OCEAN ◆ DRILLING ◆ PROGRAM

News Release

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WHAT CAUSED THE EXTINCTION OF DINOSAURS?

Scientists explore the effects of a meteorite collision with the Earth 65 million years ago

Miami, December 20 - One of the key events in Earth's geological history is the catastrophic extinction of the dinosaurs as well as about 70 percent of the then-living marine animal species. The extinction event occurred about 65 million years ago at a geological time referred to as the Cretaceous/Tertiary boundary, or K/T boundary for short. Although scientists still debate the cause of the extinctions, most favor abrupt, devastating environmental changes brought about by the impact of a large meteorite.

Much of the evidence for the impact comes from the sedimentary layers on the ocean floor, which are like pages in the history of our Earth. As in any history book, the Earth's history is divided into chapters, and each chapter terminates in a great dying or extinction of life. One of the greatest extinctions occurred at the end of the chapter known as the Cretaceous Period. During this period the dinosaurs had thrived, and indeed dominated the Earth on land as well as in the oceans and the sky. One day, 65 million years ago, the Earth was struck by a huge object that came hurling in from outer space at a speed of several tens of kilometers per second, or fifty to hundred thousand miles per hour. This object was either a meteorite or a comet, with a diameter of 10 km or more, and as it approached the Earth it would have appeared the same size as the moon when it was at a distance of about 1100 km from Earth, about forty seconds before it struck Earth's surface.

Amazingly, the site of the impact appears to be preserved at the northern tip of the Yucatan peninsula in Mexico. At the time of the impact, this was the site of a shallow and salty Yucatan sea, which had precipitated an abundance of calcium sulfate or gypsum sediments over many millions of years, forming an evaporite rock layer. The collision of the giant object with the Earth created an explosion of energy approaching a billion megatons, that carved out a 180-km-wide crater, called the Chixculub crater. The debris from this crater was thrown out to a distance of thousands of kilometers, and the finer-grained particles created a dust cloud around the Earth. At the same time, a great gas cloud of sulfur dioxide, carbon dioxide and water vapor spread through the upper atmosphere, originating from the melting and vaporization of the evaporite rock layer. It is likely that the very severe environmental effects and widespread dying at the end of the Cretaceous Period were not simply a consequence of the great size of the meteorite, but rather dictated by the highly unusual sediments where it struck the Earth: the meteorite hit the powder keg.

Evidence of the impact includes the proposed impact crater, ejecta from the impact, and other geological deposits, including the famous K/T boundary clay layer that is rich in iridium. The crater and most of the surrounding impact deposits are now buried beneath several hundred meters of sediments. Perhaps the best way for scientists to test the impact hypothesis and to measure the size, angle, and environmental effect of the impact is to study the sediments at and near the K/T boundary in the region around the impact site. This is where the Ocean Drilling Program enters the picture.

Sailing aboard the world's largest scientific drill ship, *JOIDES Resolution*, a research team of 50 scientists and technicians will spend the next two months drilling holes into the sediments on the floor of the Caribbean Sea. The ship will be drilling at five sites, one of which is near enough to the impact site that it is likely that deposits from an impact-generated tsunami will be recovered. Two of the other sites will examine K/T boundary sediments that occur further away from the impact site. The general goal at these sites is to drill completely through the sedimentary section and into the underlying basement rocks. In some places these sediments are over a kilometer thick and lie as deep as 4 km below the sea surface. In total, more than 90 million years of Earth's history should be recovered in the drill cores.

The scientists, using the ship's 12 laboratories to analyze core samples,will speed into action, interpreting a variety of scientific measurements in order to decipher this history. Additional care will be taken when examining the K/T boundary as well as other key intervals, which may hold records of ancient climatic, oceanographic, and biotic changes. In all, the drill core recovered will enable the scientists to pursue many important research topics that include studying:

- mechanisms of meteorite impact ejecta dispersal
- environmental consequences of impact aerosols and particle fallout
- catastrophic extinction events and biotic recovery
- episodes of moderate to extreme temperature changes
- the influence of tropical seas on global ocean history and climate evolution
- environmental consequences of regional tectonic change, including the opening and closing of oceanic gateways over the past 12 million years
- the role of the Caribbean in surface and intermediate water flow
- tropical climate variability during the last 250,000 years
- tropical-polar linkages in the ocean-climate system
- the origin and nature of the Caribbean basement rock

The Ocean Drilling Program is funded by the U.S. National Science Foundation, Canada, Australia, the European Science Foundation Consortium, Germany, France, Japan, and the United Kingdom to investigate such topics as earth's history and evolution, climate change and formation of the ocean crust.

Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES), an international group of scientists, provides scientific planning and program advice. Joint Oceanographic Institutions, Inc., a nonprofit consortium of 10 major U.S. oceanographic institutions, manages the program.

Texas A&M University, science operator, operates and staffs the drill ship that retrieves core samples from strategic sites in the world's oceans. Lamont-Doherty Earth Observatory of Columbia University is responsible for downhole logging.

Note: U.S. members of JOIDES are: University of California at San Diego, Columbia University; University of Hawaii, University of Miami; Oregon State University; University of Rhode Island, Texas A&M University, University of Texas at Austin; University of Washington, and Woods Hole Oceanographic Institution. The European Science Foundation Consortium consists of Belgium, Denmark, Finland, Iceland, Italy, Greece, The Netherlands, Norway, Spain, Sweden, Switzerland and Turkey.

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