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GETTING INTO HOT WATER: THE GEOTHERMAL POTENTIAL OF NE ENGLAND

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In 1961 the Rookhope Borehole proved the presence of the Weardale Granite, whose presence had first been postulated to account for the origins of Northern Pennine mineralisation, and subsequently to explain the results of detailed gravity and magnetic studies. Surprisingly, however, the top of the granite was found to be overlain unconformably by Lower Carboniferous sediments and, although it had clearly been exposed during Carboniferous times, it was still hot. It was later recognised that this heat was not residual after emplacement but resulted from the radiogenic decay of thorium and other elements.

The fiftieth anniversary of the Rookhope borehole in 2011 was marked by the drilling of the third modern geothermal well on the Weardale system by a Newcastle and Durham universities joint project. The two universities are leading the way in the UK's quest for geothermal energy – ahead of commercial concerns in Cornwall. Two wells have been drilled at Eastgate. Both penetrated the Weardale Granite. Eastgate 1 (2004) was drilled to 995m, entering the granite at about 275m and the flow rate tested at two intervals. An open fracture encountered at 411m flowed at 37m³/hour (at 46°C) and the interval below at 22m³/hour. The former value is the highest ever recorded from a granite. The thermal gradient was determined to be 38°C/km. The nature of the fracture system was uncertain. The well had planned to intersect the Slitt Vein, part of the northern, bounding fault system to the Weardale (Block) Granite. However, it was also considered possible that flow was coming from a weathering induced fracture system near the top of the granite.

Funds from DECC in 2010 allowed drilling of Eastgate 2. A location was chosen 700m from Eastgate 1 specifically to test the two possible hypotheses regarding the fracture system. The well terminated at 420m and although the temperature was as expected the well failed to flow; clear proof that Eastgate 1 had indeed penetrated a little mineralised section of the Slitt Vein.

Further funding from DECC, Newcastle Science City and the British Geological Survey in 2011 resulted in a third well. The well was spudded in central Newcastle on the old Scottish & Newcastle brewery site. Like the Eastgate 1 well, Science Central 1 was planned to intersect one of the major bounding faults to the Weardale Block, this time the 90 Fathom Fault. The well drilled to about 1850m having penetrated almost the whole of the Carboniferous section. Evaluation is currently underway to determine both the thermal gradient and potential flow characteristic.

Evaluation of all three wells continues with the intention of determining whether the temperature and flow rates will support district heating schemes. Such schemes could deliver low enthalpy heat with a near zero carbon footprint. Success in Eastgate and Science Central could pave the way for a geothermal revolution in the UK.