

Scientists identified earthquake faults in Sichuan, China

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Only last summer research published by earth scientists in the international journal *Tectonics* concluded that geological faults in the Sichuan Basin, China "are sufficiently long to sustain a strong ground-shaking earthquake, making them potentially serious sources of regional seismic hazard."

An international team of scientists including Dr. Alexander Densmore (Institute of Hazard and Risk Research, Durham University), Dr. Mike Ellis (Head of Science for Climate Change at the British Geological Survey) and colleagues from research institutes in Chengdu, carefully mapped and analysed a series of geologically young faults that cross Sichuan Province like recently healed scars.

The team mapped the densely populated Sichuan Basin and adjacent mountains using what is known as 'tectonic geomorphology'. This technique can demonstrate significant changes in ground movement over time, such as observations of offset river channels, disrupted floodplains, abnormally shaped valleys and uplifted landscape features. These subtle signals of deformation, when combined with the ability to measure the age of the disfigured landscapes (using cosmogenic nuclides that bombard the Earth from all corners of the universe), produced surprising results.

The recent earthquake in Sichuan occurred under some of the steepest and most rugged mountains in the world, the Longmen Shan: the Dragon's Gate Mountains. This dramatic range, steeper than the

Himalayas, is the upturned rim of the eastern edge of Tibet, a plateau that has risen to 5 km in response to the slow but unstoppable collision of India with Asia that began about 55 million years ago and which continues unabated today.

Two long faults in particular, running almost the entire length of the Longmen Shan, showed clear evidence of slip during the last few thousands, and in some cases hundreds, of years. The rates of slip varied between fractions of mm per year to possibly many mm per year. Millimetre by millimetre, the Longmen Shan are being sliced and displaced much like salami. One of these faults is likely to be the one that gave rise to the 7.9 magnitude earthquake that has now caused 22,069 fatalities.

Exactly why the Longmen Shan are here is a mystery. Unlike the Himalaya, which form the southern boundary of Tibet and whose faults chatter continuously with small earthquakes, faults in the Longmen Shan, remnants perhaps of geological events hundreds of millions of years ago, have historically only produced earthquakes up to magnitude 6.

Geomorphological evidence, described in the Tectonics paper, suggests that the mapped faults are very steep with dominantly lateral or strike-slip displacements taking place over time scales of thousands to hundreds of thousands of years. This contrasts with shorter-term measurements using Global Positioning Systems which suggest a greater proportion of thrust or shortening displacement than lateral displacement. The observations of seismologists at the BGS suggest both things: more thrust in the SW, nearer the epicentre, and more strike-slip toward its direction of propagation, the NE.

Source: British Geological Survey

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