**Earthquakes, Tremors, and Hydraulic Fracturing** by **Dr Paul Nathanail** on 17 -1-20

Dr Nathanail began by observing that the USA is no longer reliant on middle eastern oil - it can flex its muscles there - its gas supplies are now 60% shale. In Britain it was thought that utilising our shale gas would tide us over the few years it took to go carbon neutral; the Bowland field in North-East England is the largest.

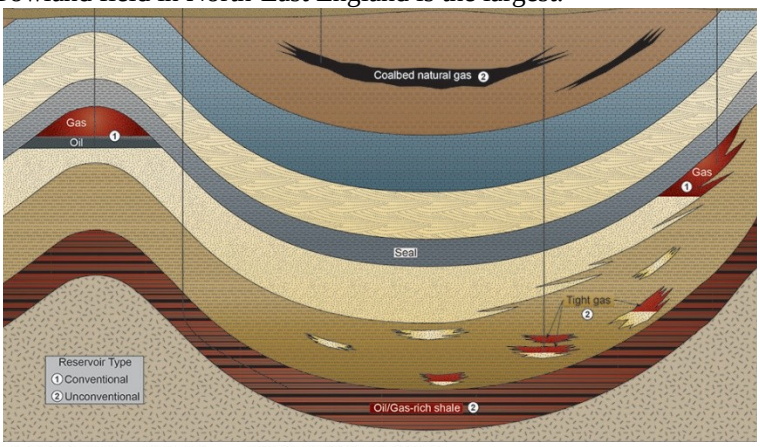
Fossil fuels were formed by bacterial action on buried Permian & Jurassic plant debris, producing coal, oil or natural gas depending on conditions.

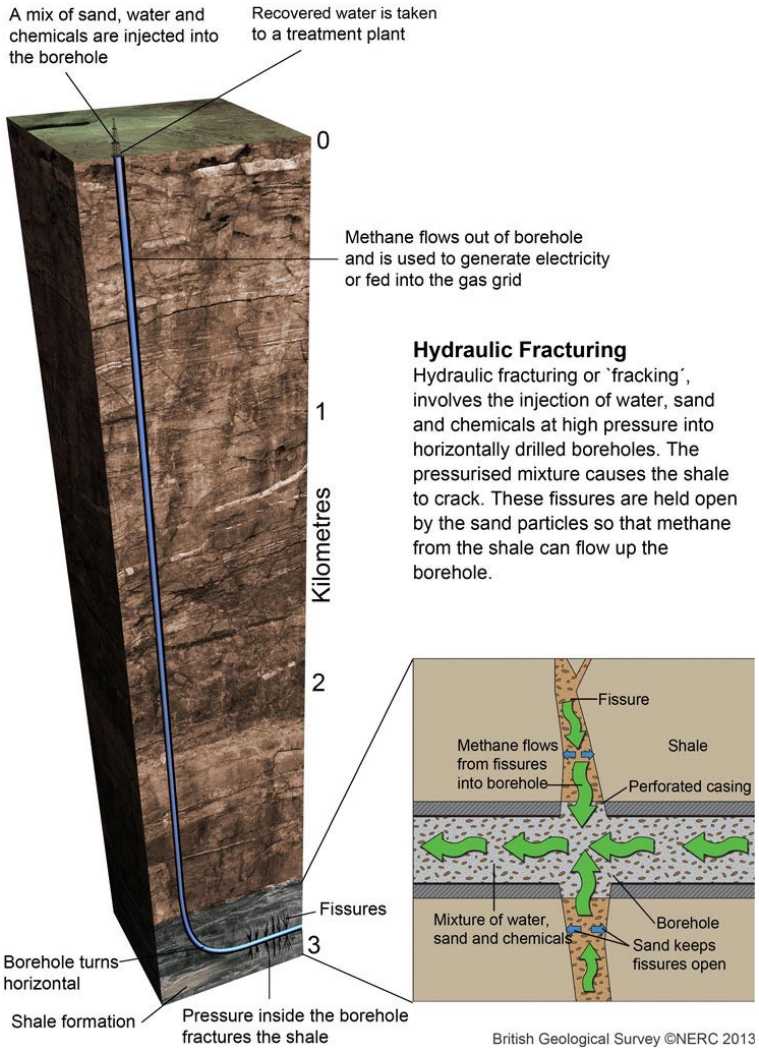
The shifting tectonic plates cause seismic activity; they build up stress until it is released as rocks give way. One seldom notices this in the UK where activity is usually in the range 0.9 to 1.9 Richter units. The logarithmic Richter scale goes up to 10 – for total destruction. Each unit increase represents a tenfold increase in amplitude, but 32 times the energy released.

He outlined a simplistic geological view of the strata below the land surface: with porous sandstone and clay, a sealant, representing upper layers. Coal seams are found here & natural gas. Where there is a sealed dome or an 'unconformity' due to seismic action creating a pocket, oil and gas can be found. At depths of 2-3 km rocks are compressed and have high shear strength, though low tensile strength. Here a mixed clay/plant debris layer in the bedding planes becomes shale, forming flakes with methane in the interstices, the high temperature producing more, thermogenic, methane.

The tremors produced by drilling for fracking is measurable, but no more than for normal seismic activity. Indeed fracking has been used to raise recovery of oil and natural gas to 70-80% in existing wells for years.

Fracking for shale gas involves drilling down to the shale, then directing the drill head horizontally through it (the drill head has multiple drill bits, and by switching some of these off on the inside of the desired bend the drill can be steered). Water (plus chemicals) and sand are pumped down at 350 – 700 Bar (1 Bar is atmospheric pressure), the water to fracture the rock, and the sand to hold open the fissures which are a few metres long. The released gas is rises through the bore hole. Within months the gas runs out, the drill is advanced and the well refracked.




The bore is lined with a pipe and the spaces between that and the rock grouted – trouble arises when the grout begins to fail, and the methane and chemicals escape. The unrestrained methane is a potent greenhouse gas, and the chemicals can contaminate ground water. Unlike conventional fossil fuel extraction, shale gas extraction does not lead to land settlement afterwards.

The shale beds in America were formed in a vast delta similar to the Mississippi delta, and are bigger and less deep than the British beds. Their largest, the Marcellus shale oil field, is under the Appalachian Basin and has no cities above it.

In Britain cities do sit atop shale beds, and there has been strong opposition to fracking. It had been thought that 15-30% recovery of shale gas was possible, but a new thermal model has revised a this down by a factor of 10, making it uneconomic. It is likely that less energy could be harnessed than that used to drill the well.

The government has placed a moratorium on fracking, and is likely to make it permanent.