Geothermal well potential locations for UK East Midlands

Widmerpool Basin plays

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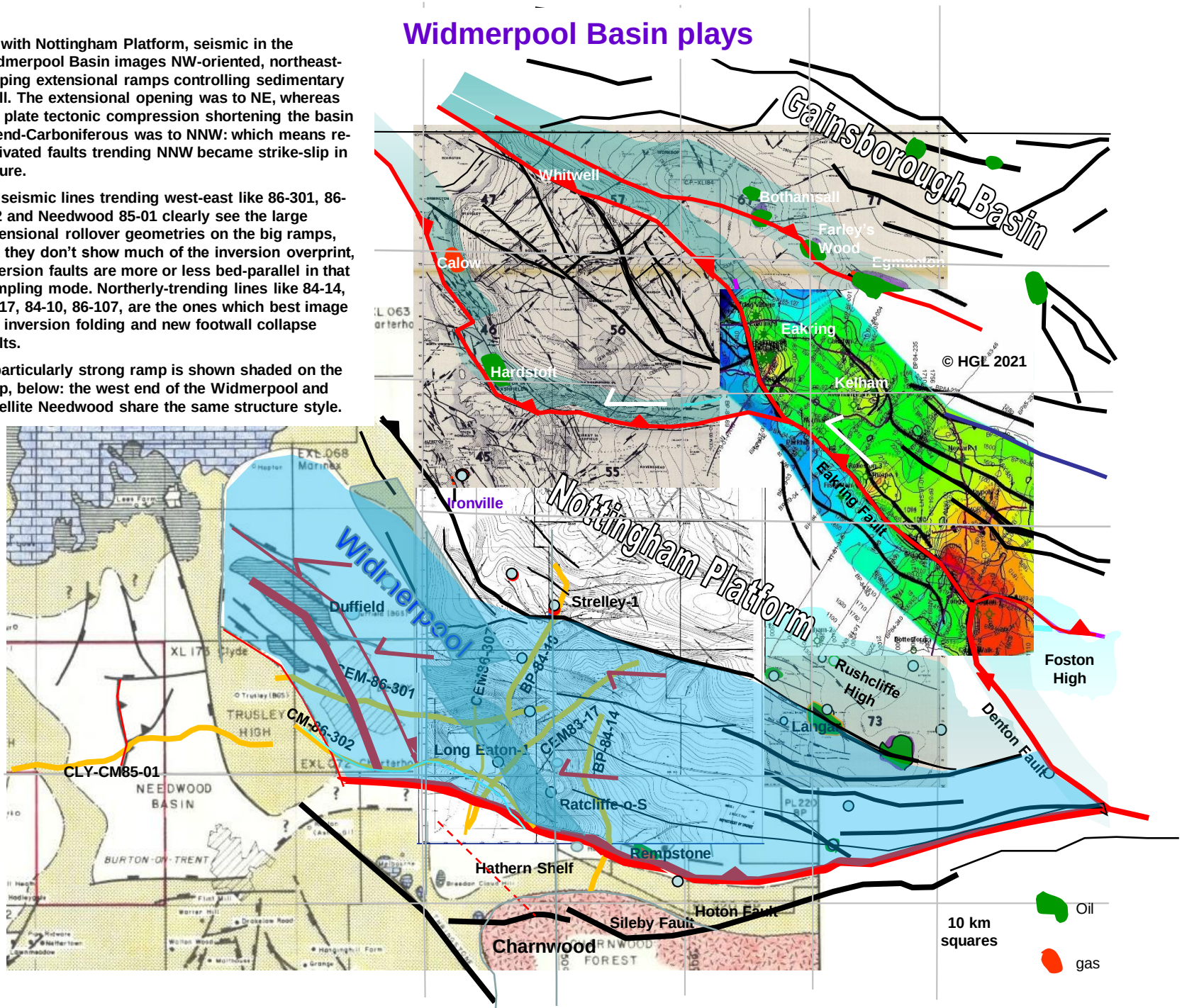
Widmerpool Basin plays

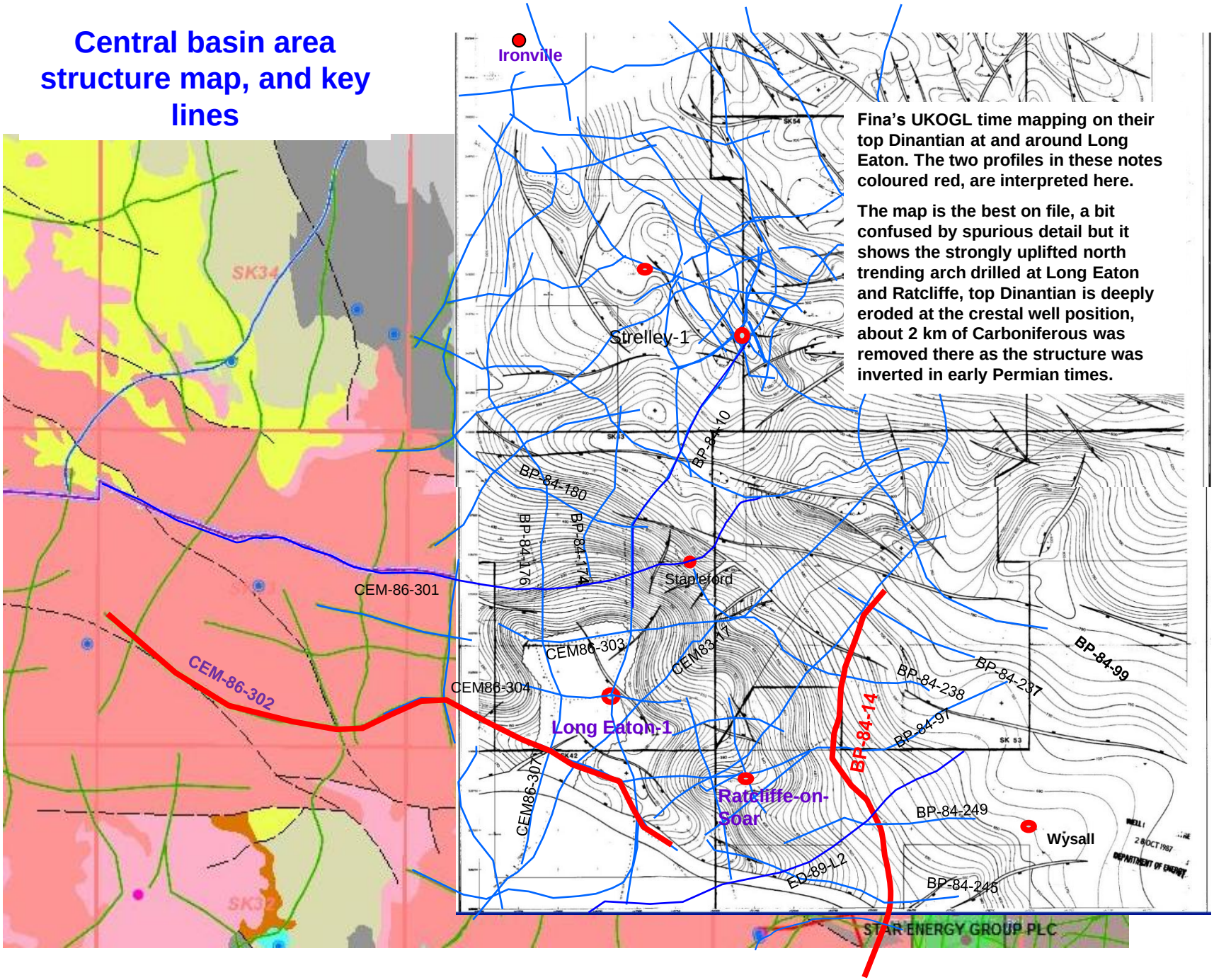
As with Nottingham Platform, seismic in the Widmerpool Basin images NW-oriented, northeast-dipping extensional ramps controlling sedimentary infill. The extensional opening was to NE, whereas the plate tectonic compression shortening the basin at end-Carboniferous was to NNW: which means re-activated faults trending NNW became strike-slip in nature.

So seismic lines trending west-east like 86-301, 86-302 and Needwood 85-01 clearly see the large extensional rollover geometries on the big ramps, but they don't show much of the inversion overprint, inversion faults are more or less bed-parallel in that sampling mode. Northerly-trending lines like 84-14, 83-17, 84-10, 86-107, are the ones which best image the inversion folding and new footwall collapse faults.

A particularly strong ramp is shown shaded on the map, below: the west end of the Widmerpool and satellite Needwood share the same structure style.

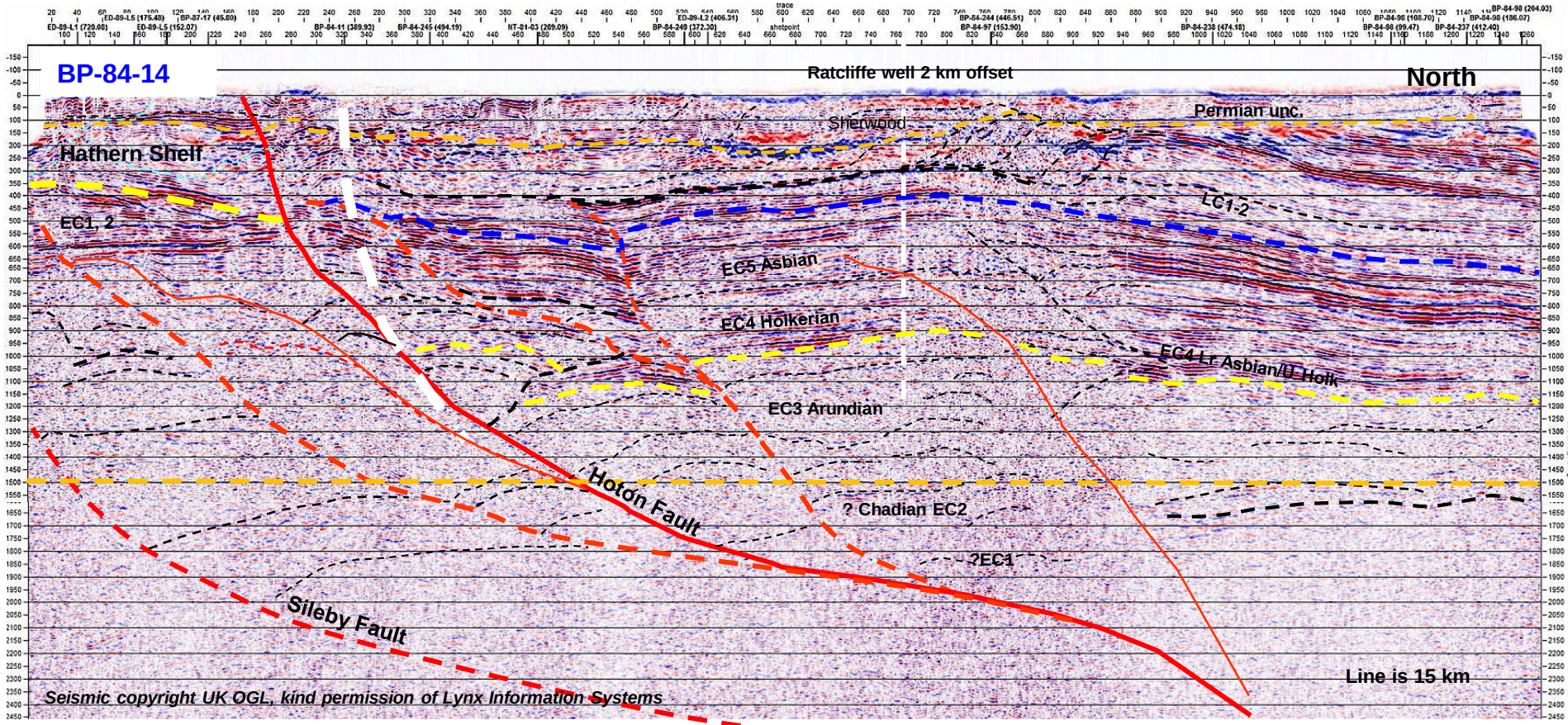


Central basin area structure map, and key lines



Fina's UKOGL time mapping on their top Dinantian at and around Long Eaton. The two profiles in these notes coloured red, are interpreted here.

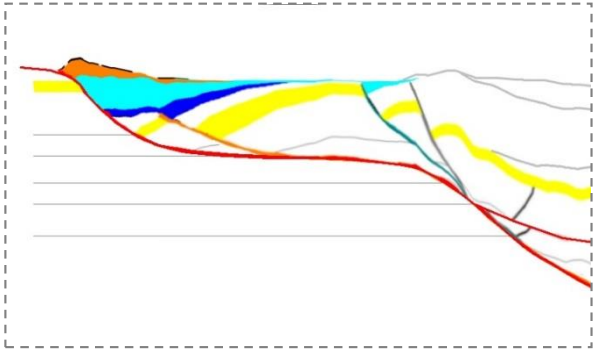
The map is the best on file, a bit confused by spurious detail but it shows the strongly uplifted north trending arch drilled at Long Eaton and Ratcliffe, top Dinantian is deeply eroded at the crestal well position, about 2 km of Carboniferous was removed there as the structure was inverted in early Permian times.



Sileby Fault defines the south end of the Carboniferous basin, together with the Hoton which has a huge displacement. This line 84-14 runs south to north, about 10 km east of the pronounced Long Eaton arch which has two of the very few deeper wells drilled to date in Widmerpool: Ratcliffe-on-Soar in 1987 terminated at around 1800 metres TVD, the other was Long Eaton-1 in 1988, it went to 2713m. Both penetrated mainly mudstones with thin limestones, and found no hydrocarbons.

Part-reversal of down-to-north extensional growth faults is evident. Hoton has a strong element of strike-slip on it, it was oblique-extensional in rifting and then part reversed and left-lateral in the inversion, which imposed buckling and northerly reverse faulting. Wholesale rock breakage is mainly why the seismic event continuity near the major faults is poor.

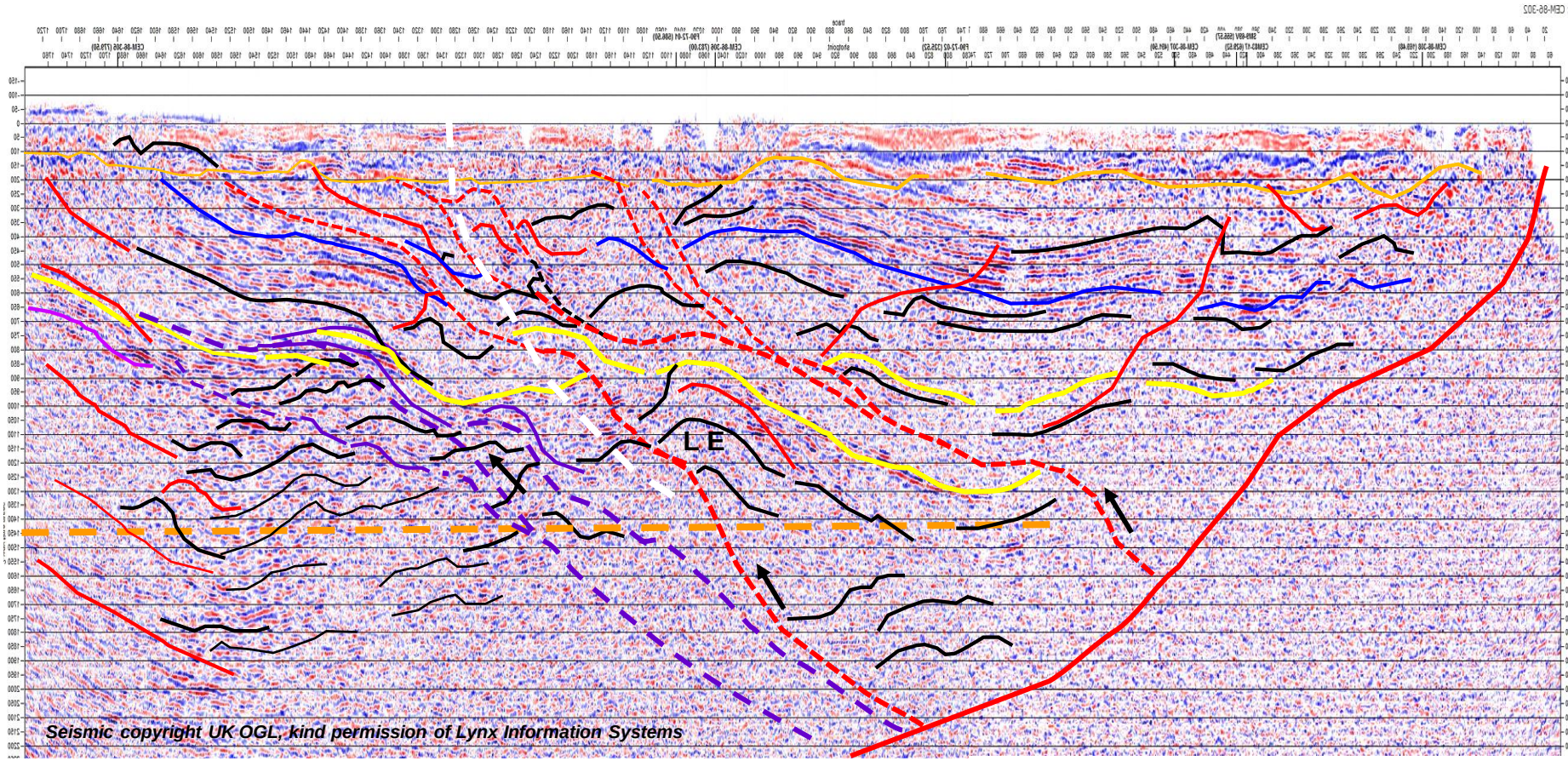
The possible producer well (white dashed) drills down the broken Hoton hangingwall, to intersect high fracture zones..



WNW

CEM-86-302

ESE

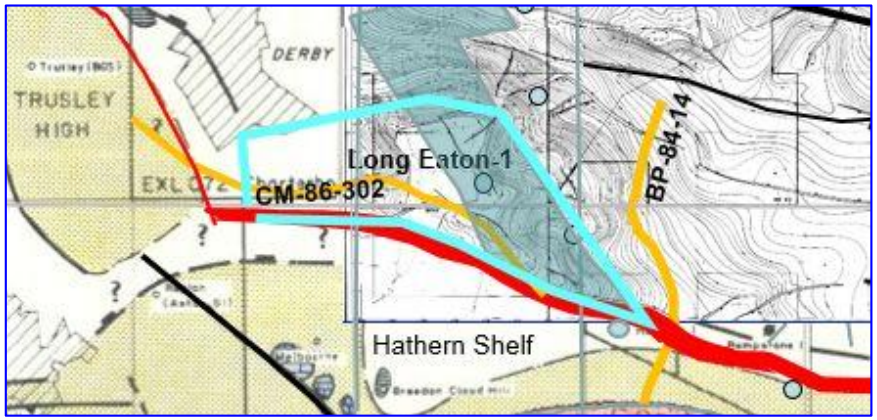


The Fina CEM-86-302 profile picked here is more or less normal to the west margin of Widmerpool basin and to the major extensional ramp set (purple): it runs very close to the west part of Hoton Fault, Hoton is schematically the red heavy line, coming out of section plane, towards the eye. The east end of -302 converges with and meets it, which is why the reflectors are all lost there.

It shows Long Eaton arch, centre, which lies at the junction of the important purple ramp and the Hoton. That extensional ramp dipping to NNE was active throughout the early and mid Carboniferous, and the Long Eaton rollover LE developed on it. The end-Carboniferous plate tectonic shunt directed NW, with left-lateral displacement on the Hoton, part-reversed nearly all of the extensional faults and formed important new fractures, and that's why the LE structure is so strongly expressed, it was tightened. Long Eaton's west flank is comprehensively reverse-faulted, the ones drawn dashed are footwall collapse structures.

<u>What a good place for a fracture-based geothermal project</u>! A lot of sequence lies below 100 degrees isotherm (orange-dashed). A 3D seismic survey here would support a series of twin-well pads along the Hoton hangingwall, at locations like the white-dashed one.

Widmerpool: action



Because of its very considerable marine shale sequences with mature, high organic carbon content, Widmerpool was rated as a strong candidate for shale gas exploration. Subsequently to the mid 2014 licensing round the moratorium on shale gas exploration inevitably resulted in cancellation of planned heavy investment in 3D seismic and drilling: and almost all the oil and gas licences awarded have been relinquished. So the field is clear for geothermal projects, emphasising the pressing need for legal framework and operational terms and conditions to be clarified.

In our opinion, its high degree of natural fracturing made it marginal for fracking: but as a geothermal target area it scores highly. The area outlined in pale blue seems to us to have particular interest for well pairs, and it warrants a high ranking in our project location list. Its has thick sedimentary sequence, major structural deformation with convincing fracture network indicated by the presently-available seismic, and its very close to major population and industrial centres. A work programme should be planned here, license and map with the 2D, design a 3D to cover a strip of acreage big enough to support three or four twin-well pads, and cost it. It could spearhead a Nottingham-East Midlands drive, together with Eakring-Newark effort.