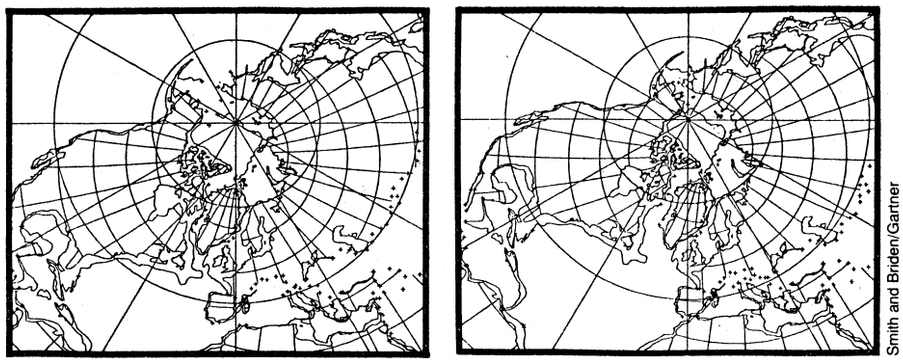
Mass Extinction: More Theories

Nearly 65 million years ago, dozens of species of marine organisms and land animals — including dinosaurs and flying reptiles — disappeared in a geologic instant. Try as they might, scientists have yet to explain the mass extinctions. Now, on the heels of an extraterrestrial explanation (SN: 6/2/79, p. 356), comes a more down to earth theory.

According to Stefan Gartner of Texas A & M University, the extinctions were caused by the spillover of a once-isolated, fresh water Arctic Ocean, which flooded the world's oceans, reduced their salinity and killed susceptible marine species. And, in a geological double play, the flush of fresh, freezing water altered the world's climate sufficiently to put the death squeeze on less adaptable land animals. Unlike other models, Gartner's theory explains both the land and marine extinctions using a single mechanism.

Gartner first developed his theory based on deep sea cores from the North Sea. At the point in the cores marking 65 million years ago, Gartner and John Keany of the Phillips Petroleum Co. found, as expected, that the planktonic plants and animals of the Cretaceous period (136 million to 65 million years ago) were wiped out and replaced by species characteristic of the Tertiary period (65 million to 1.8 million years ago.) In what should be the Tertiary part of the core, however, the Cretaceous organisms suddenly reappeared. The older fossils persisted until again, this time permanently, they were replaced by Tertiary plankton.

To Gartner and Keany, this sequence indicated that whatever catastrophe occurred was highly selective — it seemed not to permanently harm the Tertiary species — and that, in the North Sea at least, it happened twice. In a paper published last year (GEOLOGY, v.6, no. 12), they explained their proposed mechanism. According to Gartner, during the Late Cretaceous (about 80 million years ago), the Labrador Sea, the Baffin Bay and the Bering Strait had not opened. The Arctic Ocean, as a result, was completely isolated from the rest of the world's oceans. Fresh water runoff from Europe, Asia and North America into the Arctic Ocean greatly reduced its salinity. About 65 million years ago, a passage temporarily opened between Greenland and Norway and some of the fresh water spilled into the North Sea. This event is marked by the abundance of Tertiary-type species, the researchers say, which could survive the lower salinity. When the opening became permanent, all of the less salty Arctic Ocean spilled into the Atlantic and made its way to the Pacific, eventually covering all the oceans with a layer of brackish water. In a "triple whammy," says Gartner, the marine organisms died: some due to an intolerance of low salinity, others from depletion of dissolved oxygen and still others from disruption of the food chain.



Smith and Briden/Gartner

Continental position around Arctic Ocean 80 million years ago (right) shows how ocean may have been isolated. Later flooding could have altered other oceans (left).

Gartner gave the second installment of the theory — the consequences for land animals — at the recent meeting of the Geological Society of America in San Diego. With Texas A & M meteorologist James P. McGuirk, Gartner outlined the climatic effects of the Arctic spillover model: An isolated Arctic Ocean was probably 15°C colder than the rest of the Cretaceous oceans, they say. Based on their model of the global circulation patterns of the Cretaceous, a sudden rush of cold water of the volume of the Arctic Ocean would cause a world ocean temperature drop of nearly 10°C. The colder water and consequently colder air would cause a decline in precipitation—possibly by as much as 57 percent, they say. The resulting intense drought, temperature drop and greater seasonality would cause the lush tropical vegetation of the high latitudes to disappear. And when the food supply disappeared, the researchers say, so did the more susceptible, less adaptable animals.

Like all theories of the Cretaceous extinctions, however, this one has its problems. Detractors disagree primarily with the theory's basis — the North Sea cores. Some researchers interviewed by SCIENCE NEWS felt that the Cretaceous species' reappearing act is due to a disruption and resettlement of the sediments, which caused the record to be misinterpreted. Gartner, however, disputes redeposition, saying the section in question is too thick —180 feet—to have been redeposited and that mixing is not seen elsewhere in the cores. Further, Gartner says, recent research by two separate groups has found oxygen and carbon isotope evidence that appears to indicate the presence of a fresh water layer in the Cretaceous-Tertiary oceans. Gartner admits, however, that he lacks direct evidence that the Arctic Ocean was indeed fresh; cores have yet to be recovered there and critics are skeptical that so large a body of water could become fresh water in such a relatively short time span. For now, like other explanations of the extinctions, it remains unproved. And as one researcher said: "It was an elegant model based on the evidence. Now, the evidence has been undercut but the model still seems to work. And it's the only one we really have that explains the whole thing." □

T cells' complicity in autoimmunity

It used to be thought that autoimmune diseases were the result of antibodies erroneously attacking parts of the body rather than viruses, bacteria or some other foreign enemy. But now it appears that certain immune cells, suppressor T cells, also play a role in autoimmune diseases. The fine interactions between autoantibodies and suppressor T cells in various autoimmune diseases are still not totally understood, but the complicity of suppressor T cells in autoimmune diseases may offer a new strategy for treating such diseases.

In 1975, a Japanese researcher reported that defective suppressor T cells are present in patients with systemic lupus erythematosus, a chronic disease that is characterized by fever, malaise, skin rash and arthritis, and that sometimes fatally attacks the kidneys. Patients with lupus also have been found to have antibodies formed against genes in their kidney cells; so it may be that both defective suppressor T cells and autoantibodies are implicated in this disorder. In 1978, Anthony J. Strelkauskas and co-workers at Harvard Medical School reported that patients with