Seismic images show dinosaur-killing meteor made bigger splash

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The most detailed three-dimensional seismic images yet of the Chicxulub crater, a mostly submerged and buried impact crater on the Mexico coast, may modify a theory explaining the extinction of 70 percent of life on Earth 65 million years ago.

The Chicxulub crater was formed when an asteroid struck on the coast of the Yucatan Peninsula. Most scientists agree the impact played a major role in the “KT Extinction Event” that caused the extinction of most life on Earth, including the dinosaurs.

According to Sean Gulick, a research scientist at the Institute for Geophysics at The University of Texas at Austin’s Jackson School of Geosciences and principal investigator for the project, the new images reveal the asteroid landed in deeper water than previously assumed and therefore released about 6.5 times more water vapor into the atmosphere.

The impact site also contained sulfur-rich sediments called evaporites, which would have reacted with water vapor to produce sulfate aerosols. According to Gulick, an increase in the atmospheric concentration of the compounds could have made the impact deadlier in two ways: by altering climate (sulfate aerosols in the upper atmosphere can have a cooling effect) and by generating acid rain (water vapor can help to flush the lower atmosphere of sulfate aerosols, causing acid rain). Earlier studies had suggested both effects might result from the impact, but to a lesser degree.

“The greater amount of water vapor and consequent potential increase in sulfate aerosols needs to be taken into account for models of extinction mechanisms,” says Gulick.

The results appear in the February 2008 print edition of the journal *Nature Geosciences*.

An increase in acid rain might help explain why reef and surface dwelling ocean creatures were affected along with large vertebrates on land and in the sea. As it fell on the water, acid rain could have turned the oceans more acidic. There is some evidence that marine organisms more resistant to a range of pH survived while those more sensitive did not.

Gulick says the mass extinction event was probably not caused by just one mechanism, but rather a combination of environmental changes acting on different time scales, in different locations. For example, many large land animals might have been baked to death within hours or days of the impact as ejected material fell from the sky, heating the atmosphere and setting off firestorms. More gradual changes in climate and acidity might have had a larger impact in the oceans.

Gulick and collaborators originally set out to learn more about the trajectory of the asteroid. They had hoped the crater’s structure in the subsurface would hold a tell-tale signature. Instead, the structure seemed to be most strongly shaped by the pre-impact conditions of the target site.

“We discovered that the shallow structure of the crater was determined much more by what the impact site was like before impact than by the trajectory of the impactor,” says Gulick.

If scientists can determine the trajectory, it will tell them where to look for the biggest environmental consequences of impact, because most of the hazardous, shock-heated and fast-moving material would have been thrown out of the crater downrange from the impact.

Researchers at Imperial College in London are already using computer models to search for possible signatures in impact craters that could indicate trajectory regardless of the initial surface conditions at the impact site.

"As someone who simulates impact events using computers, this work provides valuable new constraints on both the pre-impact target structure and the final geometry of the cratered crust at Chicxulub," says Gareth Collins, a research fellow at Imperial College.

Source: University of Texas at Austin

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