

13 Energy

Reading: MANSON, IOWA: GROUND ZERO

Name _____

AP/Inquiry Physics

There is now overwhelming evidence that the dinosaurs and over half of the species on our planet were wiped out by an asteroid impact on Mexico's Yucatan peninsula sixty-five million years ago. But nine million years before that event, the most devastating impact to ever strike the area of the mainland United States hit what is now Manson, Iowa.

Ice age glaciers have long since filled the crater below Manson with rocks and soil. This completely disguises that Manson's 2,000 citizens live above a crater that is three miles deep and more than twenty miles across. The crater was created by a rock about a mile and a half across, weighing ten billion tons and striking the Earth at perhaps two hundred times the speed of sound.

Modeling Devastation

How hard a meteor hits depends on a lot of variables: angle of entry, velocity and trajectory, whether the collision is head-on or from the side, and the mass and density of the impacting object, among much else. Scientists can measure an impact site and calculate the amount of energy released. From that they can work out plausible scenarios of what it must have been like - or, more chillingly, would be like if the Manson meteor impact happened today.

Instant Vaporization at Ground Zero

An asteroid or comet traveling at cosmic velocity would enter the Earth's atmosphere at such a speed that the air beneath it couldn't get out of the way and would be compressed, as in a bicycle pump. As anyone who has used such a pump knows, compressed air grows swiftly hot, and the temperature below the meteor would rise to some 108,000°F, or ten times the surface temperature of the Sun. In the instant of its arrival in our atmosphere, everything in the meteor's path - people, houses, factories, cars - would crinkle and vanish like cellophane in a flame.

One second after entering the atmosphere, the meteorite would slam into the Earth's surface, where the people of Manson had a moment before been going about their business. The meteorite



itself would vaporize instantly, but the blast would blow out a thousand cubic kilometers of rock, earth, and superheated gases. Every living thing within 150 miles that hadn't been killed by the heat of entry would now be killed by the blast. Radiating outward at almost the speed of light would be the initial shock wave, sweeping everything before it.

For those outside the zone of immediate devastation, the first inkling of catastrophe would be a flash of blinding light - the brightest ever seen by human eyes - followed an instant to a minute or two later by an apocalyptic sight of unimaginable grandeur: a roiling wall of darkness reaching high into the heavens, filling an entire field of view and traveling at thousands of miles an hour. Its approach would be eerily silent since it would be moving far beyond the speed of sound.

Bartlesville Included in the Destruction

Within minutes, over an area encompassing what had once been Denver, Detroit, Chicago, Kansas City, St. Louis, Kansas City, the Twin Cities - the whole of the Midwest, in short, including Bartlesville - nearly every standing thing would be flattened or on fire, and nearly every living thing would be dead. People up to a thousand miles away would be knocked off their feet and sliced or clobbered by a blizzard of flying projectiles. Beyond a thousand miles the devastation from the blast would gradually diminish.

Over a Billion Deaths in a Day

But that's just the initial shockwave. No one can do more than guess what the associated damage would be, other than that it would be brisk and global. The impact would almost certainly set off a chain of devastating earthquakes. Volcanoes across the globe would begin to rumble and spew. Tsunamis would rise up and head devastatingly for distant shores. Within an hour, a cloud of blackness would cover the planet, and burning rock and other debris would be pelting down everywhere, setting much of the planet ablaze. It has been estimated that at least a billion and a half people would be dead by the end of the first day. The massive disturbances to the ionosphere would knock out communications systems everywhere, so survivors would have no idea what was happening elsewhere or where to turn. It would hardly matter. As one commentator has put it, fleeing would mean "selecting a slow death over a quick one. The death toll would be very little affected by any plausible relocation effort, since Earth's ability to support life would be universally diminished."

The amount of soot and floating ash from the impact and following fires would blot out the sun, certainly for months, possibly for years, disrupting growing cycles. In 2001 researchers at the California Institute of Technology analyzed helium isotopes from sediments left from the later impact that killed off the dinosaurs and concluded that it affected Earth's climate for 10,000 years.

No Warning

And in all likelihood this incredible event would come without warning, out of a clear sky. Iowa geologist Ray Anderson was asked how much warning we would receive if a rock the size of the one that hit Manson was coming toward us today.

"Oh, probably none," he replied breezily. "It wouldn't be visible to the naked eye until it warmed up, and that wouldn't happen until it hits the atmosphere, which would be about one second before it hit the Earth. You're talking about something moving many tens of times faster than the fastest bullet. Unless it had been seen by someone with a telescope, and that's by no means a certainty, it would take us completely by surprise."

Could We Prevent the Impact?

But let's assume we did see the object coming. What would we do? Everyone assumes we would send up a nuclear warhead and blast it to smithereens. The idea has some problems, however. First, our missiles are not designed for space work. They haven't the oomph to escape Earth's gravity and, even if they did, there are no mechanisms to guide them across tens of millions of miles of space. Still less could we send up a shipload of space cowboys to do the job for us, as in the movie *Armageddon*; we no longer possess a rocket powerful enough to send humans even as far as the Moon. The last rocket that could, *Saturn 5*, was retired years ago and has never been replaced. Nor could we quickly build a new one because, amazingly, the plans for the Saturn rockets were destroyed as part of a NASA housecleaning exercise.

Even if we did manage somehow to get a warhead to the asteroid and blasted it to pieces, the chances are that we would simply turn it into a string of rocks that would slam into us one after the other. Scientists remind us of comet Shoemaker-Levy 9. In 1994, that comet broke apart and the pieces slammed into Jupiter, temporarily creating Earth-sized scars in the gas giant's atmosphere.

No Extinctions?

Amazingly, however, the actual Manson impact left no fossil record of species extinctions despite the terrible devastation across much of the Earth and complete annihilation for hundreds of miles around ground zero. Of course, the same cannot be said for the later and much larger impact that hit Mexico. Half of the species on Earth disappeared from the fossil record at the time of that impact.

What, Me Worry?

However, we can find solace in predictions that an impact like that which struck the Manson area only occur roughly once every million years. And a dino-killer style impact seems to occur about once every 100 million years.

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