Dinosaurs dominated the continents during the Mesozoic Era. Now they prey on the imaginations of children of all ages. It's hard to accept that beings as powerful and varied as dinosaurs existed and were wiped out. But the fossil record is clear—when the Mesozoic came to a close, dinosaurs became extinct. Not a single of the numerous dinosaur species survived into the Cenozoic Era. Not only did the dinosaurs go, but about 75% of all plant and animal species, marine as well as terrestrial, were extinguished. This was one of the Earth's "great dyings"—an even "greater dying" was when the Paleozoic Era ended with the extinction of over 95% of all species. Most major extinctions have been gradual and scientists usually have attributed them to climate changes.

A decade ago, geologist Walter Alvarez, his father, physicist Luis Alvarez, and two other scientists proposed a hypothesis that the dinosaur extinction was caused by the impact of an asteroid. This was based on the chemical analysis of a thin layer of clay marking the boundary between the Mesozoic and Cenozoic eras (usually referred to as the K-T boundary—it separates the Cretaceous [K] and Tertiary [T] periods). The K-T boundary clay was found to have about 30 times the amount of the rare element iridium as is normal for crustal rocks. Iridium is relatively abundant in meteorites and other extraterrestrial objects such as comets, and the scientists suggested that the iridium was brought in by an extraterrestrial body.

The scientists proposed a scenario in which an asteroid 10 kilometers in diameter struck the earth. This generated a gigantic dust cloud, which darkened the earth long enough to disrupt plant life growth and reproduction as well as drop the temperature of the earth worldwide. Creatures perished because of the disruption in their food supply or because of their inability to withstand the sudden climate change.

Other scientists proposed an alternative hypothesis blaming exceptional volcanic activity for the extinction as well as for the high iridium in the K-T boundary layer. (Some Hawaiian eruptions have a high iridium content.) Debate between proponents of the two alternate hypotheses became heated and further evidence to support each was sought. K-T layers throughout the world were found to have grains of quartz that have been subjected to shock metamorphism (see Astrogeology Box 15.1), supporting the asteroid hypothesis. Concentrations of some elements common in volcanic rocks but not in meteorites were found in the K-T boundary layers, supporting the volcanic hypothesis. Critics of the asteroid hypothesis also pointed out that the dinosaurs had been on the decline for millions of years before the end of the Cretaceous. On the other hand, organisms in the oceans apparently died out very rapidly.

The asteroid hypothesis advocates predicted that a large meteorite crater should be found someplace on earth that could be dated as having formed around 66 million years ago when the Mesozoic ended.

In 1990, evidence was found suggesting a large (120 km in diameter) crater centered off the coast of Mexico's Yucatan peninsula at a place called Chicxulub. The alleged crater at Chicxulub, now buried beneath sediment, would be the right size to have been formed by a 10-kilometer asteroid. Geologists were quick to search for and present evidence in support of the Chicxulub crater. Among evidence cited was sediment that appeared to have been deposited in various locations by giant sea waves. Also cited were widespread microscopic spheres of glass (now weathered into clays) that formed when rock melted from the impact and droplets were thrown high into the air.

Geologists checking Mexican records compiled during drilling offshore for oil find there are breccias in the Chicxulub area. Breccias, due to meteorite impact, are common at known meteorite craters. Also, the age of the impact seems to be correct for the K-T boundary. The evidence for an asteroid impact is overwhelming. However, the impact may not be entirely to blame for dinosaur extinction.

We do know that climates were changing toward the end of the Cretaceous and dinosaur species were decreasing. Perhaps exceptional volcanic activity led to climate changes that were not favorable to dinosaur survival and the asteroid dealt the final unfortunate blow to dinosaurs.

"Unfortunate" is from the perspective of dinosaurs, not humans. The only mammals in the Cretaceous were inconsequential, mouse-sized creatures. They survived the K-T extinction and, with dinosaurs no longer dominating the land, evolved into the many mammal species that populate the earth today, including humans.

Related Web Resources

Dinosaur Extinction.
http://ericir.syr.edu/Projects/Newton/12/Lessons/dinoextn.html

McGEARY, DAVID. PHYSICAL GEOLOGY, 4TH EDITION, NEW YORK 2001, McGRAW-HILL