

And Finally...

Joshua 10, the Gibeon strewn meteorite field in Namibia, and the Chelyabinsk fall

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On 15th February 2013 over Chelyabinsk, Russia, an asteroid entered Earth's atmosphere, heated, and exploded in a remarkable airburst comparable to a medium-size nuclear explosion. A shower of small meteorite fragments rained down. These events offer a plausible and perhaps testable explanation of Joshua 10, one of the thornier puzzles in the biblical narrative.

Joshua 10 describes an extraordinary shower of large stones falling 'from heaven', and gives a puzzling comment implying the sun shone at night ("did not hurry to set for about a whole day"). The site of the biblical fall is closely located at the 'ascent of Beth-Horon' near Gibeon. This account, of an event perhaps around 1250-1400 BCE, has long been dismissed by many as corrupted text, myth, or pure fiction.

In the Chelyabinsk event, which occurred at 3.21 am UT (~GMT), an asteroid about 17-20 m in diameter heated in the air, and then broke up in a series of explosions. The event is described by Brown *et al.* (*Nature* 503, pp. 238-241, 2013). The largest explosion was equal to about 500,000 tons of TNT (comparable to a medium-sized nuclear weapon). Many people were temporarily blinded: to an observer underneath at a range of 100km, the flash would have been about 30 times as bright as the Sun. The series of fragmentation events broke up the asteroid, producing a 'strewn field' of meteorites. Thousands of these falling fragments had masses greater than 100g, ranging from pebbles up to a boulder of nearly half a ton.

One of the most famous of all 'strewn field' meteorite falls was discovered by Capt. Alexander in Namibia (*Journal of the Royal*

Geographical Society, 8, pp. 8-28, 1838). The Namibian locality is duly named Gibeon, echoing Joshua 10. In an exemplary paper, Sir John Herschel (*Philosophical Magazine*, 14, pp. 32-34, 1839) correctly realised that the meteorite, which was made of iron, had been molten as it passed through the air, but was understandably puzzled (not knowing of the Chelyabinsk airburst) by the astonishing inference that it had exploded in mid air. He notes "a shower of iron must have fallen; and as we can imagine no cause for the explosion of a mass of iron, and can hardly conceive a force capable of rending into fragments ... we must of necessity conclude it to have arrived in a state of fusion, and been scattered around by the assistance of the air..."

Even Herschel may not have fully appreciated the close parallels between the biblical fall and its namesake in Namibia. A night-time airburst comparable in energy to a nuclear bomb explosion many times greater than Hiroshima would be seen as the sun shining at night; while the description of a rain of fragments capable of injuring or killing is compatible with the fall of a strewn field. If the Beth-Horon asteroid had been iron, comparable to Gibeon (Namibia), remnant fragments would likely not have survived, since iron would have been very highly prized indeed for weapons and tools. However, Joshua 10 suggests a stony fall, like Chelyabinsk, and just possibly a few long-weathered but identifiable pieces may remain at Gibeon (Beth-Horon) today.

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