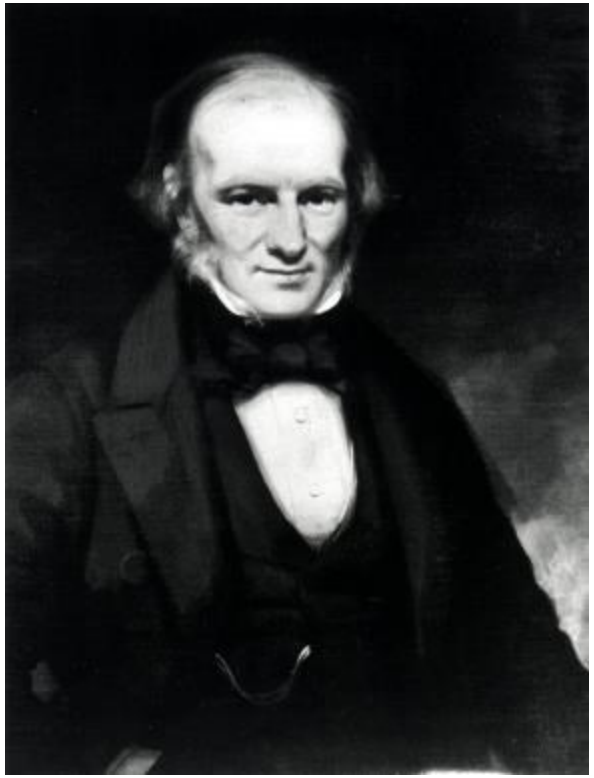

'Bings Ain't What They Used to Be'
Prof. Roy Thompson



James "Paraffin" Young', portrait painted c.1860

Oil paraffin lamp by Young's Paraffin Light & Mineral Oil Company Ltd

Refinery at Pumpherston

James Young (1811-1883)

Timeline of important dates and events in the development of paraffin

1811 – Born in humble circumstances in Glasgow

1847 – Successfully distils paraffin from Derbyshire naphtha

1848 – Sets up a small business refining crude oil

1849 – Found high yields in Boghead 'parrot' coal

1850 – Sets up commercial refinery at Bathgate

1852 – Patents extraction of paraffin from coal and shale

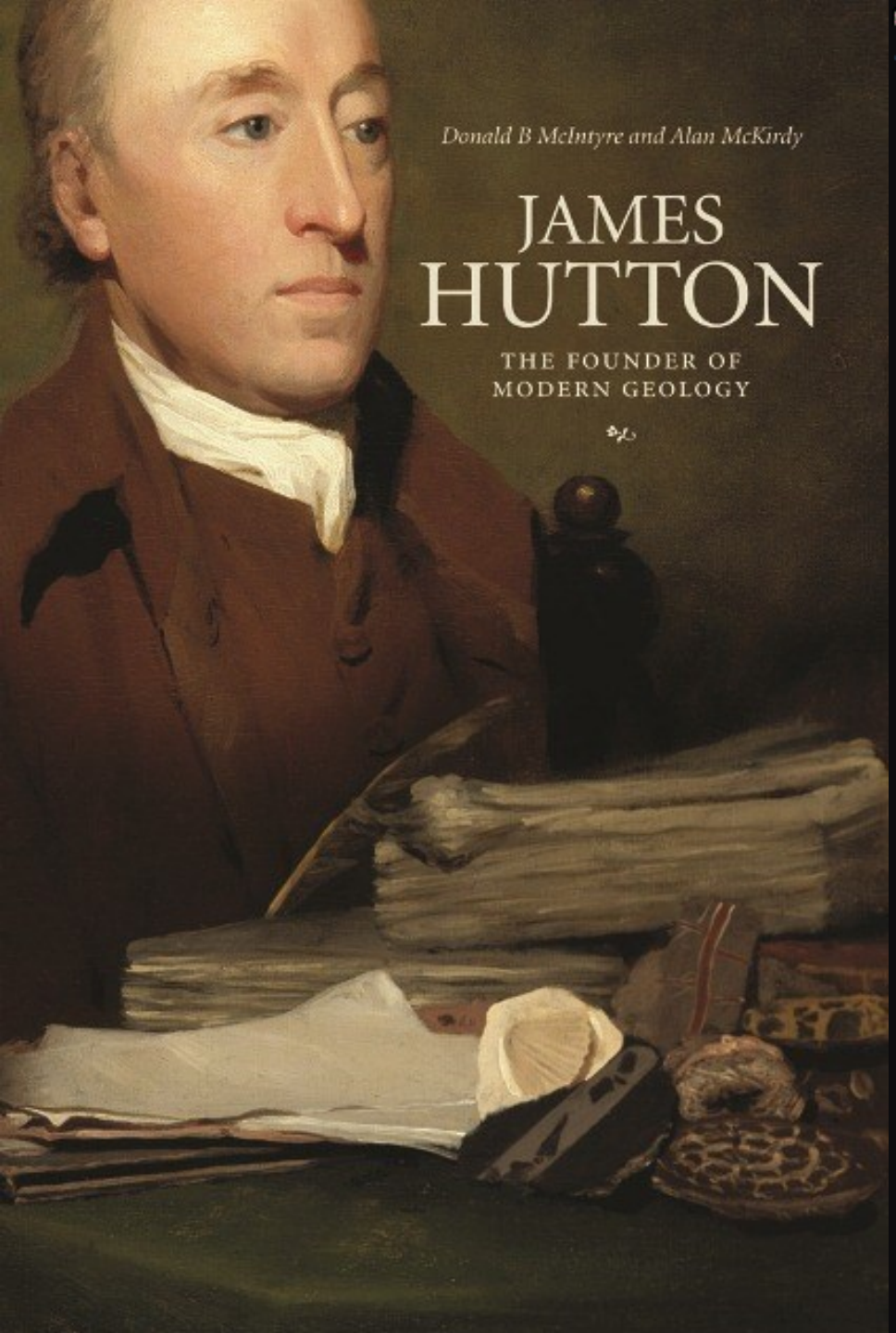
1913 – Peak production (30-40,000 workers)

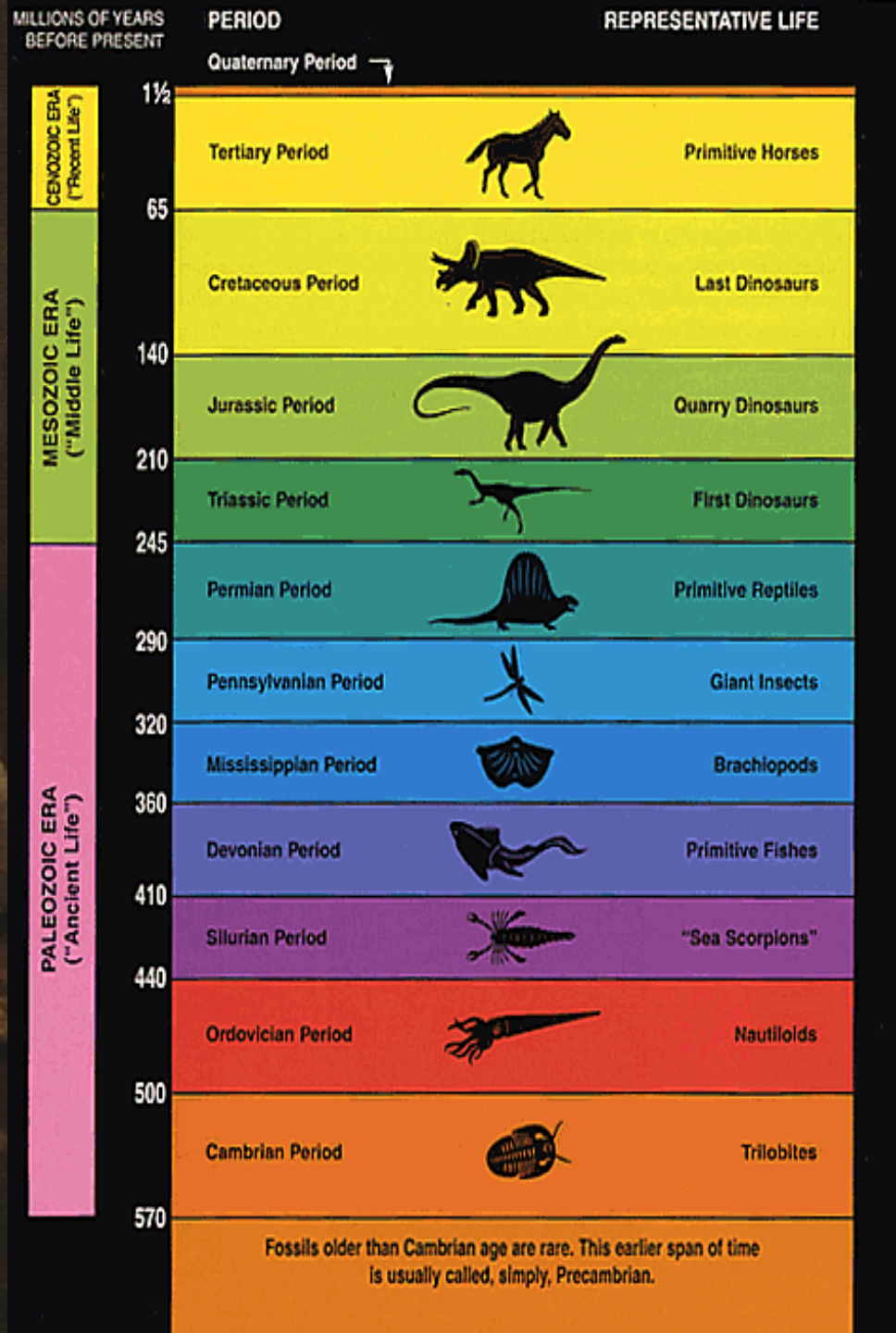
1962 – Last operation closed (Total production 75 million barrels)


Geological history

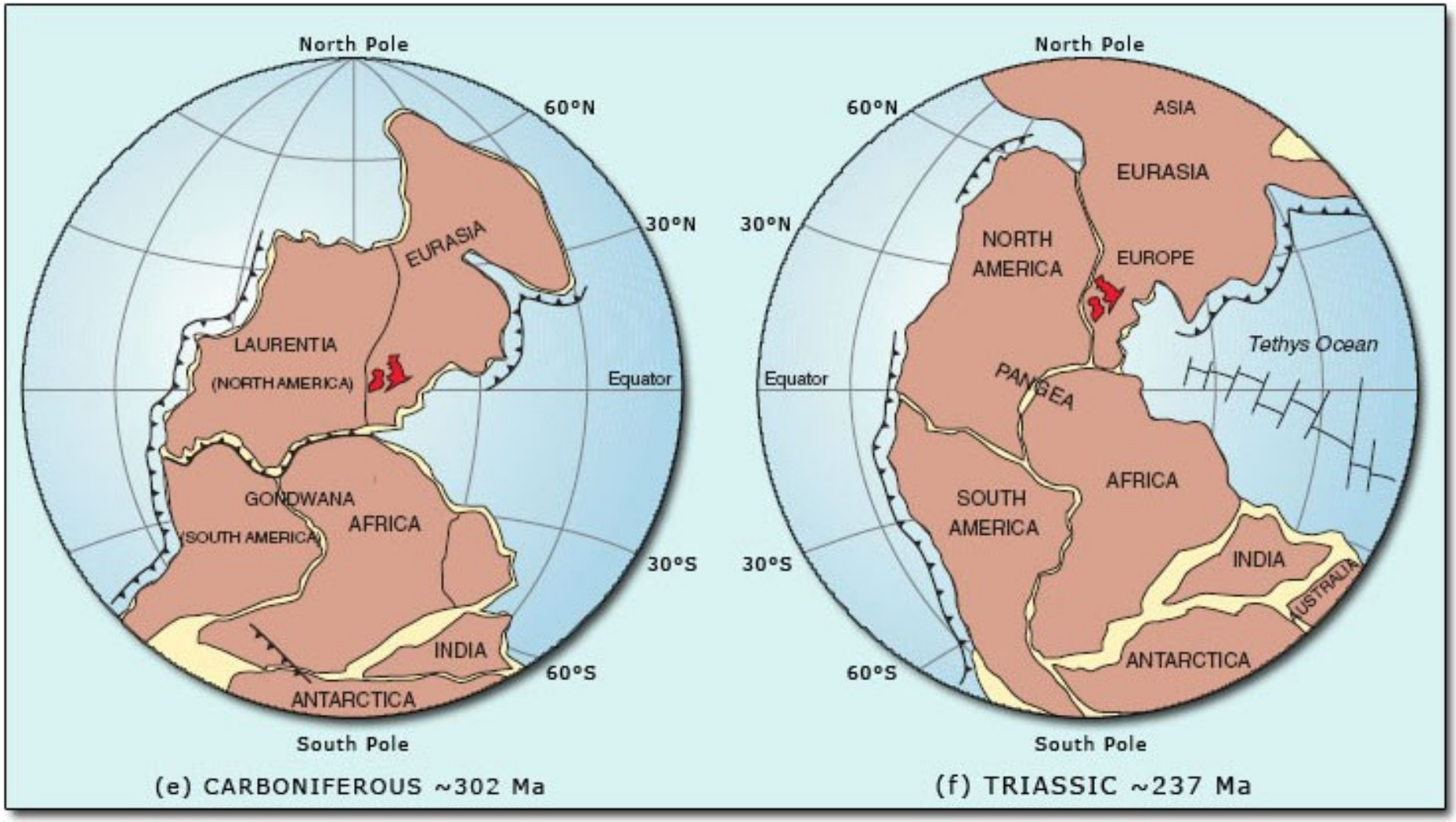
Oil-shales - Kilve beach

Fine-grained sedimentary rocks rich in organic matter

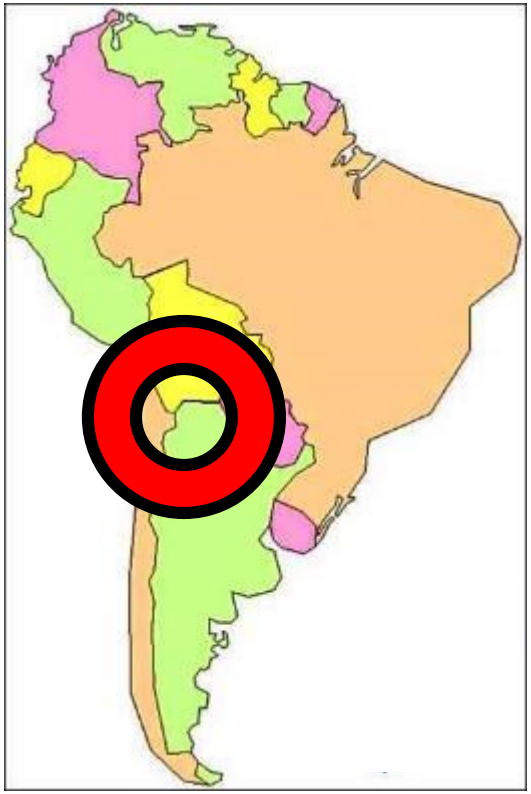

Donald B McIntyre and Alan McKirdy
JAMES
HUTTON
THE FOUNDER OF
MODERN GEOLOGY


MILLIONS OF YEARS BEFORE PRESENT
PERIOD
REPRESENTATIVE LIFE
Quaternary Period
1½
CENOZOIC ERA ("Recent Life")
Tertiary Period
Primitive Horses
65
MESOZOIC ERA ("Middle Life")
Cretaceous Period
Last Dinosaurs
140
Jurassic Period
Quarry Dinosaurs
210
Triassic Period
First Dinosaurs
245
PALEOZOIC ERA ("Ancient Life")
Permian Period
Primitive Reptiles
290
Pennsylvanian Period
Giant Insects
320
Mississippian Period
Brachiopods
360
Devonian Period
Primitive Fishes
410
Silurian Period
"Sea Scorpions"
440
Ordovician Period
Nautiloids
500
Cambrian Period
Trilobites
570
Fossils older than Cambrian age are rare. This earlier span of time is usually called, simply, Precambrian.

The British Isles Through Geological Time: A Northward Drift

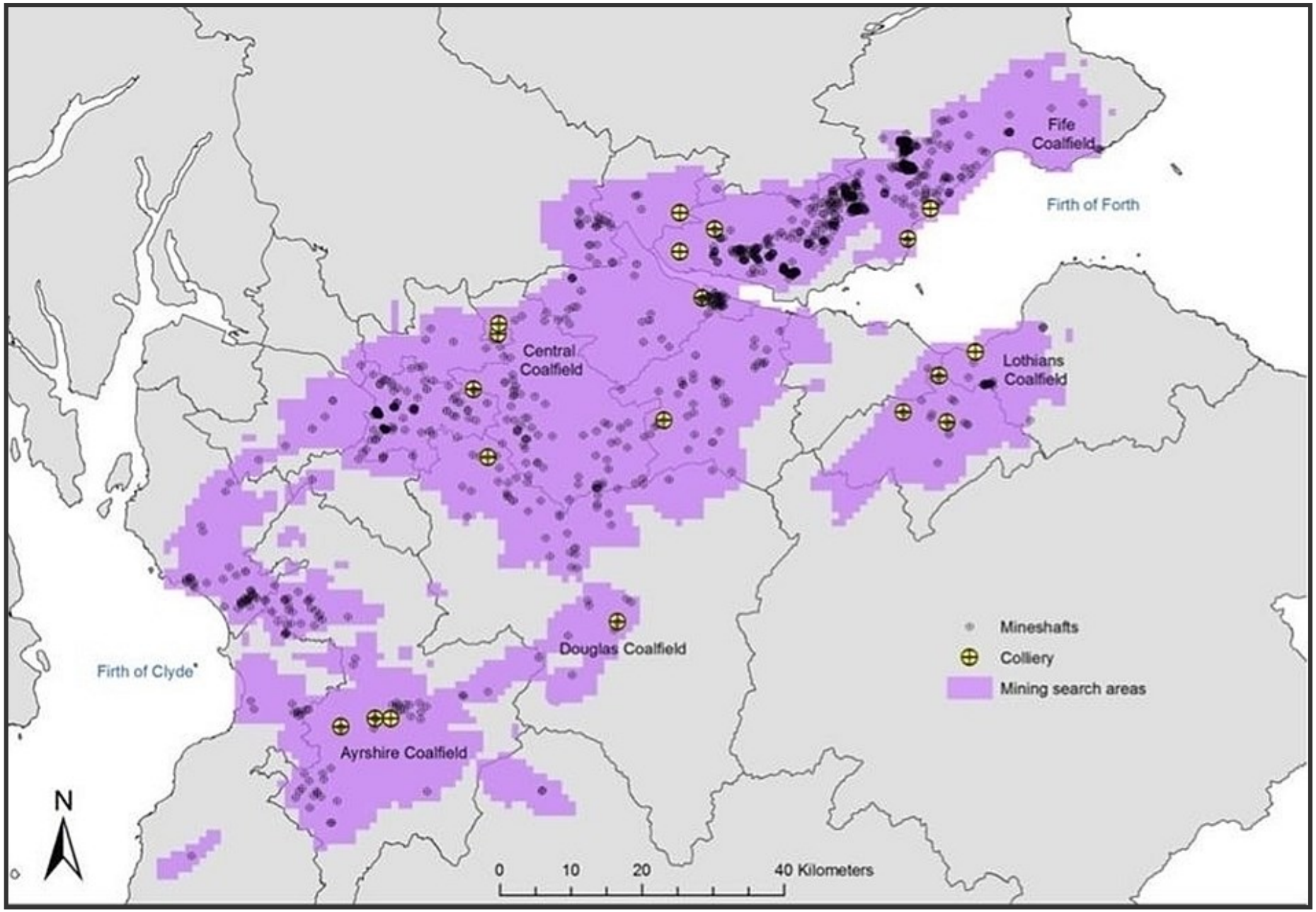


Palaeomagnetic rock collecting in South America Ph.D., 1969



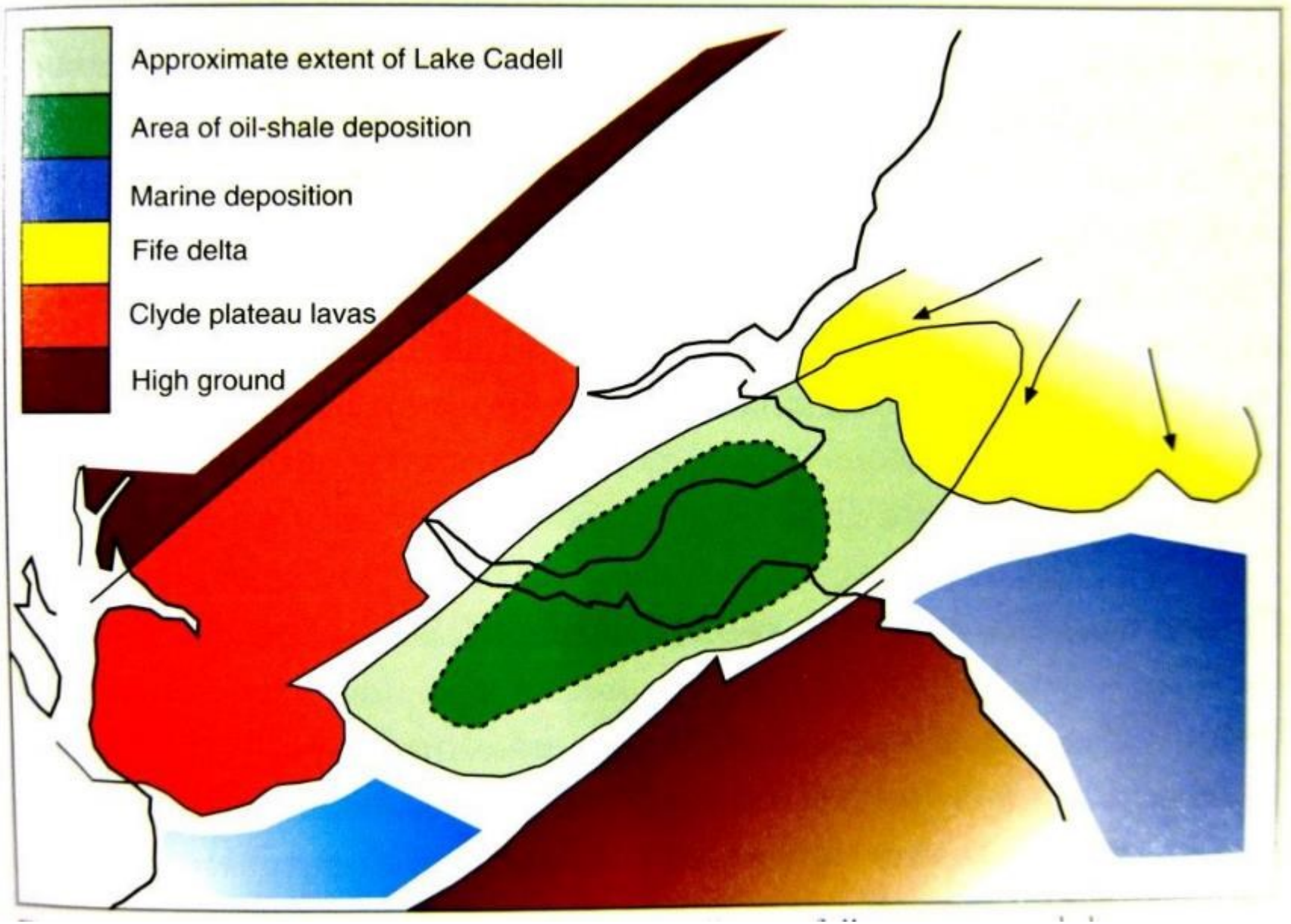
Carboniferous equatorial forest reconstruction

Old coal-mine shafts in the Midland Valley of Scotland



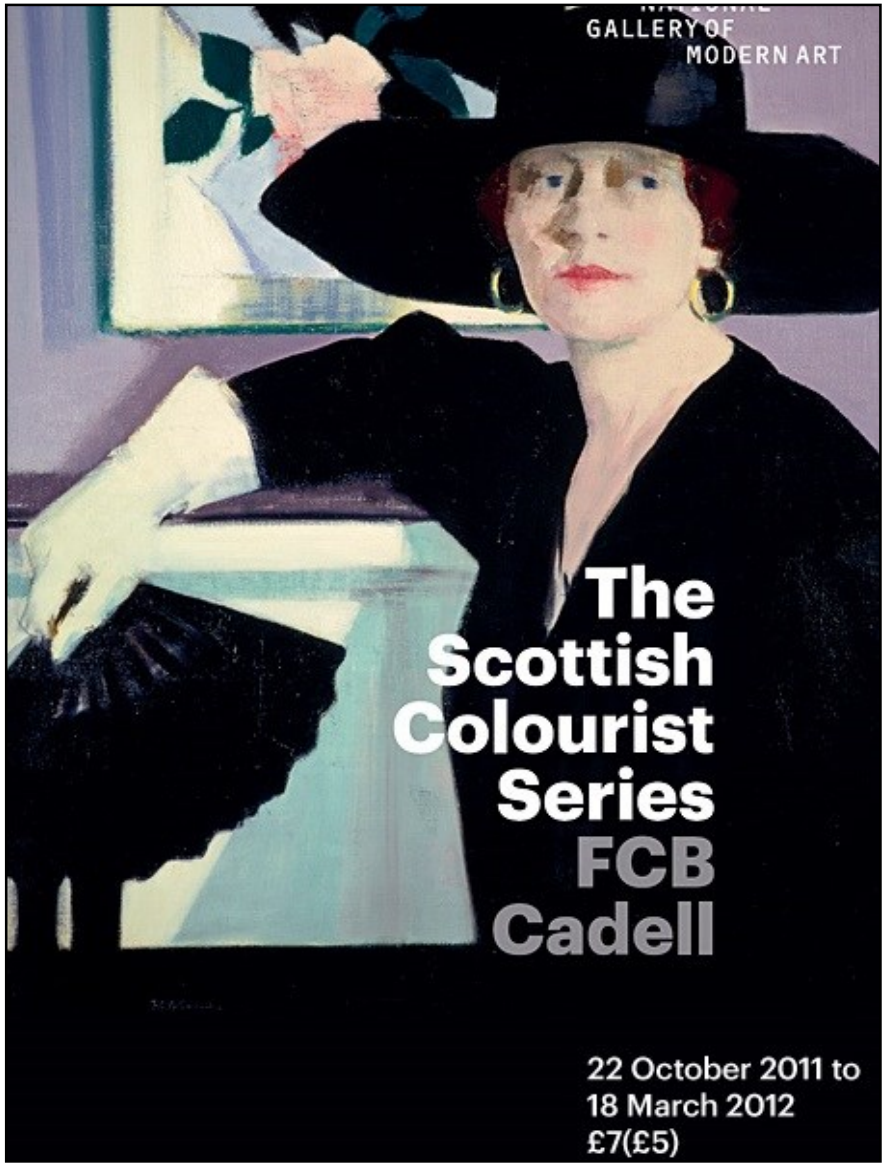
Water hyacinth infestation

Lake Cadell

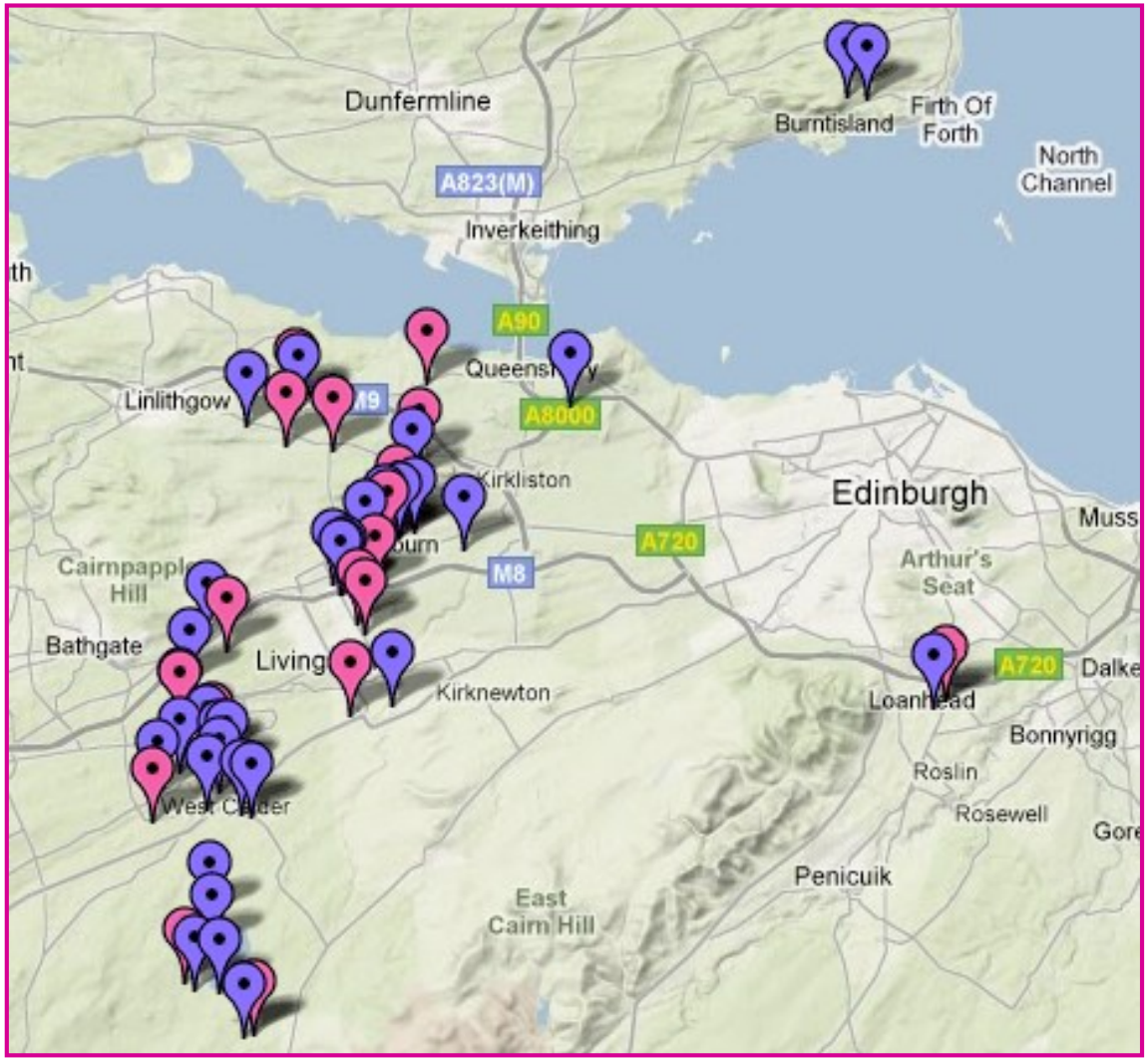

Approximate extent of Lake Cadell
Area of oil-shale deposition
Marine deposition
Fife delta
Clyde plateau lavas
High ground

Henry Moubray Cadell (1925) mapped the Lothian lake

Portrait of a Lady in Black, Francis Campbell Boileau Cadell



Lothian ‘ghost’ oil-shale villages



Pink markers villages that still exist.

Purple markers 'ghost' villages (completely demolished).

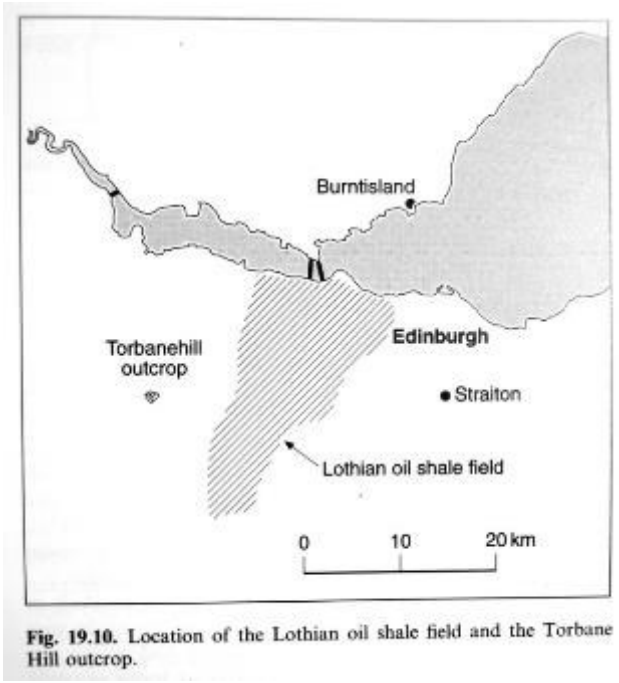
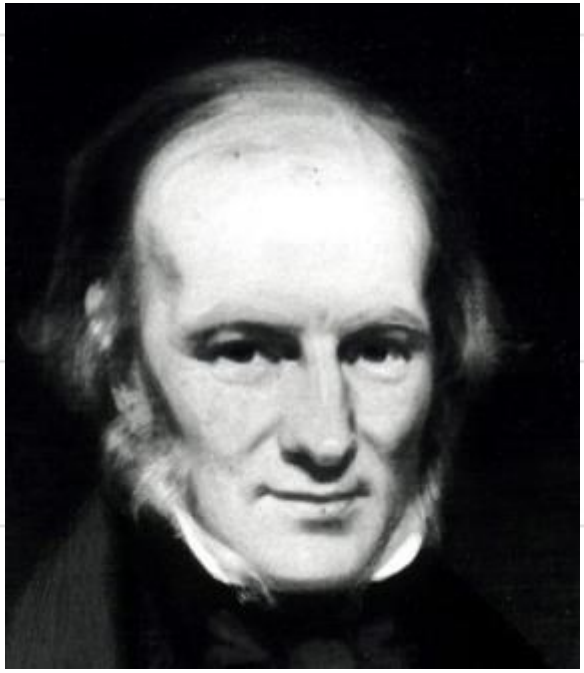


Fig. 19.10. Location of the Lothian oil shale field and the Torbane Hill outcrop.


History of the
shale industry

Global Oil Production



1850

Peak oil?
2015

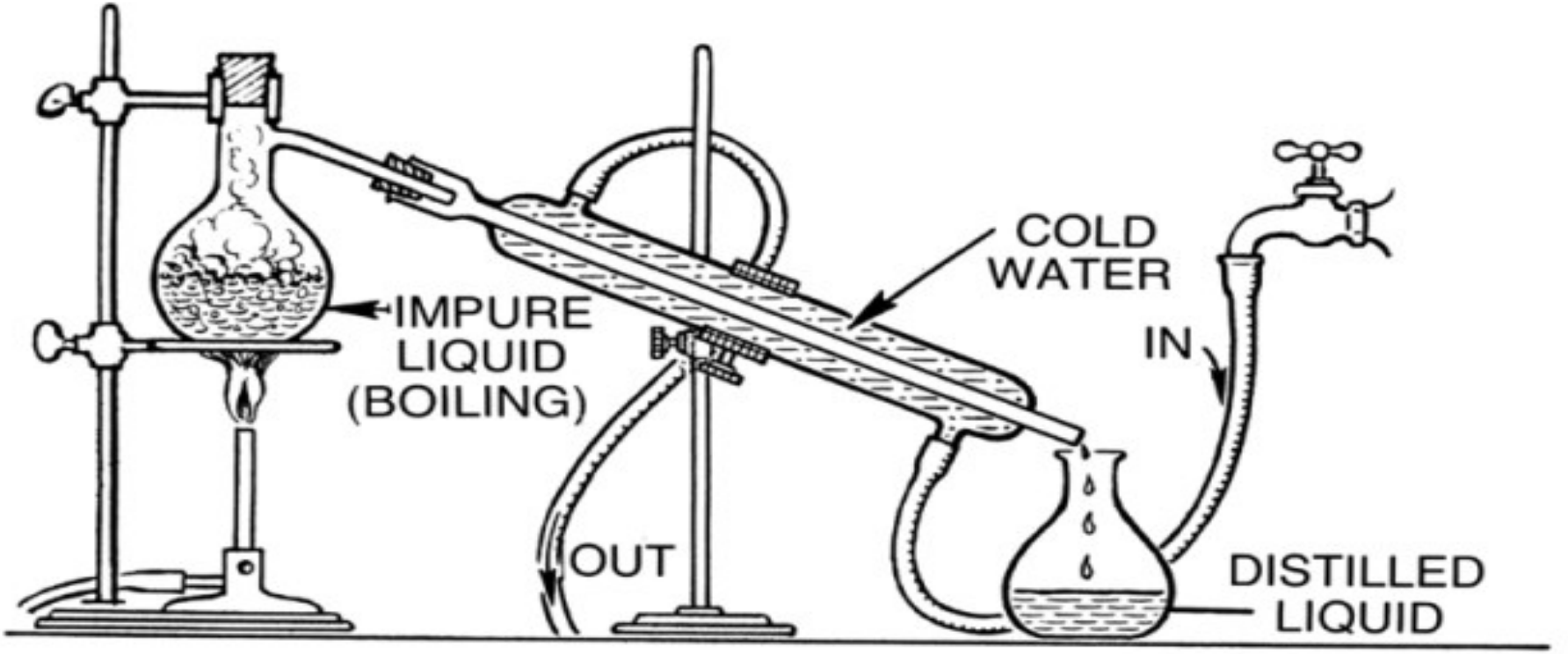
30
25
20
15
10
0

1870 1880 1890 1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010 2020 2030 2040 2050 2060 2070 2080 2090 2100

Conventional Deep Heavy

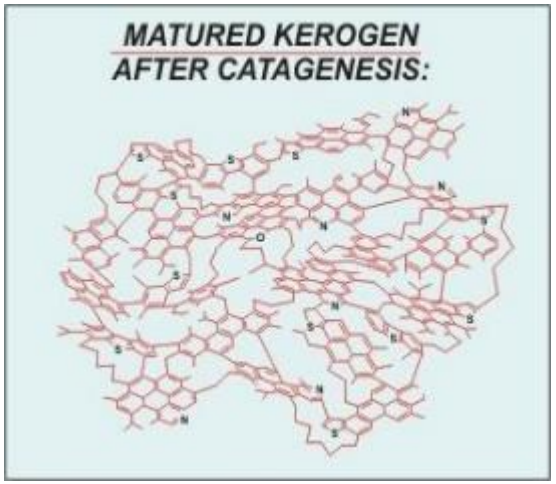
Oil distillation and cracking

“Cracking" - breaking down large molecules of heavy oil into shorter, more useful molecules

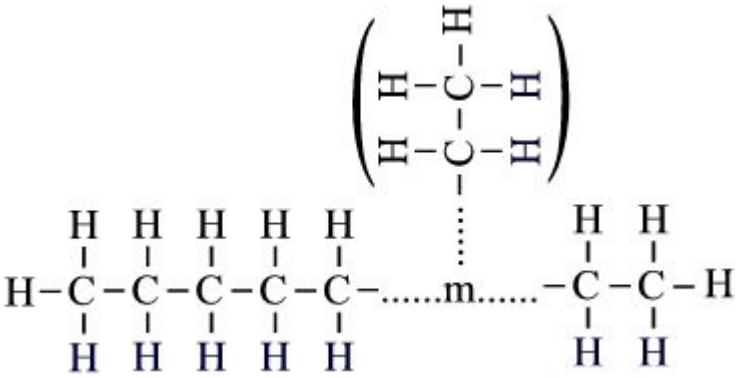


Cracking (slow distillation) of oil-shale generated the high demand products paraffin, naphtha, and ammonium sulphate. All returned high profits.

$C_{1000}\ H_{850}\ N_{13}\ S_2\ O_{188}$



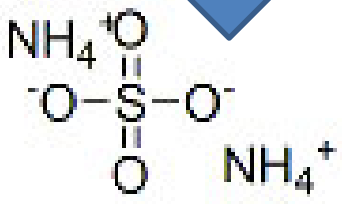
200 °C



Paraffin (Lighting)

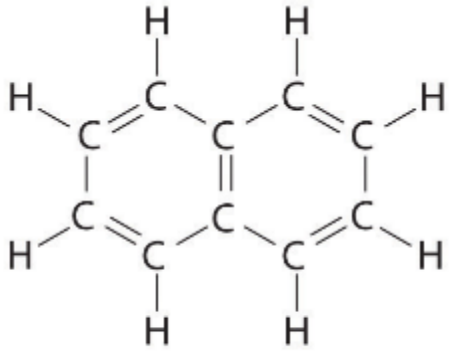
Heavy ammonia liquid

50 °C



Ammonium Sulphate (Fertilizer)

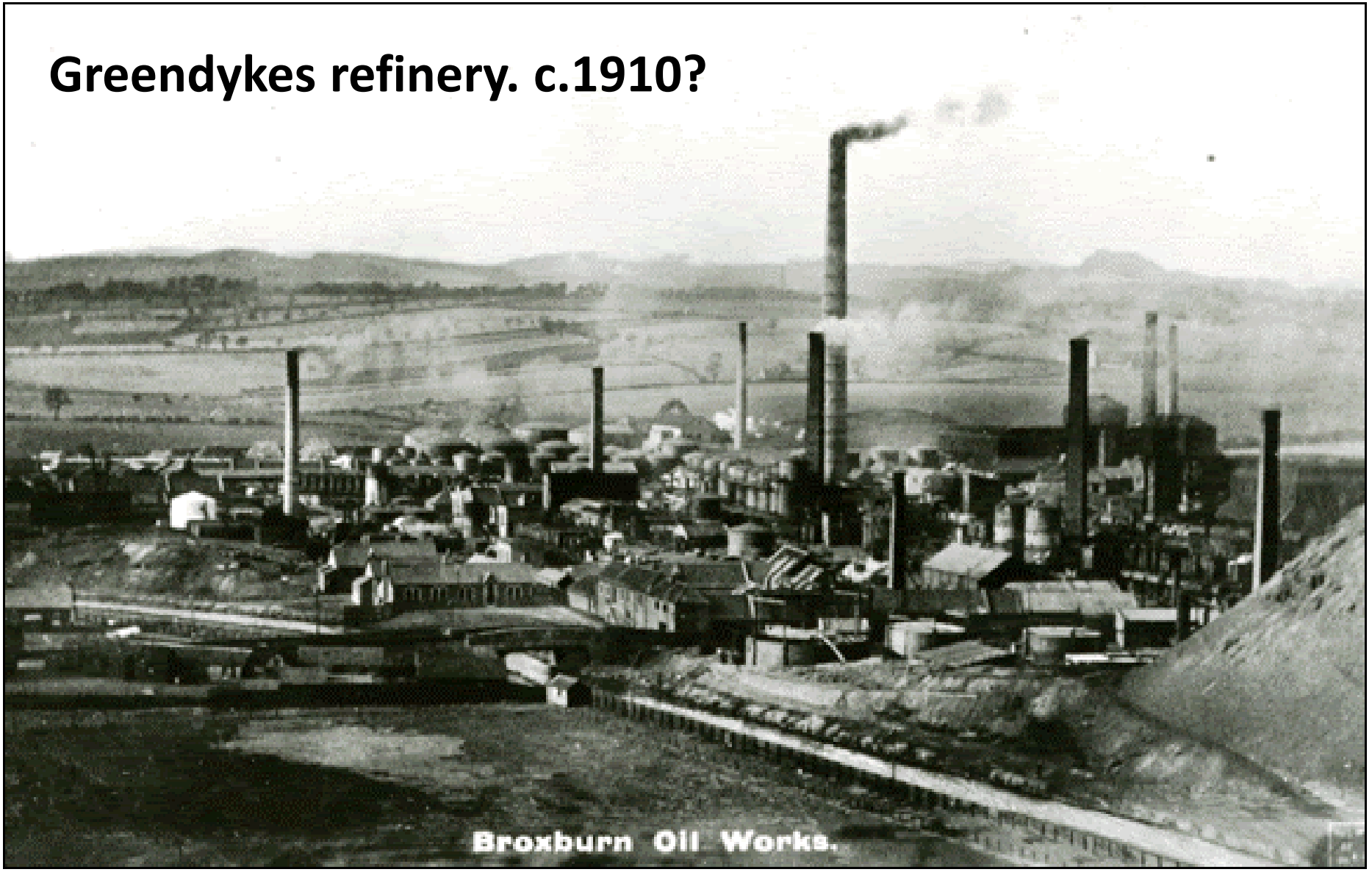
100 °C



Naphthalene (Solvent)

Young's early retorts may have looked like these from Joadja, an historic shale oil mining site in Australia (1878-1911)

Greendykes refinery. c.1910?



By 1865 about 120 crude-oil works were serving three refineries. The central process - retorting - was a technology in which Scotland led the world.

The former office building (1890s?) is the only surviving part of the Broxburn Oil Works complex

BP located its refinery near Grangemouth, due to its flat ground, its transport links, but most importantly the rich vein of labour skilled in shale-oil refining.


Social history

Category B-Listed Limefield House, 2014

The vanished village of Oakbank, c.1910

Miners' rows

Parlour/kitchen, bedroom, plus scullery.

Addiewell girls' class with three teachers, 1890s

Children were educated from age 5 to age 13. Then they left school, and went straight into a job. The boys almost certainly went into the pits or the oil works. The girls probably spent a few years in domestic service, before getting married.


Broxburn Oil
euphonium band

QUOITING: required a great deal of skill and strength as it involved throwing heavy iron rings (weighing up to 12 pounds) at a pin in the ground a distance of 21 yards away.

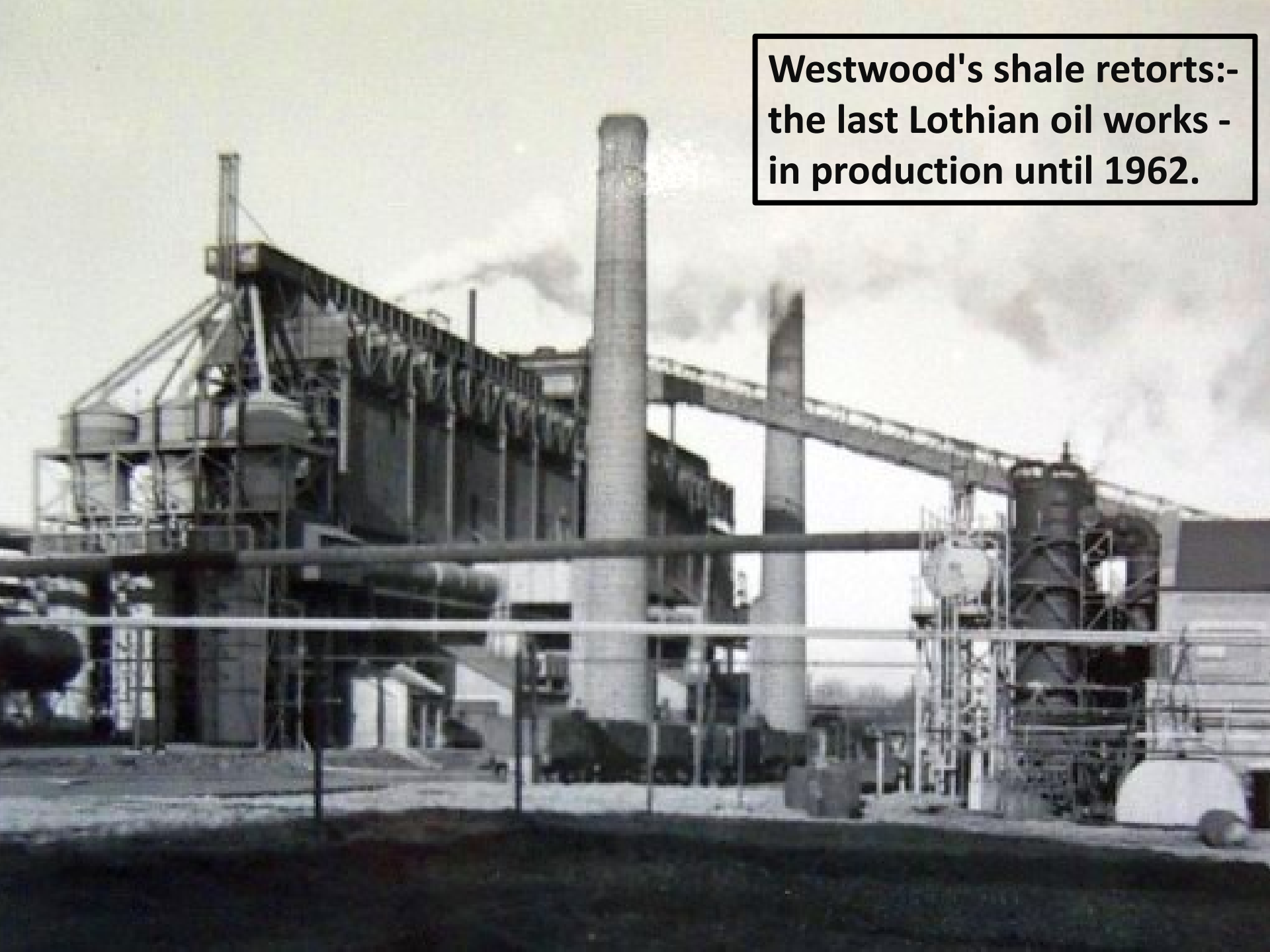
Stoop and room (pillar and stall) is an old method of mining where the material is extracted leaving pillars to support the roof.


Facemen breaking up large blocks of shale after charges have detonated

Newliston mine rescue team

In comparison to coal mines, shale seams were generally much higher. Their spacious nature meant quite sizeable horses could be used underground, including large Clydesdales.

The shale from the pits was drawn to the retorts at Addiewell by steam locomotives which were better known as “pugs”.

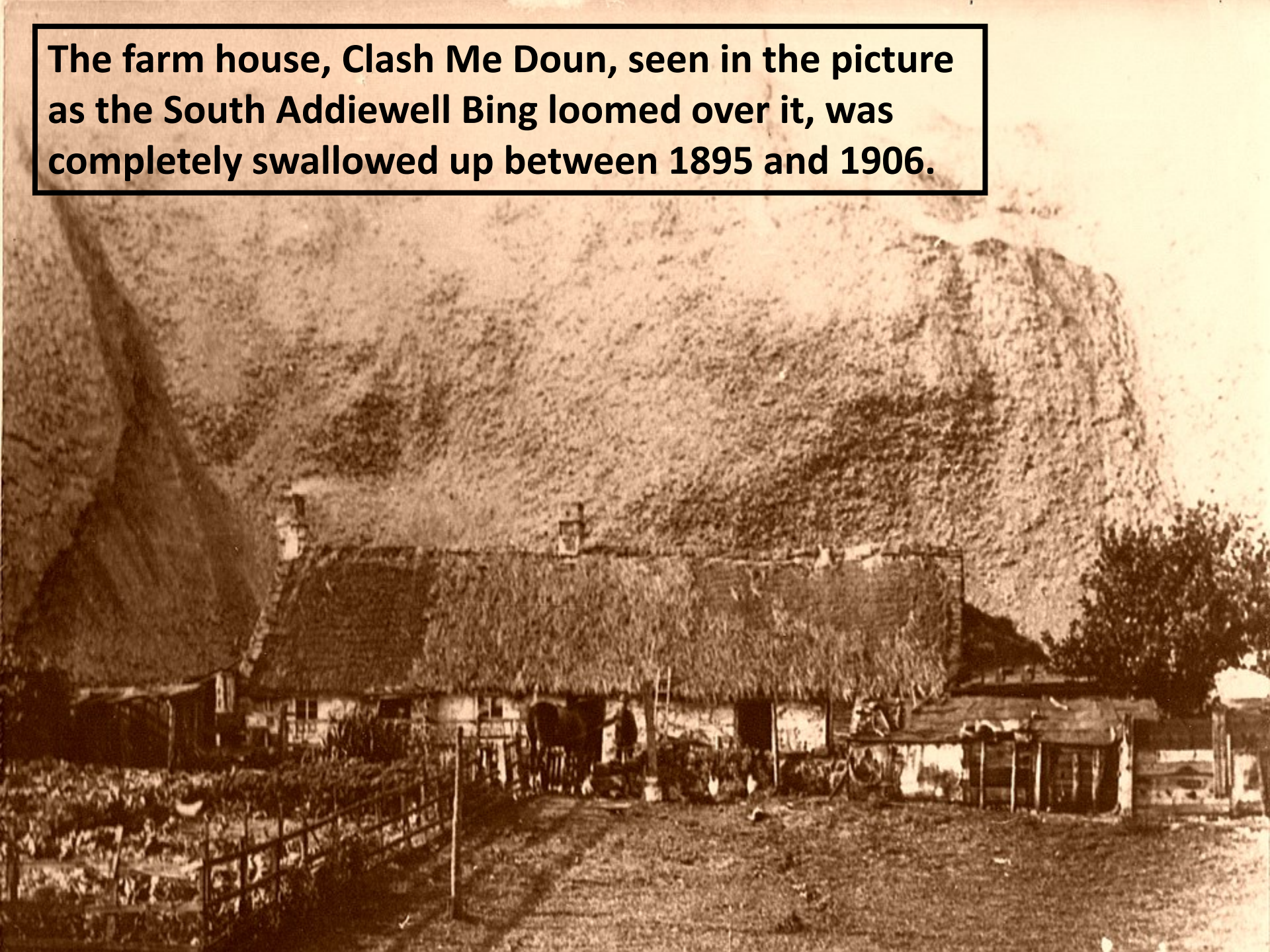

Westwood's shale retorts:-
the last Lothian oil works -
in production until 1962.

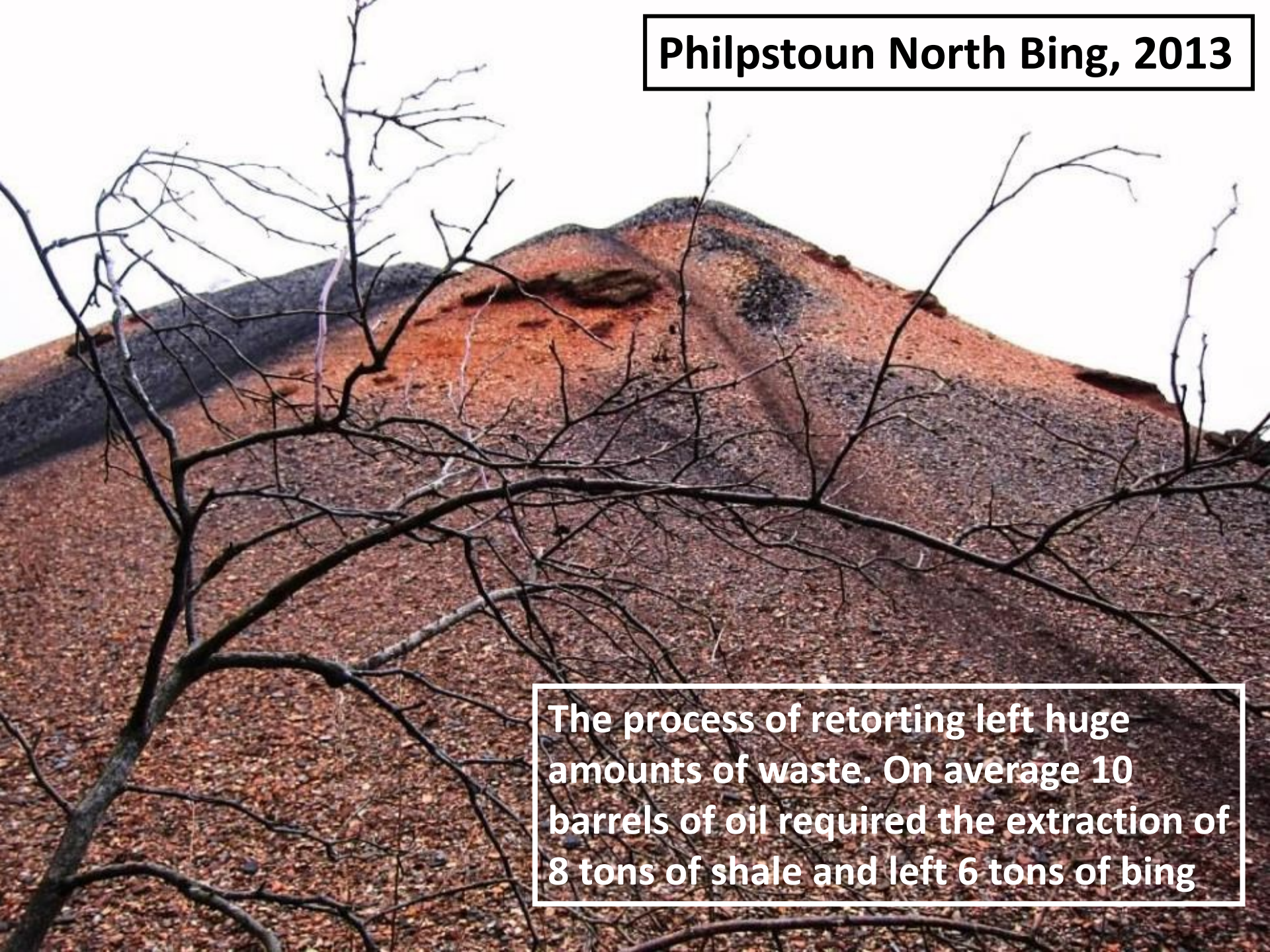
Retort Drawers, or Gulletmen, at Niddry Castle Crude Oil Works, Winchburgh

After the great famine of 1846-7, emigration from Ireland became a flood. The Catholic Irish settled wherever muscle and strength was in demand. They were not given the best jobs.

Tip man, circa 1929

The job of a tip man was a dangerous one: as well as the risk of being badly burned from the roasting hot shale, there was the risk of falling or being pulled from the top of the bing by the heavy hutches of shale.


The farm house, Clash Me Doun, seen in the picture as the South Addiewell Bing loomed over it, was completely swallowed up between 1895 and 1906.



Philpstoun North Bing, 2013

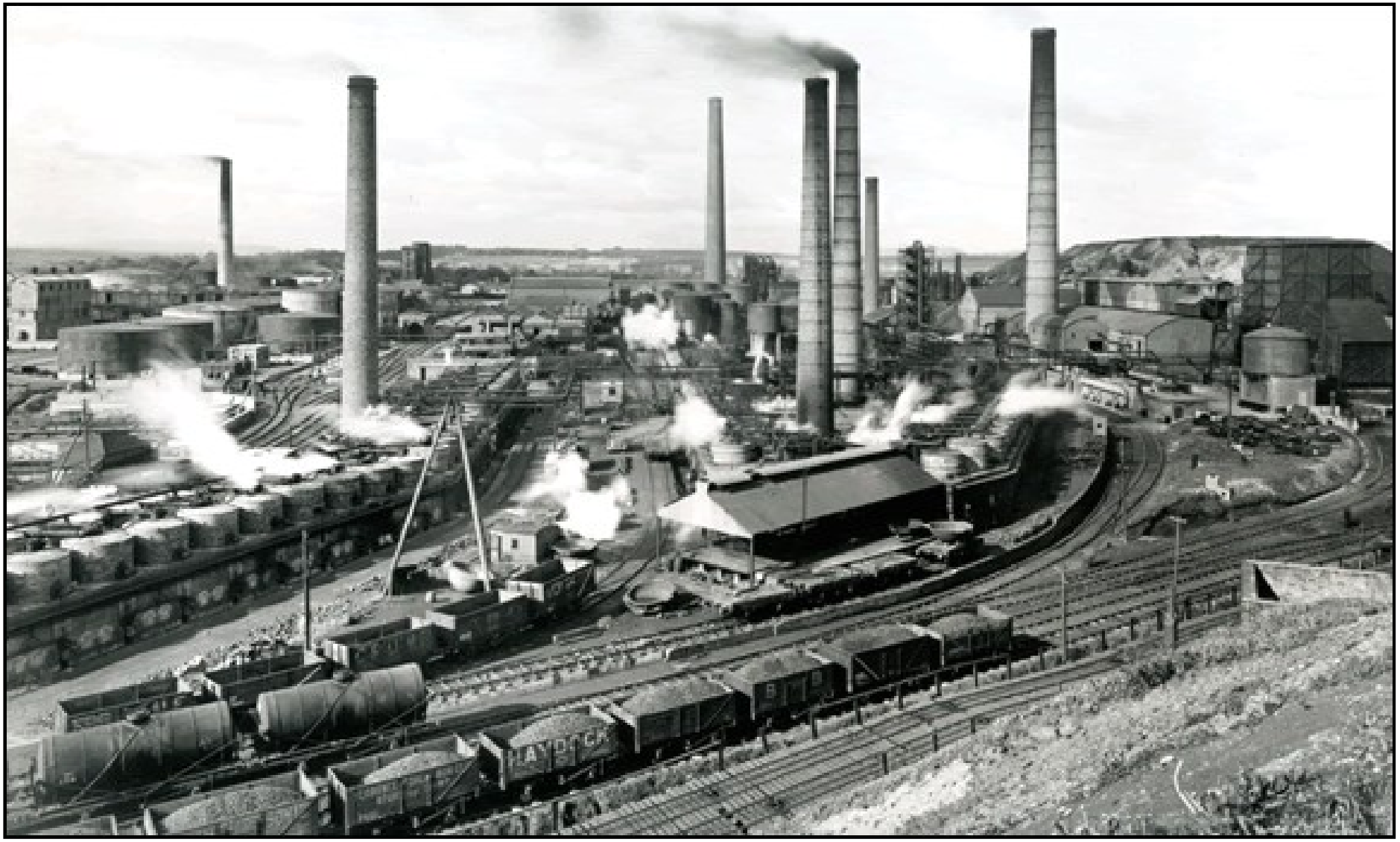
The process of retorting left huge amounts of waste. On average 10 barrels of oil required the extraction of 8 tons of shale and left 6 tons of bing

Rail tankers transporting crude oil

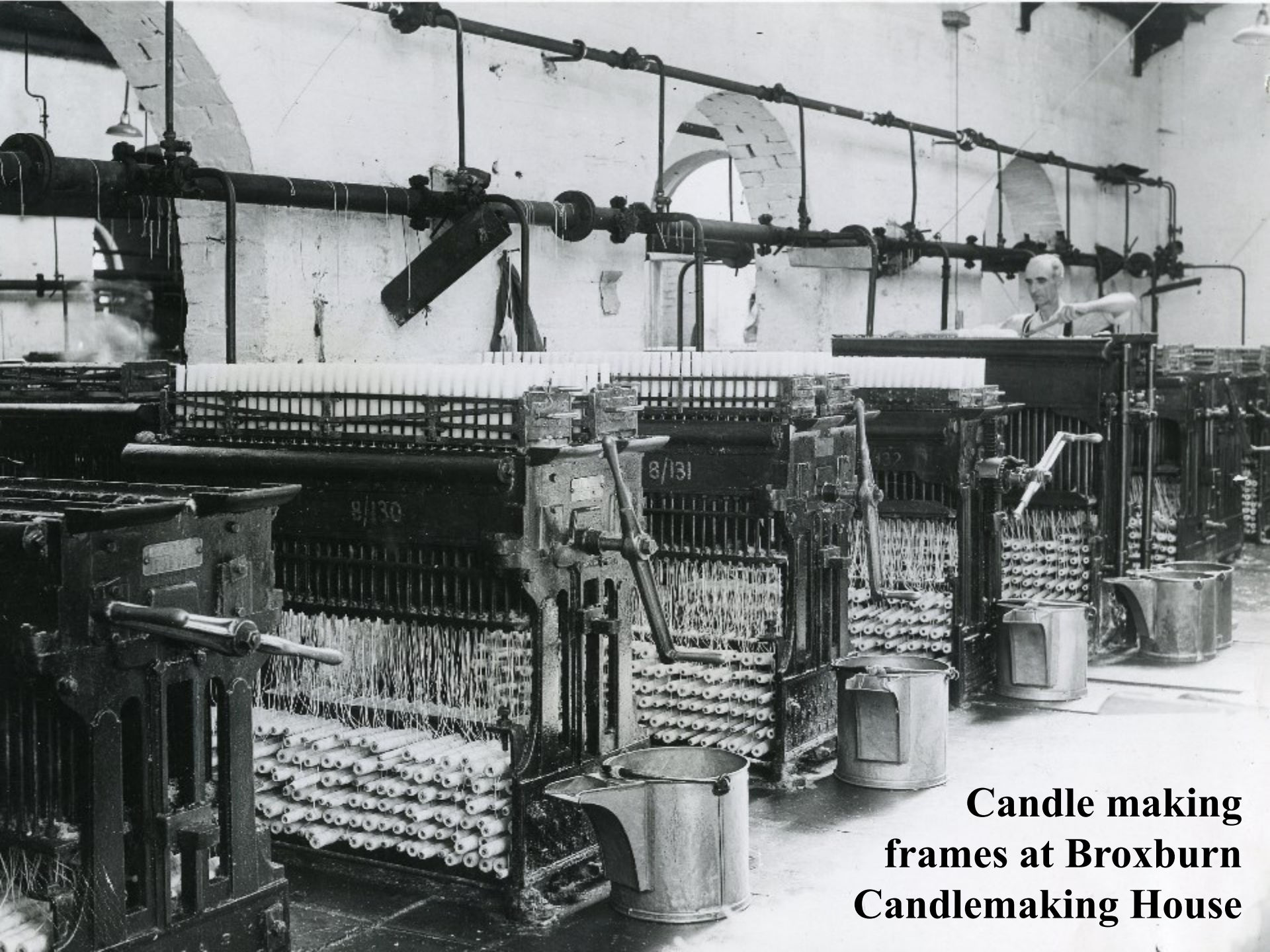
Oakbank Oil Works.

T. G. W. Copyright.

Pumpherston Refinery - Looking west from the bing c.1935



Wicking and packing paraffin wax night lights



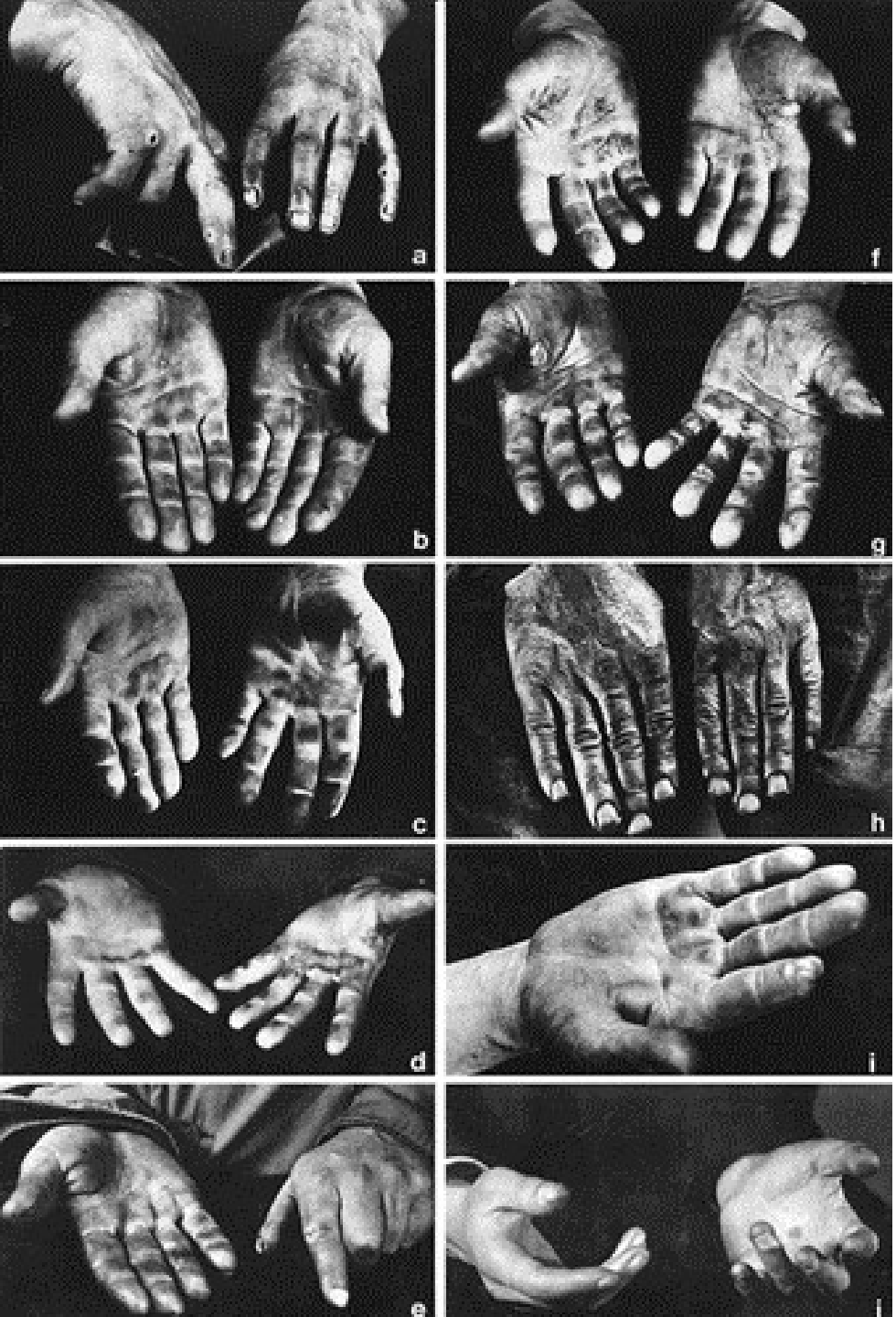
Candle making frames at Broxburn Candlemaking House

Candle making today: Mr Cameron attempts to make a candle by pouring hot wax into a mould

Scottish oil shale distillates, 1905 vintage

Top row:- Crude Shale Oil, Crude Distillate, Blue Oil, Heavy, Paraffin, Naptha, Burning Oil.

Bottom row:- Scrubber Naptha, Sulphate of Ammonia, Ammoniacal Liquor, Motor Spirit, Lighthouse Oil, Power Oil, Cleaning Spirit.



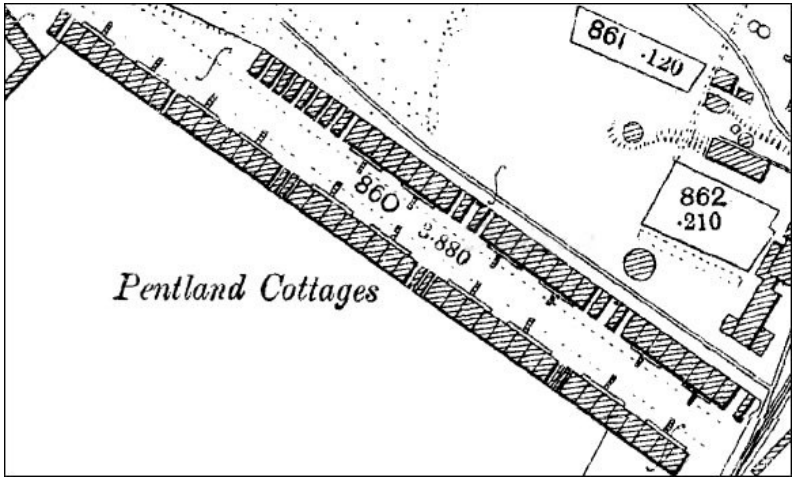
Work-induced anatomical lesions

(a) Tanner's ulcers
(b) Blacksmith
(c) Sawmill worker
(d) Stonemason
(e) Mason
(f) Marble Mason
(g) Chemical factory worker
(h) Paraffin refinery worker
(i) Printer
(j) Violinist


Heritage:
From ugly blot on the landscape to cultural and biological resource


DANGER
KEEP OUT

Midlothian: apart from the Straiton cottages, little now remains.




Niddry Bing blaes used for road foundations. 3,500 new homes (£1bn) to be built within the old bing.

visit west lothian


The
Beautiful Bings
OF BROXBURN
CALENDAR 2013

Group of wildlife recorders on Stoneyburn Bing

Oakbank Bing: an extensive, well-planned restoration project with considerate planting. 'Native' replanting unfortunately includes beech with shading problems for ground vegetation and future tree regeneration


Natural regeneration: –
Pioneer species-poor grass-herb community - Roman Camp


Summer flower
meadow, 6/6/13
Five Sisters Bing


Pet cemetery on the open, leached, heathland summit plateau of East Whitburn Bing


Stark, enigmatic birch woodland on Albyn Bing


Birch/willow/elder/hawthorn scrub on Broxburn Bing: colonisation by plants and animals is wholly natural

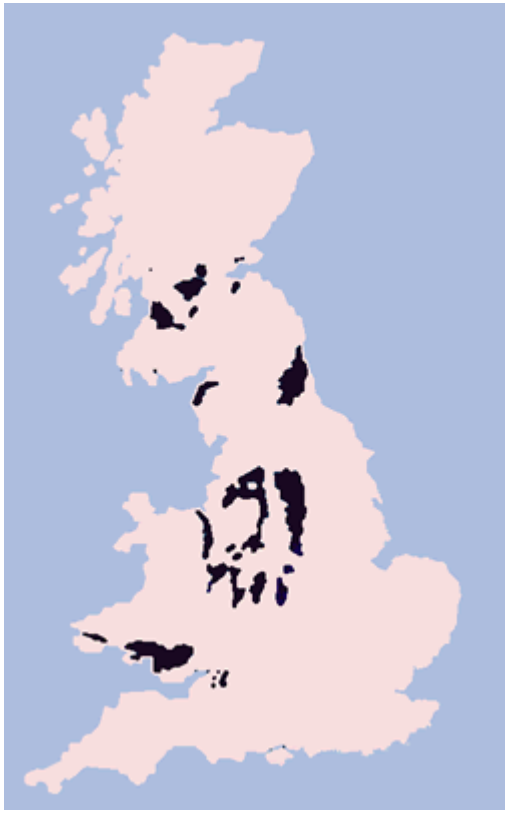

2015: Two Lothian bings
(Broxburn & Five-Sisters)
are today legally
protected as Scheduled
Historic Monuments

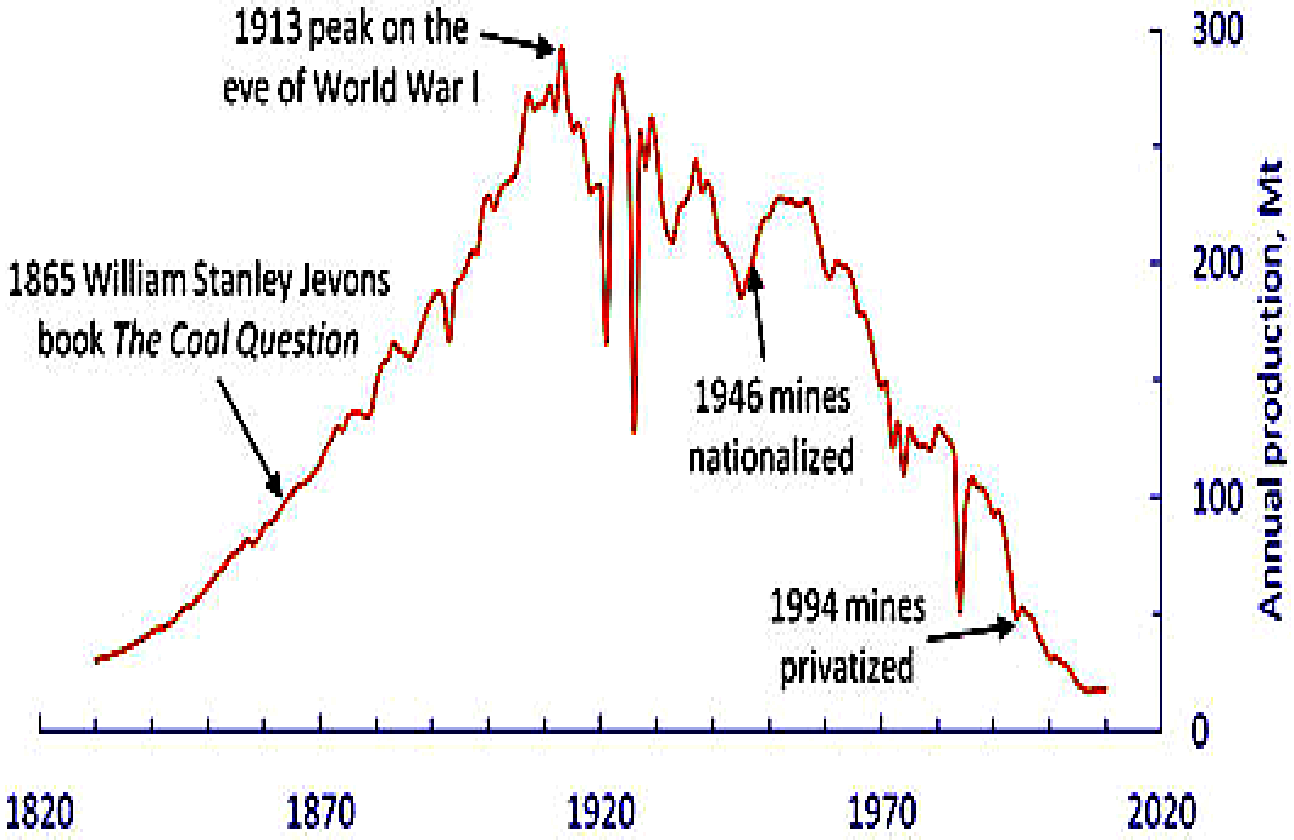

The Future…

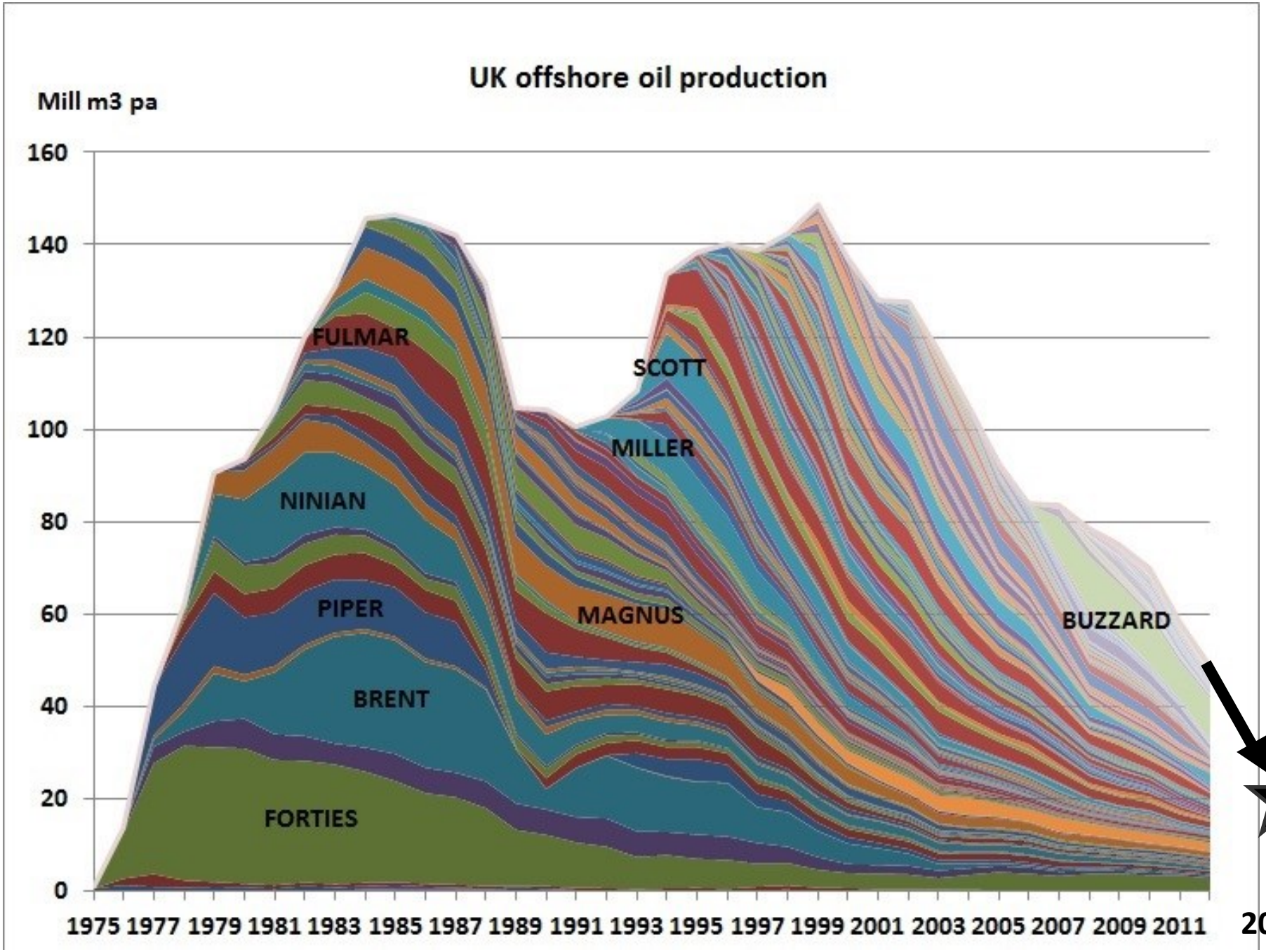

NO FRACKING IN THE UK
STOP
RACKING
NOW
DON'T
FRACK
NEW YORK
CREDO
Ban Fracking Now
www.foodandwaterwatch.org
food&waterwatch


North Sea oil: stormy waters ahead?

UK coal production (1820-2010)



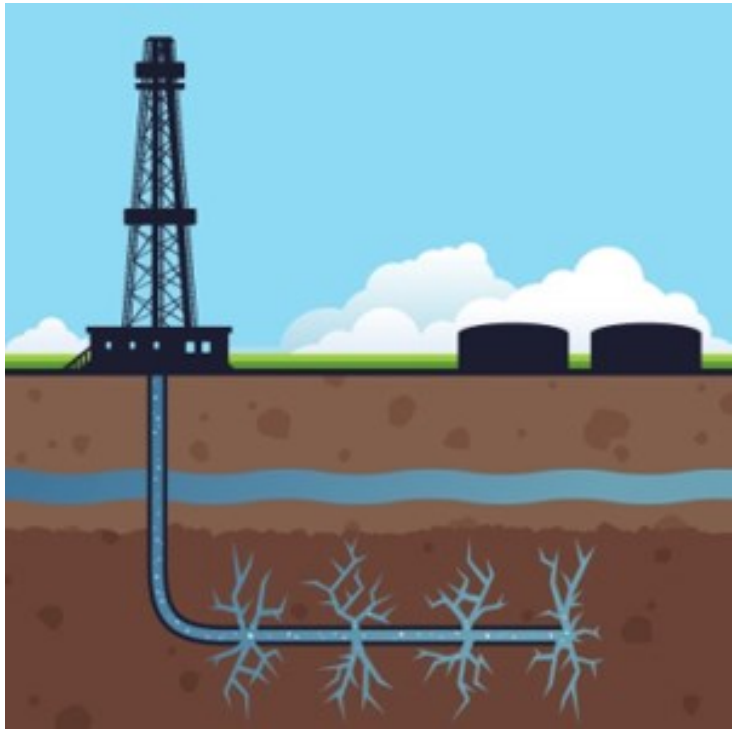



UK offshore oil production
Mill m3 pa
160
140
120
100
80
60
40
20
0
FULMAR
SCOTT
MILLER
NINIAN
PIPER
MAGNUS
BUZZARD
BRENT
FORTIES
1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011
2015

George P. Mitchell, the father of fracking

Billionaire Texas oilman, developer and philanthropist

Fracking operations near a farm over the Marcellus shale formation in Pennsylvania



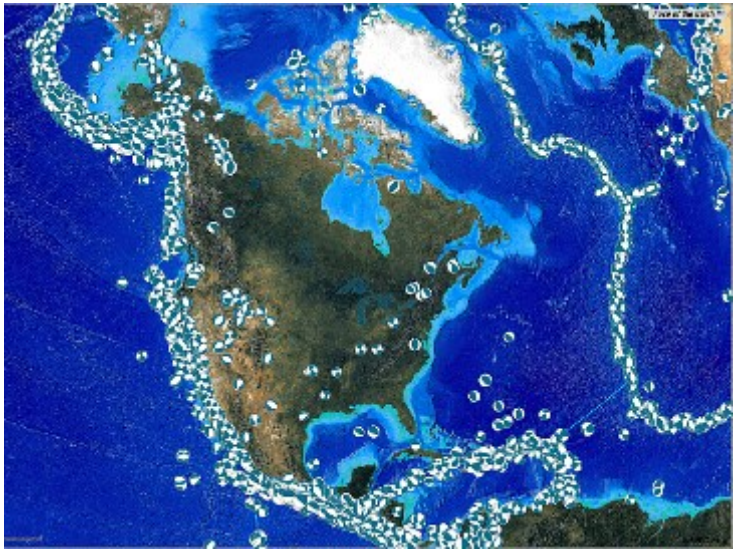
Horizontal drilling – a key process – laterals can extend over 10,000 feet

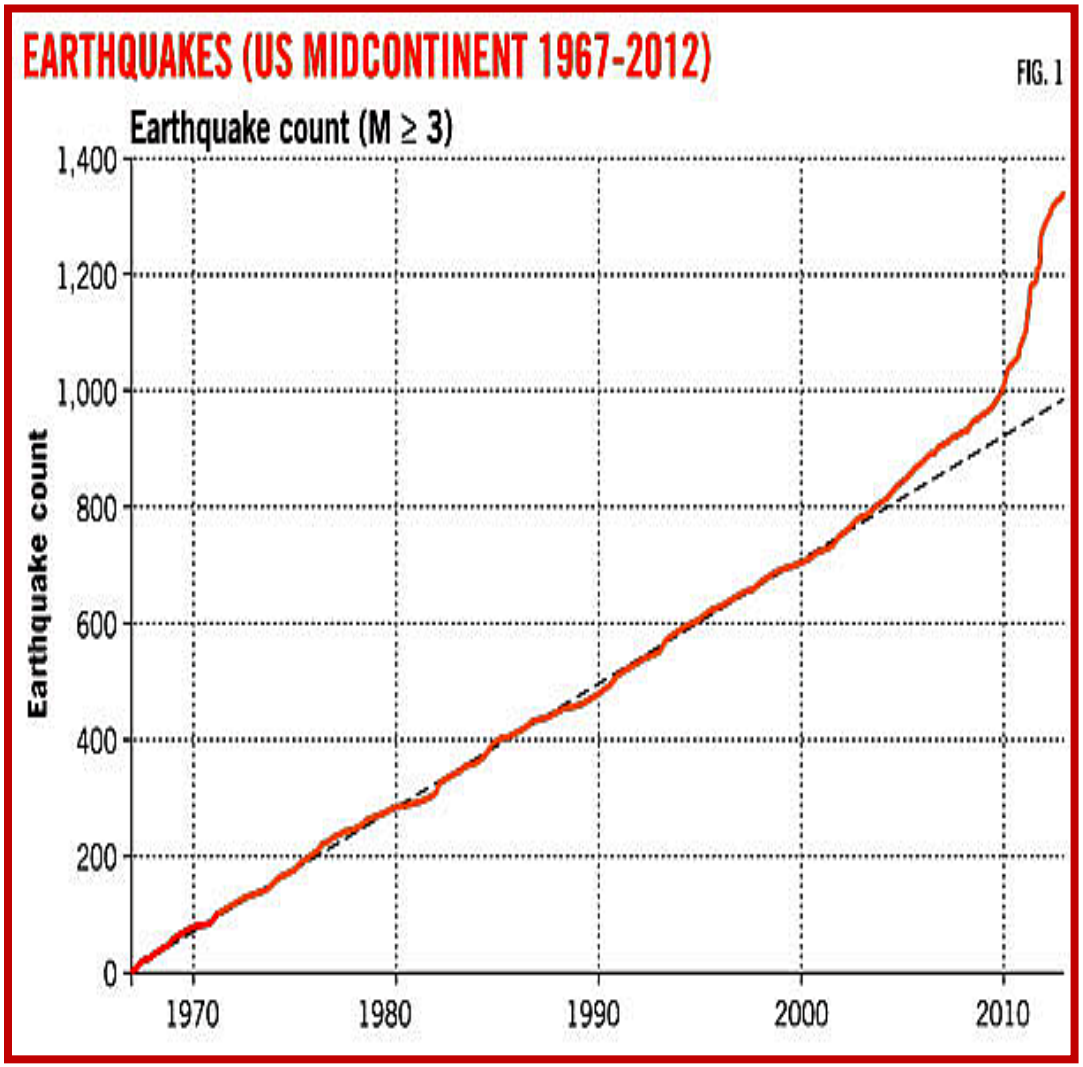
1 to 5 million gallons of water, mixed with sand and chemicals, are required for fracking each well

Fracking wastewater spill in Dakota leaks 3 million gallons into river


Hydraulic fracturing in Bradford Co. PA.
Water from Carol French's well
Fracking
led to
$4.1M
settlement

Human induced earthquakes

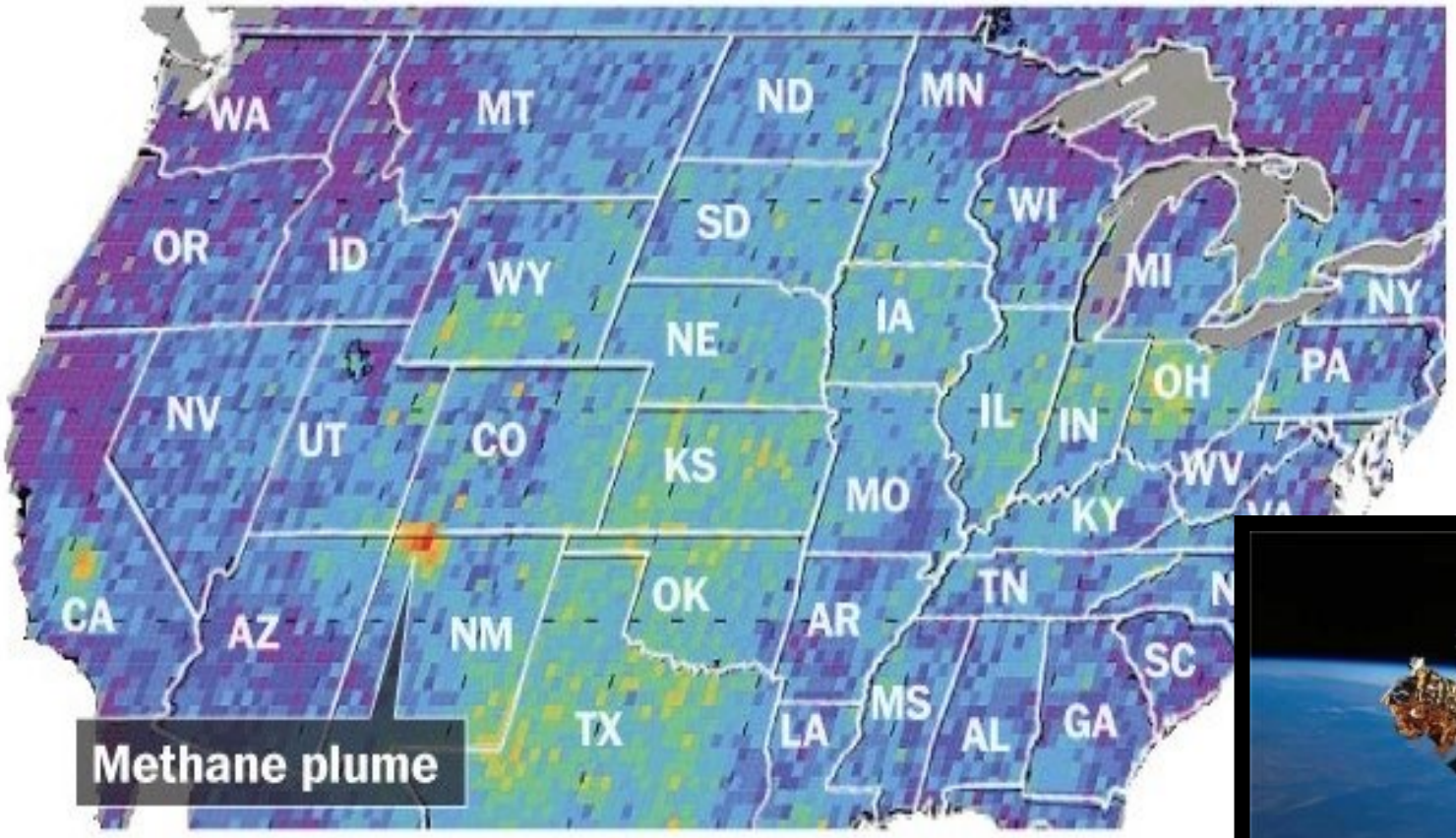




Fracking pit for contaminated (carcinogenic) wastewater

Methane plume in N.M.

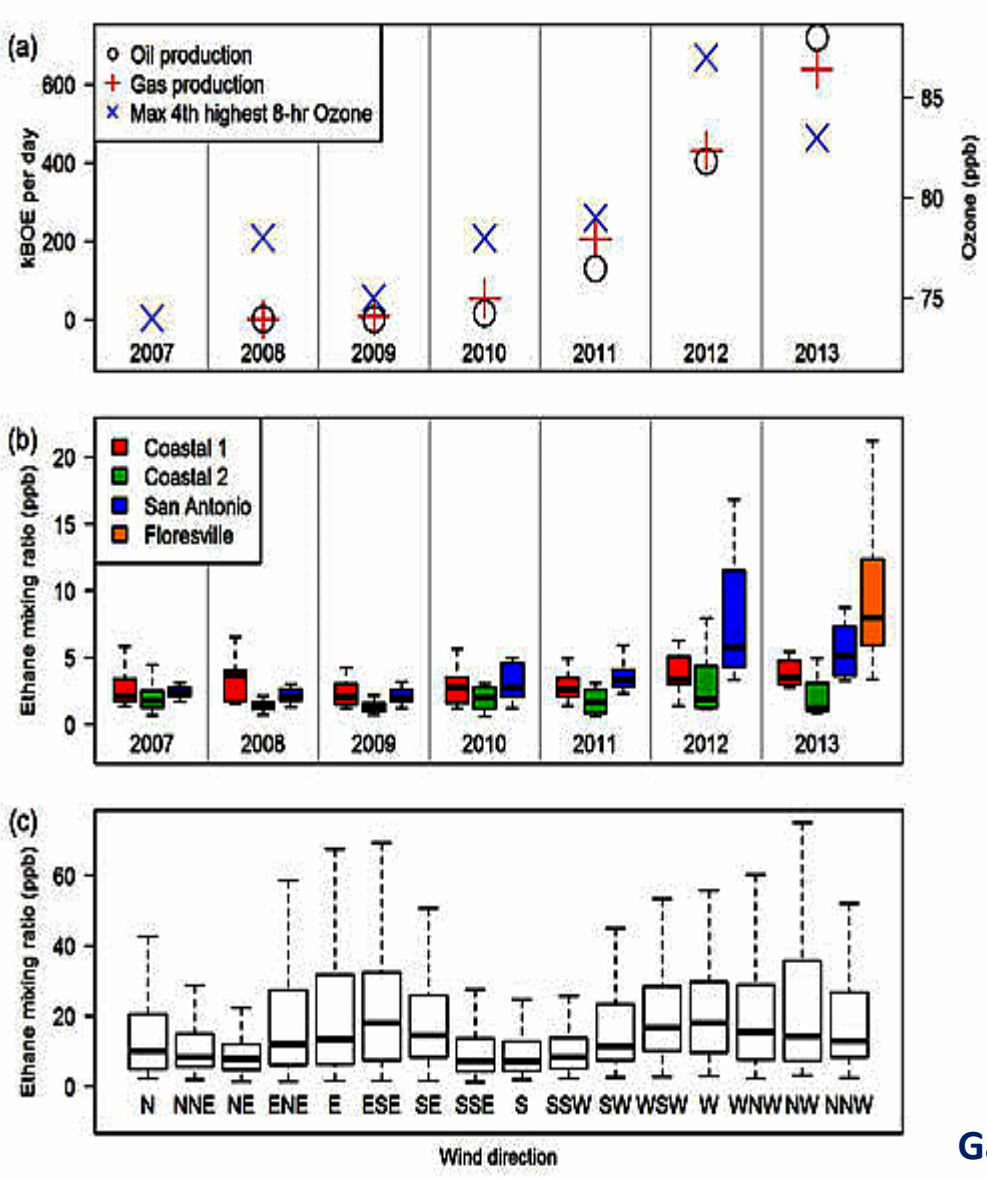
A decade of European Space Agency Envisat satellite data reveal large amounts of methane escaping from oil and gas operations in northwestern New Mexico.

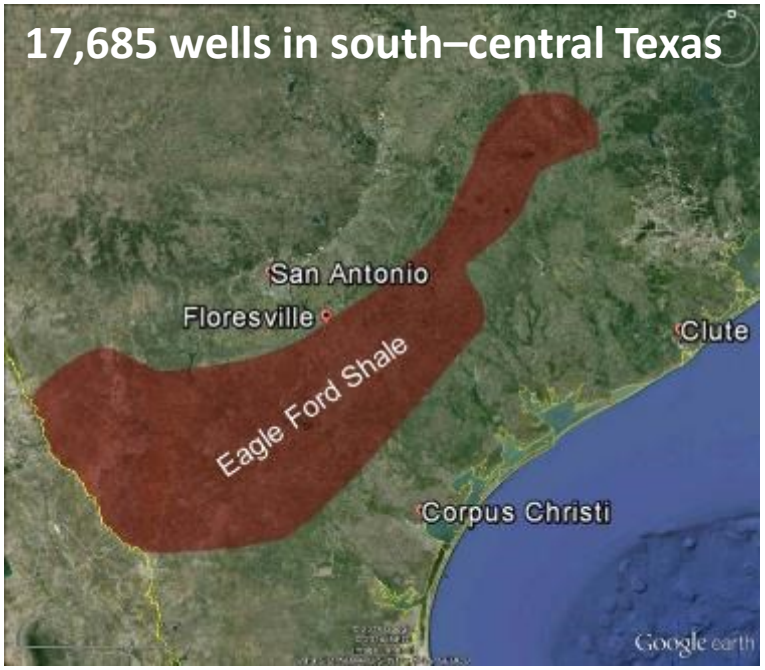


Methane concentrations determined by SRON on the Dutch-German space instrument on SCIAMACHY

Is the Shale Boom Causing Ozone Pollution?

Schade and Roest 21 April 2015

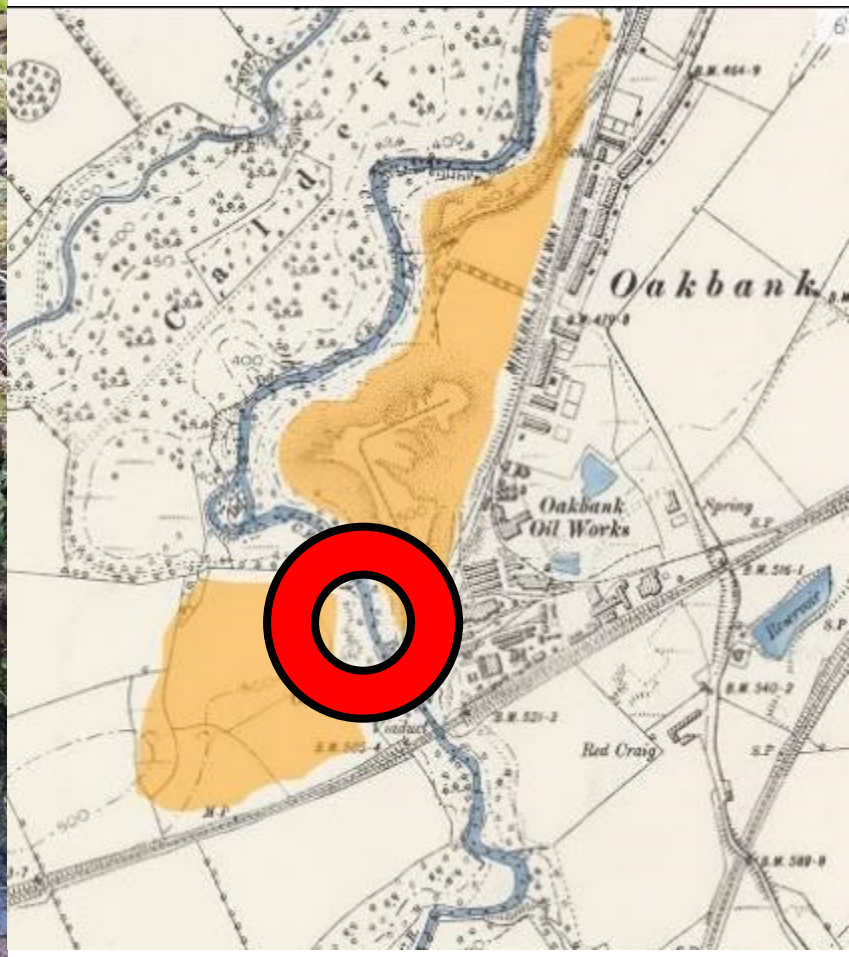




Gas flaring & crescent-shaped scatter of night light

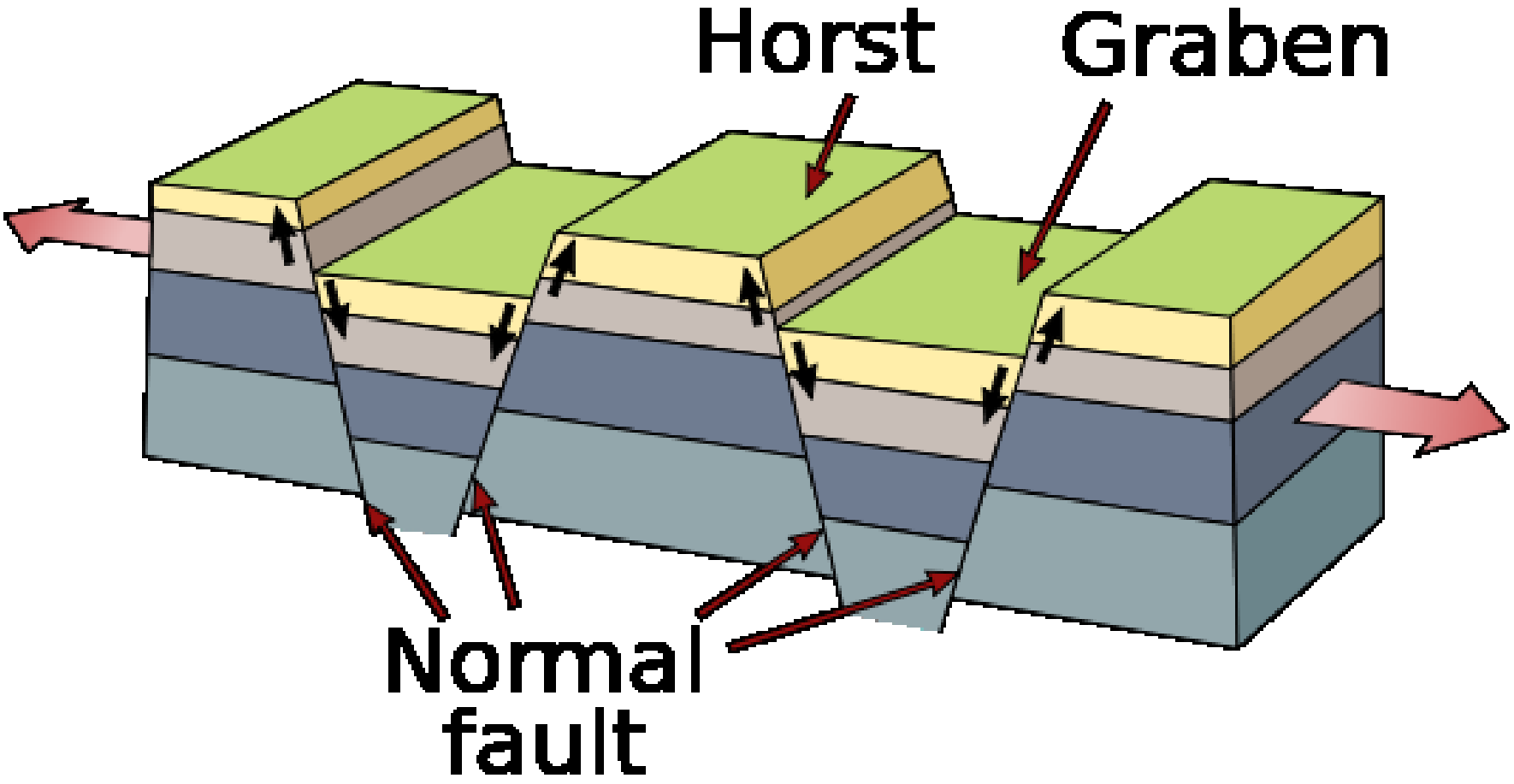

St Ninian's
open cast mine in Fife

Oil shale near Oakbank Paraffin Oil Works



6" OS map c.1895 annotated to show maximum extent of bings


<<<<<Pumpherston oil-shale >>>>>

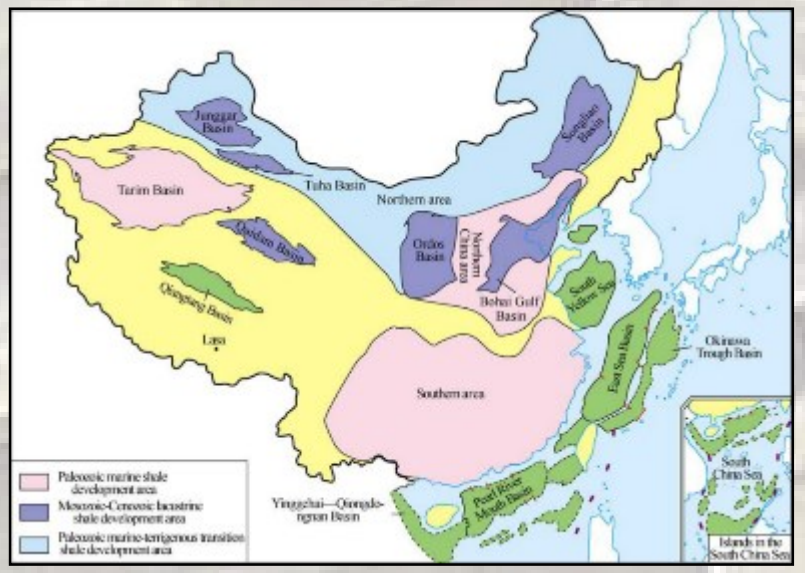


Faults:-

- > Gas leakage
- > Discontinuities limit effective lateral lengths
- > Distort hydrofracture growth patterns
- > Abnormal stress fields which reduce recovery
- > Detrimentally serve as conduits for water

Basic geologic conditions required for shale gas generation in China

(1) TOC >2% (non-residual organic carbon)
(2) Brittle minerals (e.g. quartz) content over 40%
(3) Clay minerals less than 30%
(4) Thermal maturity over 1.1%
(5) Air porosity over 2%
(6) Permeability over 0.0001×10^{-3} μm^2
(7) Effective thickness over 30 m,
… if discontinuous over 50 m.
(8) Not controlled by structure
(9) Continuous and large area.



Geological characteristics and resource potential of shale gas in China by Zou Caineng (2010)


New UK Fracking License Areas Confirmed
Newly available area
Already licensed


Fracking for Scottish shale-gas:
Storm in a teacup?