

# Newcastle Central no 1: Progress in Geothermal Exploration in Newcastle

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*On behalf of the project team: Newcastle Science City and Newcastle City Council;*

*Mott MacDonald and BGS*

# Newcastle Science Central



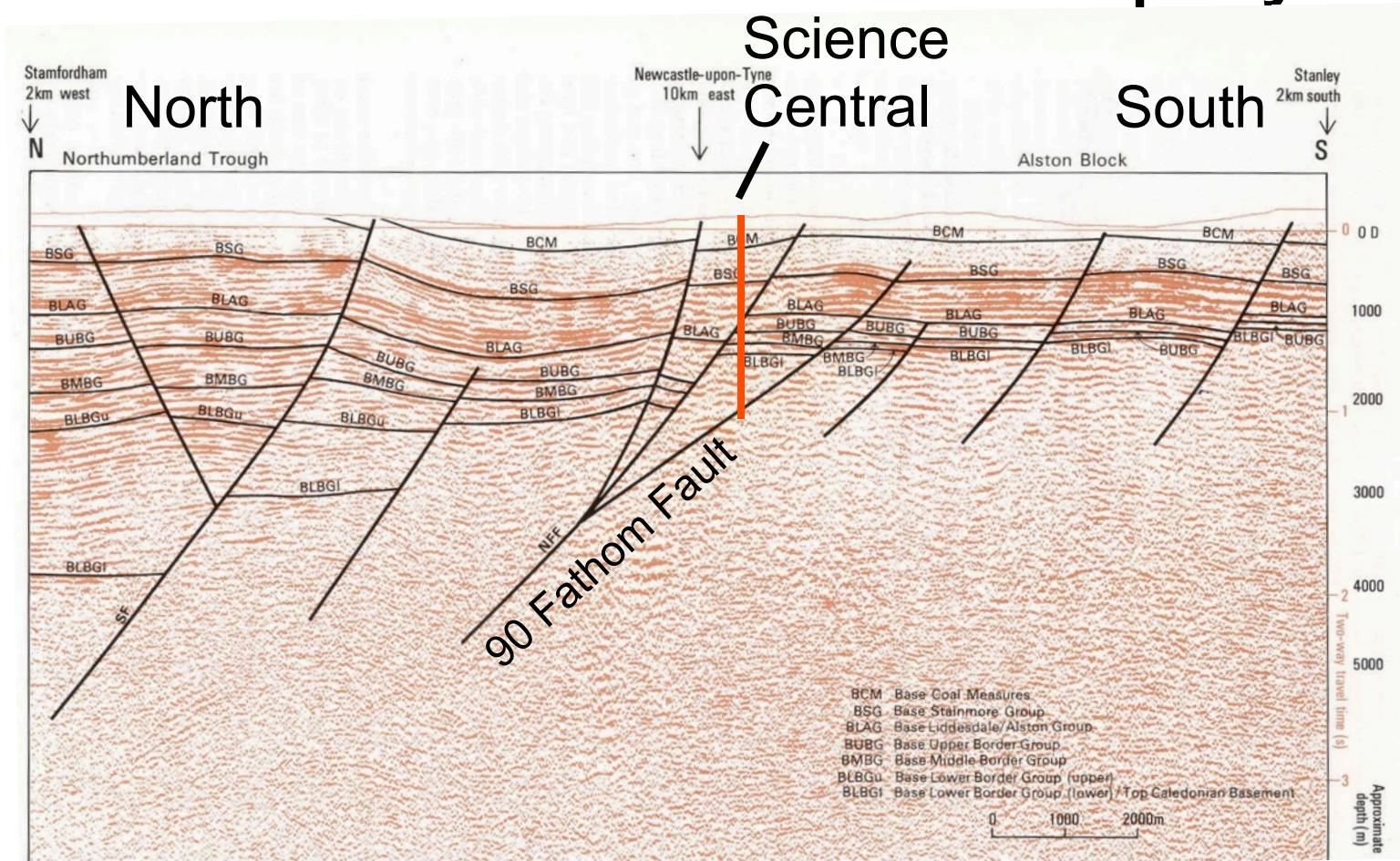
10 ha site delivered by Newcastle Science City  
Partners: Newcastle University & Newcastle City Council

# Science Central: the opportunity

- Former site of Newcastle Brown Ale brewery
- 20 acres/10 ha – one of the UK's largest city-centre redevelopment site
- Land in joint ownership: Newcastle City Council, Newcastle University
- Masterplan for 15-year site development emphasises state-of-the-art in sustainable urbanism
- Commitment to CHP site grid development, into which geothermal fits very well

# The target:

# 90 Fathom Fault and its ‘splays’



*Concept: Paul Younger  
Seismic profile source: BGS*

# 2000 m depth in the footwall splays of 90 Fathom Fault zone

- Ninety Fathom Fault System surface trace strikes ENE through urban Newcastle
- **Geothermal target waters** known from:
  - Ba-Cl brines in Rising Sun and Backworth Collieries, North Tyneside ( $\leq 1.8$  Ml/d pumped until 1978)
  - Barite cementation of Basal Permian Sands at Cullercoats
- Why 2000m depth?
  - To establish geothermal gradient
  - To prove any **permeable formations** accessing fault laterally at depths of interest
  - To maximise chances of intersecting splay-faults

Drilling in central Newcastle, June-July 2011

The deepest geothermal exploration well in the UK

1820 m deep

77°C bottom hole temperature





2014...

- Sensitive city-centre location
- Full-scale drilling rig on site for 2 months



# Well construction, 2014

1415 m Top Fell Sandstone

$62.8^{\circ}\text{C}$  at 1416 m

$68^{\circ}\text{C}$  at 1649 m

1651 m Base of casing

$2\frac{7}{8}^{\prime\prime}$  production string -

- 4.5" casing
- Double packers
- 4.5" perforated casing

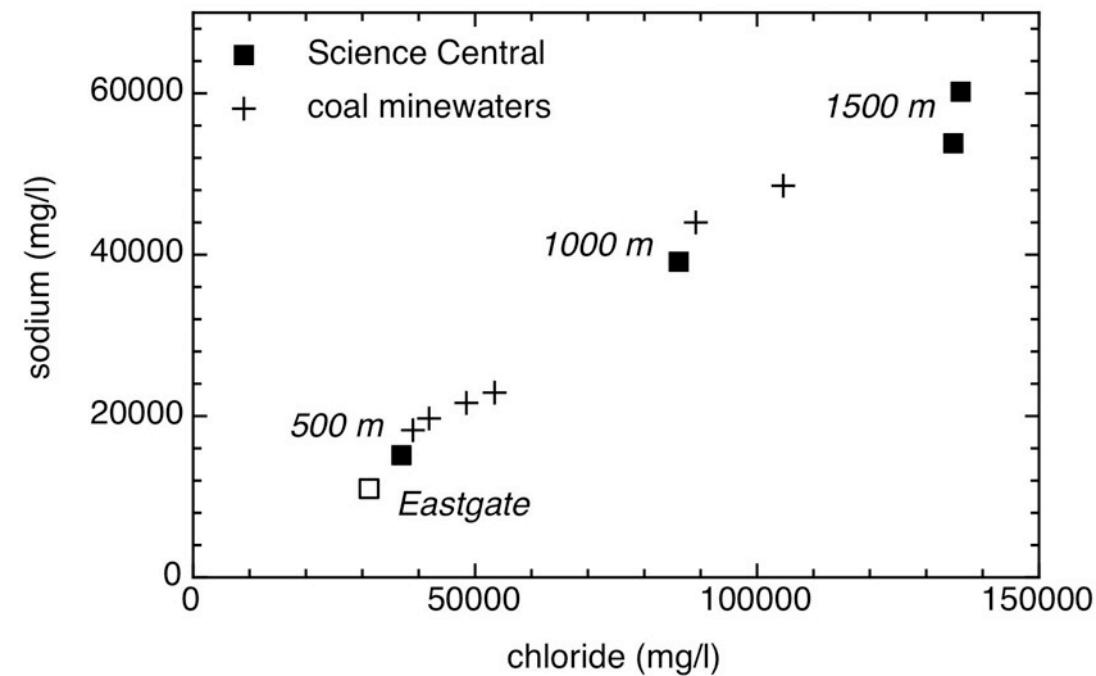


# Aquifer properties

- Pump tests as originally planned not possible
- Rising head test gave hydraulic conductivity over slotted interval of  $7 \times 10^{-5}$  m/d, i.e.  $8.1 \times 10^{-10}$  m/s (234 m; Charles Jones, Mott MacDonald)
- Corresponding permeability is  $5 \times 10^{-17}$  m<sup>2</sup> or 0.05mD – remarkably low

# Water composition

- Highly saline brine encountered
- Sampled at 1500, 1000 and 500 m depth
- Similar to brines from elsewhere in the region



# Science Central no 1 outcomes:

- Geothermal gradient:  $35^{\circ}\text{C}/\text{km}$ : ✓
- Right sort of target water: matches known geothermal systems in region: ✓
- Right amount of water: ✗

More work needs to be done to find sufficient flow of water

We now have a well suitable for research into innovative ways of recovering heat over a geothermal temperature gradient

# Thank you

