It's official:
An asteroid wiped out the dinosaurs!

Edited By Lance Stewart 7th March 2010

Researchers say it was the crash of a giant asteroid that killed off the dinosaurs.
Think you've heard that before? You're right.
In 1980, Louis Alvarez and his son Walter published a paper blaming the dinosaur extinction 65 million years ago on an asteroid impact. The probable crater was later found at Chicxulub, Mexico, and the idea gained wide scientific acceptance.

In the past few years, however, suggestions were made that the demise of the dinosaurs might have been caused by the eruption of volcanoes, known as the Deccan Traps, in India, or multiple asteroid impacts.
That prompted 41 geologists, paleontologists and other researchers to come together to review the data.
Their conclusion, published in Friday 5th March edition of the journal "***Science***" **:**
It was a giant asteroid striking Chicxulub that blasted a cloud around the world that led to the end of the dinosaurs.

The argument for multiple impacts isn't supported by worldwide data, and the Deccan eruptions actually began 400,000 years before the end of the dinosaurs, Kirk Johnson of the Denver Museum of Nature and Science said.

AFP/File – Skeleton of a dinosaur is pictured on display at a Tokyo museum. Dinosaurs were wiped out by a huge asteroid

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LONDON (Reuters) – A giant asteroid smashing into Earth is the only plausible explanation for the extinction of the dinosaurs, a global scientific team said on Thursday, hoping to settle a row that has divided experts for decades.

A panel of 41 scientists from across the world reviewed 20 years' worth of research to try to confirm the cause of the so-called Cretaceous-Tertiary (KT) extinction, which created a "hellish environment" around 65 million years ago and wiped out more than half of all species on the planet.

Scientific opinion was split over whether the extinction was caused by an asteroid or by volcanic activity in the Deccan Traps in what is now India, where there were a series of super volcanic eruptions that lasted around 1.5 million years.

The new study, conducted by scientists from Europe, the United States, Mexico, Canada and Japan and published in the journal Science, found that a 15-kilometre (9 miles) wide asteroid slamming into Earth at Chicxulub in what is now Mexico was the culprit.

"We now have great confidence that an asteroid was the cause of the KT extinction. This triggered large-scale fires, earthquakes measuring more than 10 on the Richter scale, and continental landslides, which created tsunamis," said Joanna Morgan of Imperial College London, a co-author of the review.

The asteroid is thought to have hit Earth with a force a billion times more powerful than the atomic bomb at Hiroshima. It resulted in the crater known as the Chicxulub crater buried underneath the Yucatan Peninsula.

The asteroid - about the size of the Isle of Wight - would have blasted material at high speed into the atmosphere. That set off a chain of events that caused a global winter, wiping out much of life on Earth in a matter of days, the review says.

Morgan said the "final nail in the coffin for the dinosaurs" came when blasted material flew into the atmosphere, shrouding the planet in darkness, causing a global winter and "killing off many species that couldn't adapt to this hellish environment."

Scientists working on the study analyzed the work of paleontologists, geochemists, climate modelers, geophysicists and sedimentologists who have been collecting evidence about the KT extinction over the last 20 years.

Geological records show the event that triggered the dinosaurs' demise rapidly destroyed marine and land ecosystems, they said, and the asteroid hit "is the only plausible explanation for this."

Peter Schulte of the University of Erlangen in Germany, a lead author on the study, said fossil records clearly show a mass extinction about 65.5 million years ago -- a time now known as the K-Pg boundary.

Despite evidence of active volcanism in India, marine and land ecosystems only showed minor changes in the 500,000 years before the K-Pg boundary, suggesting the extinction did not come earlier and was not prompted by eruptions.

The Deccan volcano theory is also thrown into doubt by models of atmospheric chemistry, the team said, which show the asteroid impact would have released much larger amounts of sulphur, dust and soot in a much shorter time than the volcanic eruptions could have, causing extreme darkening and cooling.

Gareth Collins, another co-author from Imperial College, said the asteroid impact created a "hellish day" that signaled the end of the 160-million-year reign of the dinosaurs, but also turned out to be a great day for mammals.

"The KT extinction was a pivotal moment in Earth's history, which ultimately paved the way for humans to become the dominant species on Earth," he wrote in a commentary on the study.

(Collins has created a website at http://impact.ese.ic.ac.uk/ImpactEffects/Chicxulub.html which allows readers to see the effects of the asteroid impact.) (See pictures below.)

Scientists have long debated the cause of dinosaur extinction. Popular extinction theories over the last few decades include a super volcano, a gigantic asteroid and mass sickness spread over the Pangaea super continent.
Now, an international team of 41 scientists, including a University of Missouri geologist, have completed a lengthy investigation and determined the official cause of extinction.
Ken Macleod, associate professor of geological sciences in the University of Missouri's College of Arts and Sciences, said the group determined a single meteor near Chicxulub, Mexico killed off numerous plant and animal species across the globe nearly 65.5 million years ago. The full results of the study are published in this week's edition of "***Science***" magazine.
The discovery of the massive crater in Mexico during the early 90s served as a turning point in extinction study, Macleod said. In this recent study, the team analyzed the thickness and abundance of material in a thin layer of clay that formed 65.5 million years ago, known as the end of the Cretaceous Period.
That clay layer has been located at 350 sites around the globe, indicating a large displacement of minerals and other materials upon impact of the meteor. Another fact to support the impact theory is that those clay layers contain high levels of iridium, a rare Earthly element found to be common in asteroids.
Macleod said the team determined the space rock that killed the dinosaurs to be roughly six miles in diameter. The impact left a crater more than 110 miles in diameter, causing tsunamis, earthquakes with magnitudes greater than 11, fires, extended darkness, cooling temperatures and acid rain.
According to Macleod, the team ultimately ruled out the volcano theory because the volcanic activity occurred over hundreds of thousands of years and the dinosaur extinction was much faster and more catastrophic.

Estimated Chicxulub Parameters:
Projectile diameter: **12.00 km (= 7.45 miles)**
Projectile Density: **3000 kg/m^3**
Impact Velocity: **20.00 km per second (= 12.40 miles per second)**
Impact Angle: **90 degrees**
Target Density: **2700 kg/m^3**
Target Type: Liquid water of depth **500.0 meters (= 1640.0 feet)**, over crystalline rock.
Energy:
Energy before atmospheric entry: **5.43 x 10^{23} Joules** = **1.30 x 10^8 MegaTons TNT**
The average interval between impacts of this size somewhere on Earth during the last 4 billion years is **1.0 x 10^{7}years**
Major Global Changes:
The Earth is not strongly disturbed by the impact and loses negligible mass.
The impact does not make a noticeable change in the Earth's rotation period or the tilt of its axis.
The impact does not shift the Earth's orbit noticeably.
Crater Dimensions:
What are Transient and Final Crater Diameters?
When the projectile strikes the surface, it ejects rock from the surface, resulting in a crater. Shortly after the impact, the ground around the initially formed crater begins to collapse inward.
The Transient Crater Diameter is the distance from rim to rim of the crater that forms immediately after the impact, before the collapse begins.

The Final Crater Diameter is the distance from rim to rim of the crater once collapse has completed.

The crater opened in the water has a diameter of **141 km (= 87.7 miles)**.
For the crater formed in the seafloor:
Transient Crater Diameter: **85.7 km (= 53.2 miles)**
Transient Crater Depth: **30.3 km (= 18.8 miles)**

Final Crater Diameter: **154 km (= 95.4 miles)**
Final Crater Depth: **1.35 km (= 0.836 miles)**
The crater formed is a complex crater.
The volume of the target melted or vaporized is 4660 km^3 = 1120 $miles^3$
Roughly half the melt remains in the crater, where its average thickness is **808 meters (= 2650 feet)**.

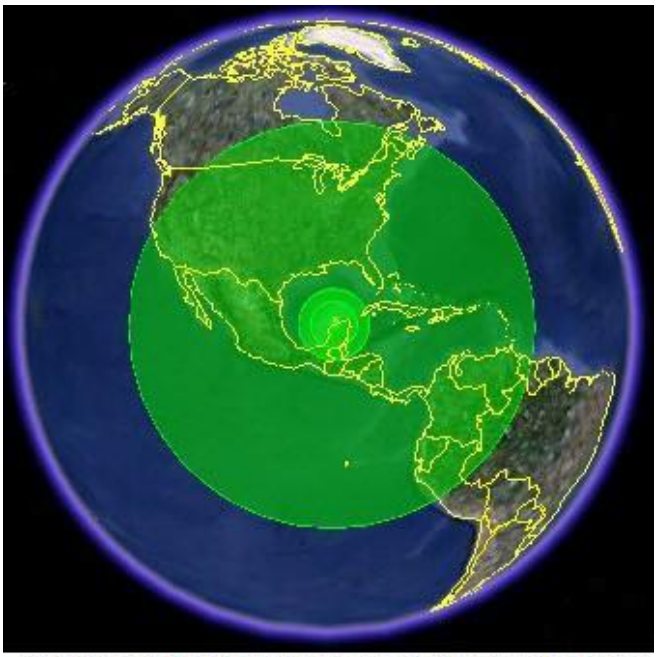
What is the air blast?
The energy due to the impact causes a distortion in the air. This distortion travels in the form of a wave. If the energy of the impact is very high, the wave may initially be a shock wave, travelling at a velocity greater than the speed of sound in air. The wave eventually decays into a sound wave travelling at 300 m/s (671 mph).
Peak overpressure is a measure of how much the pressure in the blast wave exceeds the atmospheric pressure of 10^5 Pa (1 bar). The air blast caused by the impact can cause a great deal of damage.

What is ejecta?
Debris excavated during the impact is deposited on the Earth's surface around the impact crater. This debris is called ejecta.
The average ejecta thickness is greatest at the transient crater rim and decreases as one over the distance from the rim cubed.

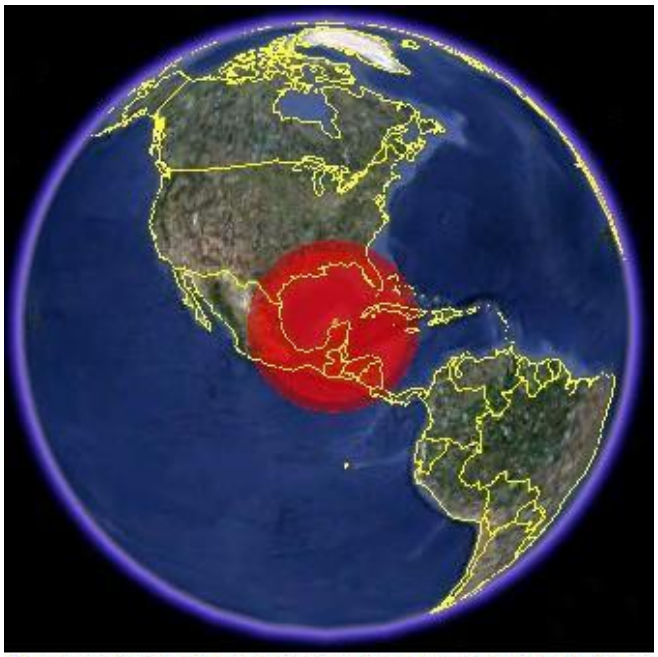
What is Thermal Radiation?
Terrestrial meteoroid impacts produce a cloud of hot vapor, termed the "fireball," which expands away from the impact point. The bulk of the thermal energy from this cloud is emitted when the fireball has expanded and cooled to a surface temperature of about 3000 degrees Kelvin.

Chicxulub Meteor Impact: Air Blast

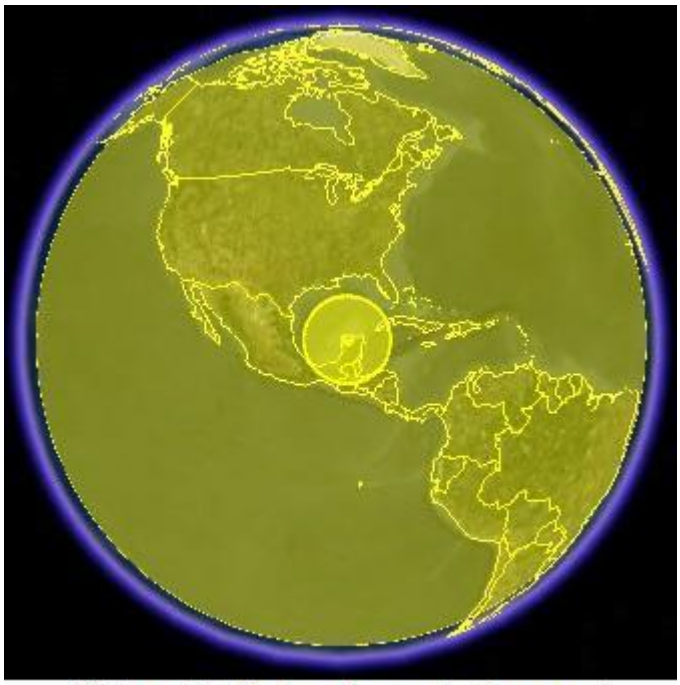
Chicxulub Meteor Impact: Ejecta



Chicxulub Meteor Impact: Seismic Shaking

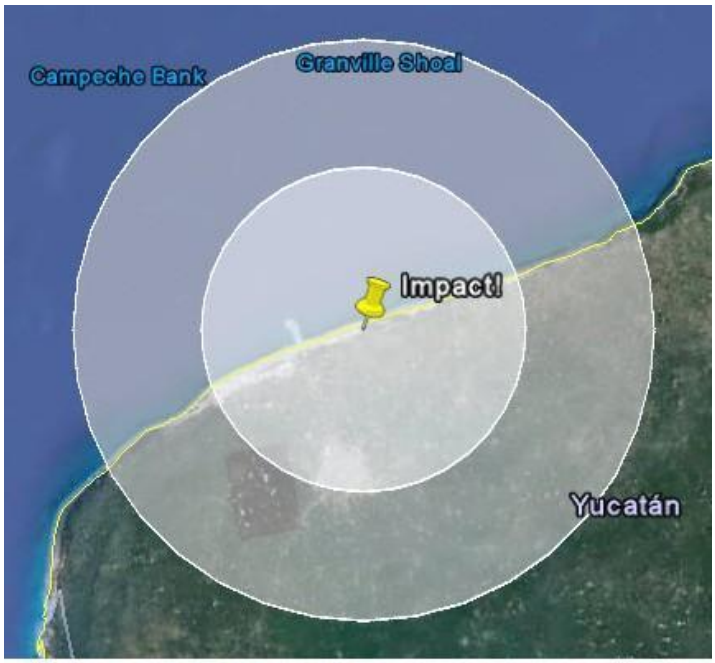


Chicxulub Meteor Impact: Thermal Radiation



Chicxulub Meteor Impact: Tsunami

Chicxulub Meteor Impact:
Crater Size & Location



Chicxulub Meteor Impact:
Crater Size & Location (Closer)

Artist's Impression of the first moment of Impact.