

COLLISION OR COINCIDENCE?

Extinction is the eventual fate of all species. Indeed, 99% of all species ever on the earth are now extinct. Often, the rate of extinction is low; however, on several occasions in earth's history, rates of extinction have increased dramatically, resulting in the total extinction of many formerly successful taxa. For example, at the Permian/Triassic boundary, a mass extinction resulted in the loss of 80 to 90% of all animal species. About 65 million years ago, the dinosaurs, along with 50% of all other animal species, became extinct. This Cretaceous/Tertiary extinction occurred over a period of tens of thousands to several million years. From a geological perspective, these extinctions are "sudden." How the age of the reptiles ended has been the subject of speculation for many years. Various hypotheses involving catastrophic or gradual change have been proposed.

Some scientists have suggested that asteroid impacts or periods of intense volcanic activity are catastrophic events that have caused mass extinctions. Both events may have injected large quantities of dust into the air that shaded the earth's surface, reducing photosynthetic production, and thus, food for animals.

The presence of the element iridium in rock strata from the Cretaceous/Tertiary boundary and other periods of mass extinction is the primary evidence supporting the catastrophic hypotheses. Iridium is a primarily extraterrestrial element that is deposited during asteroid impacts with the earth. Some deposits may also result from volcanic activity. Opponents of the catastrophic hypotheses

do not deny that asteroid impacts or periods of volcanic activity resulted in iridium deposits on the earth. They question, however, whether the catastrophes are responsible for mass extinctions. They point out that the paleontological record indicates that extinctions are not as abrupt as implied in catastrophic hypotheses. Extinctions apparently occurred over tens of thousands of years, not tens of years. In addition, catastrophic events would be expected to affect all animal groups more or less equally, which was not the case with the Cretaceous/Tertiary extinction. For example, dinosaurs became extinct, but crocodiles, turtles, birds, and early mammals did not.

Numerous hypotheses propose gradual, selective changes as explanations for mass extinction. Some of these involve climatic changes that continental drift could have induced. In the Cretaceous period, warm, shallow seas covered 70% of the present land area. By the end of the Cretaceous period, these seas were reduced to 15% of the present land area, resulting in the reduction of habitat for shallow-water marine organisms, a decrease in atmospheric temperatures, and dissection of land areas by newly formed rivers. Climatic and habitat changes such as these could have resulted in extinctions over periods of tens of thousands of years.

Regardless of what hypothesis (or hypotheses) of mass extinction is correct, this question is a good example of how interest fueled by controversy stimulates scientific inquiry. The gradualism/catastrophism debate has led to new, innovative ideas on the origin, evolution, and extinction of taxa.