

SCIENCE NEWS OF THE WEEK

Dinosaur Demise: Extraterrestrial Source?

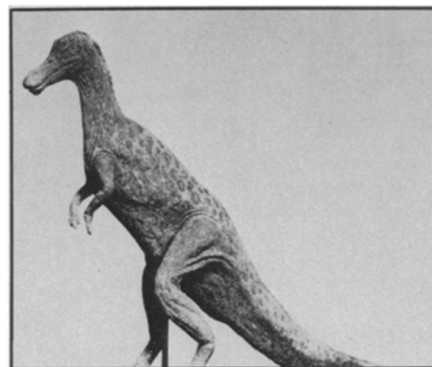
In the geologic timescale, the break between the Cretaceous and Tertiary periods, 65 million years ago, is marked distinctly by the sudden disappearance of about 50 percent of the genera, including dinosaurs, that inhabited earth at that time. No satisfactory explanation has ever been proposed for such a vast extinction. No sweeping climatic changes are recorded in the sediments, and theories that dinosaurs simply lost the evolutionary struggle do not account for the extinction of a multitude of other creatures, nor for the apparent suddenness of their demise. For lack of anything else, some scientists have proposed that an extraterrestrial event such as a meteorite swarm, a giant solar flare or a supernova could — either directly, by radiation, or indirectly, by inducing climatic changes — have been responsible. But hard evidence in support of any theory, conservative or outlandish, has been lacking.

Now, data reported at the meeting of the American Geophysical Union in Washington this week, while not solving the mystery, make the extinction look "more extraterrestrial than terrestrial," according to researcher Walter Alvarez of the University of California at Berkeley. Alvarez described a sudden jump in the amount of iridium — an element that is about 1,000 times more abundant in extraterrestrial material than in the earth's crust — in the boundary layer between Cretaceous and Tertiary sedimentary rock. Because the earth's own iridium is concentrated at the core, all of the element found in the crust must have an extraterrestrial origin, drifting in from space to settle in sedimentary rock or added violently by meteors. The sudden increase found by the researchers — about 25 times the background amount of iridium — is exactly coincident with the disappearance of the dinosaurs and other species and indicates that some large extraterrestrial event may have been involved in their extinction.

The finding, says Alvarez, was totally unexpected. He and co-workers Luis Alvarez (Walter Alvarez's father), Frank Asaro and Helen V. Michel were attempting to find the sedimentation rates of Cretaceous and Tertiary rocks from Gubbio, Italy, using the technique of neutron activation, in which certain elements such as iridium will pick up a neutron and then decay, giving off detectable gamma rays. (Rocks from Gubbio contain the most complete record of the Cretaceous-Tertiary boundary, according to Alvarez.) Though the method was useless in determining sedimentation rates, the researchers found the spectacular jump in the amount of iridium

— from $.25 \times 10^{-8}$ grams per cubic centimeter in the Cretaceous layer to 6×10^{-8} g/cm³ in the boundary layer. In the Tertiary layer, 20,000 to 30,000 years later, the iridium level returns to normal.

A terrestrial explanation for the increased iridium, such as a chemical change in the sea water that may have altered the sedimentation rate of iridium at the boundary layer, is "the least possible," says Alvarez. But extraterrestrial causes seem improbable as well. Were a collision with an asteroid or meteorite responsible, it would have had to be 10 kilometers in diameter, he says. The postulated supernova would have to have occurred one-tenth of a light year away, and the probability of that event is 10^{-10} in 100 million years, according to Alvarez. The supernova theory, at least, is testable. The signature of a supernova is the presence of plutonium 244, an isotope with a



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half life of 83 million years, and a ratio of the stable isotopes of iridium that is different from that found on earth. The presence of either — which can also be determined by neutron activation — "will clinch" the supernova theory. Preliminary results, however, "kind of look like it's not" a supernova that caused the mass extinction, Alvarez reported. "The mystery is still a big mystery," he told SCIENCE NEWS. "This is a new piece of evidence in the pot. It provides constraints on the solution. ... We're not insisting it's extraterrestrial; it just looks more extraterrestrial than terrestrial." □

Naturally created holes in the sky

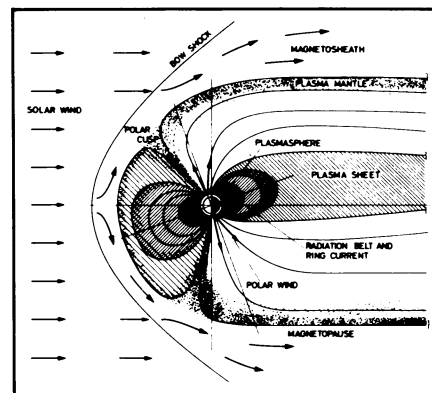
Solar wind, the sun's stellar gasses that lash out into the solar system, is thought to produce auroras — luminous forms in the night sky. The earth's magnetic field lines carry particles of solar wind (mainly electrons) into the ionosphere and lower atmosphere where they interact with ions and release radiation.

The solar wind also may cause gaping "holes" in the ionosphere, similar to those created accidentally by the exhaust systems of the Saturn V rockets in 1973 and purposely last year by a pair of experimental sounding rockets (SN: 4/22/78, p. 244), said Frederick Rich at the meeting of the American Geophysical Union. And these holes may prove useful to radio astronomers.

The effect of rocket exhaust on the ionosphere was to produce positive molecular ions (H₂O⁺ and OH⁺) that reacted with local free electrons. The result was a neutral field — a "hole" of missing charge, lasting more than an hour and extending several hundreds of kilometers.

Experimenters have produced such a field artificially by "seeding" the ionosphere with rocket-borne water and carbon dioxide. Again, "holes" appeared, about 50 kilometers wide.

Rich had been reviewing data produced by the Air Force's S3-2 satellite and discovered in December 1978 a "strong trough" in the ionosphere's electric field. The trough corresponded to a solar wind substorm (which happens between two and 20 times a day) and to the appearance of auroras. The trough could mean only



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one thing — the absence of charge in a small region of the ionosphere, says Rich.

Rich speculates that the substorm compressed the plasma sheet, which usually flows out behind the earth, to such an extent that the sheet pressed into the plasma sphere surrounding the earth. This caused an electric field that traveled down the earth's magnetic field lines, carrying ionospheric ions with it and leaving a neutral area 50 to 70 kilometers from north to south and 2,000 to 3,000 kilometers from east to west. The gap filled by diffusion in about 30 minutes.

Because the ionosphere is used to reflect radio signals, low-frequency radio communication was disturbed during the 30-minute gap. But to radio astronomers measuring background radiation, radio emissions from Jupiter, or the galactic center, these "holes" may well become windows into outer space. □