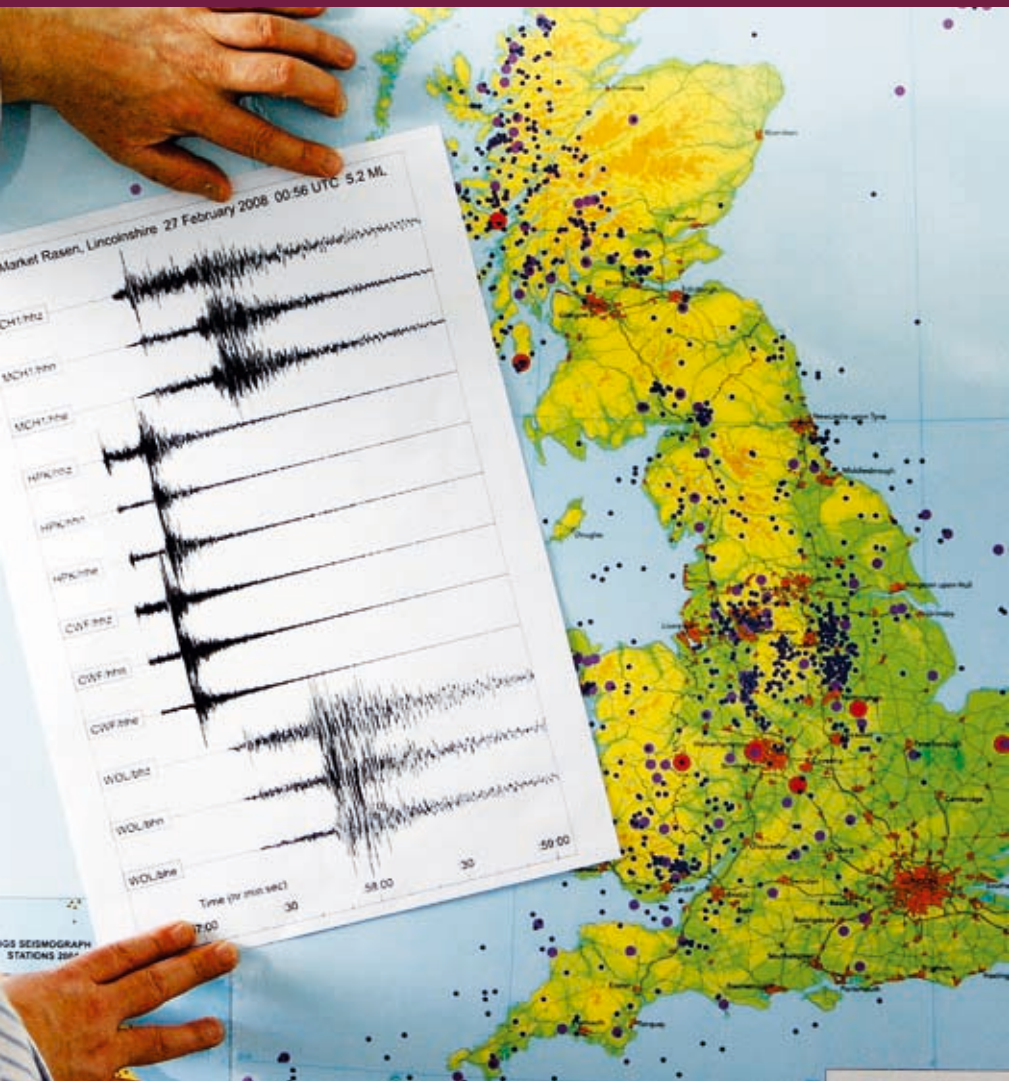
Things that go BUMP in the night

The UK's largest earthquake since 1984 struck Market Rasen earlier this year. **Susanne Sargeant** discusses the British Geological Survey's response to this event.

Surveying the damage.

A British Geological Survey scientist holds a seismogram readout of Britain's strongest earthquake in 20 years.



David Moir/Reuters

Shortly before 1am on 27 February 2008, seismic waves from the Market Rasen earthquake began to speed towards the British Geological Survey's (BGS) seismic stations across Britain.

Their arrival at the seismometers triggered the Earlybird automatic detection system, set up to give rapid notification of significant earthquakes around the world. Earlybird determined a location and magnitude for the earthquake within a couple of minutes and sounded the alarm, sending text messages to our seismology team in Edinburgh. It told us that much of England had been rocked by a magnitude 5.2 earthquake.

Our first priority was to verify the earthquake's location and magnitude. One of our analysts determined a preliminary location and magnitude from home. We published this reviewed earthquake location on the BGS earthquakes website around 50 minutes after the earthquake struck.

We now had confirmation that Earlybird's initial estimate was spot on: the epicentre was around four kilometres north of Market Rasen in Lincolnshire. The constraint on the depth was poor although indications were that it was probably fairly deep in the crust at about 20km.

In the meantime, BGS seismologists rushed to Murchison House. Enquiries from the media and general public flooded in. Between responding to these enquiries, the team worked hard to build up as complete a picture of the earthquake as possible. They

The team gathered vital information from the emergency services.

> **The epicentre was 4km north of Market Rasen.**

spoke to the emergency services to gauge the level of damage and compiled background information on the geology of the area and the historical seismicity.

The earthquake dominated the news bulletins. Throughout the day, we gave numerous interviews to journalists from TV, radio and newspapers.

Shortly before 2am we published a questionnaire on felt effects on our website. Over the coming days more than 20,000 responses flowed in from the public. This gave us an opportunity to study the felt effects of the earthquake in unprecedented detail. The earthquake was felt over most of England and Wales.

The earthquake location and media reports helped us to target our damage survey. It is vital to get on the ground and survey damage as soon as possible after an earthquake before the clear-up begins.

I grabbed a camera and jumped on the first train south, meeting colleagues from BGS Keyworth and the University of East Anglia (and several TV crews), in Gainsborough, west of the epicentre, at 10am. This is where we had received reports of the greatest damage.

Thankfully, the damage was not as bad as we had first feared because of the depth of the earthquake. Had it been shallower, we would have expected to see more severe effects near the epicentre. Instead, the responses to the questionnaire indicated that there were sporadic incidences of damage over a wide area rather than a distinct 'hot-spot' near the epicentre. This was borne out by our field survey. Most of the damage in Gainsborough was to the tops of chimneys. But there was also some secondary roof damage caused by falling bricks.

We also found indications that damage may be related to the distribution of river floodplain sediments, something that we will continue to investigate. Overall, the damage was relatively minor.

A seismologist and two of our field engineers followed on several hours behind me, their Land Rovers loaded up with four rapid-deployment systems to record any aftershocks. These systems contain state-of-the-art seismometers. Instruments are ready for action at a moment's notice. The last deployment was shortly after the Folkestone earthquake in April 2007.

As the team headed towards Lincolnshire, seismologists back in Edinburgh identified potential deployment sites from geological maps and satellite images. The best sites are quiet rural areas away from roads where bedrock is close to the surface.

We installed the first seismometer near Market Rasen around 18 hours after the earthquake.*

Months afterwards, when the dust had settled, our team continue to work with the data. We want to establish a better location and depth and to understand its source. Recently installed broadband seismometers across the UK are really helping the research.

We've also used global data to home in on the earthquake's depth. This confirmed that the earthquake was relatively deep. The distribution of aftershocks recorded on the temporary stations will help identify the orientation of the fault.

The Market Rasen earthquake was the largest in Britain since the Lleyn peninsula earthquake of 19 July 1984 (magnitude 5.4). Back then, seismic data were recorded on magnetic tapes, and questionnaires were published in local newspapers. With today's technology, we are able to respond within minutes to significant earthquakes, and the broadband data we collect are capturing more information than ever before. All this flows through into the science we do and the knowledge we generate. ❖

** The temporary stations were pulled out at the end of June. They'd recorded 11 aftershocks. The largest had a magnitude of 2.8.*

More information: www.earthquakes.bgs.ac.uk

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