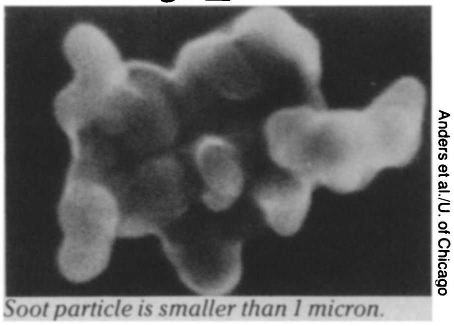
Wildfires: Apocalypse Then and Now

Just when it was looking really bad for the dinosaurs, it got worse. Another element has been added to the already dire scene painted of the world 65 million years ago. Some scientists posit that is when an asteroid or torrent of comets pelted the planet, wiping out the dinosaurs and hordes of other life (SN: 6/2/79, p. 356). In addition to the possible dust clouds, blast waves, tidal waves and poisonous gases triggered by the impact, researchers at the University of Chicago have added yet another deadly plague: continent-size wildfires churning out massive clouds of soot that engulfed the globe.

Their findings not only enhance understanding of the forces that drove the dinosaurs to extinction, but they provide a much needed quantitative basis for studies of future cataclysms that could befall the earth. In particular, "these data suggest that some of the assumptions used in nuclear winter scenarios were too optimistic," warn the U. of Chicago's Edward Anders, Roy S. Lewis and Wendy S. Wolbach in the Oct. 11 SCIENCE.

Since high levels of iridium, normally rare in the earth's crust, were discovered in the "K-T" layer marking the geologic boundary between the Cretaceous and Tertiary periods, scientists have been exploring the possibility that the iridium came from a meteorite or comet shower. In order to determine what kind of asteroid might have struck the earth, Anders's group set out to analyze the noble (inert) gas content of clay layer samples, because the ratios of these gases provide a distinctive signature of their origin. One step in this process is to chemically isolate carbon from the clay layer since meteoric noble gases tend to be concentrated in such carbon residues.

But after the chemical etching, the researchers noticed that they were left with an unusually large amount of carbon. The concentration of elemental carbon in the residue was 4 to 5 times higher than that contained in rocks above and below the K-T boundary and it was 4 to 25 times greater than that found in modern marine sediments. Scanning electron microscopy of the samples revealed what the researchers think is soot — small carbon particles made in irregular and fluffy shapes and sometimes formed in chain-like clusters. According to Anders these shapes and configurations are known to arise only from forest fires or the burning of fossil fuel. The researchers believe that the combusted organic matter came from living plants and animals and not fossil material at the impact site or from the asteroid itself; the asteroid, they explain, would have supplied oxygen for binding up the carbon atoms instead of the carbons linking themselves to form soot. Anders says that this conclusion is supported by the isotopic analysis of the carbon samples done recently by two British researchers.



Anders et al./U. of Chicago

Soot particle is smaller than 1 micron.

The scientists suspect that wildfires could have been ignited by the heat from a fireball and a cloud of hot rock particles generated by the impact. Even if the asteroid had fallen into an ocean, as many scientists presume, it could have triggered fires on a continent thousands of kilometers away. Once started, a fire could spread over an entire continent, and the resulting winds would disperse the soot worldwide, say the researchers.

Indeed, Anders's group found soot from widely spaced sites in Denmark, Spain and New Zealand. Drawing on other evidence suggesting that the asteroid hit in the Bering Sea and that the swath of greatest plant extinctions occurred in the Northern Hemisphere between the Rocky Mountains and the Ural Mountains, Anders speculates that the fires spread through what is now Siberia and the United States until they were stopped by the two mountain ranges. He estimates that the fires burned up about 4 percent of the total carbon biomass of precivilized times.

A large wildfire would be lethal to animals and plants in its immediate path, but the soot from the fire would also amplify many of the other global extinction mechanisms already proposed. For example, soot would be much more effective than dust at blocking out sunlight and initially cooling the planet. And because soot washes out of the air more slowly than dust, it would prolong these effects as well. The fire would also produce toxic gases and the carbon dioxide it generated would greatly enhance the slow greenhouse warming of the planet. "Without the fire, life would be blasted to death, or frozen, or starved or steamed to death," says Anders. "But with the fires, it could also be burned or choked to death."

While the researchers found an unusually large amount of carbon residue in their samples, they also measured a surprisingly minuscule amount of noble gases. Typically, much more meteoric noble gas survives the vaporizing effects of an impact by being trapped in particles of a dust train which forms when the meteorite pierces the atmosphere. But in this case, Anders thinks that the impact was so large and explosive that the giant fireball it triggered swallowed all of this train and vaporized most of the gases.

The recent paper has two important consequences, one for the beginning of life and one for its possible end. The relative dearth of noble gases suggests that if life orginated, as some believe, from organic matter delivered to the earth by asteroids, these bodies would have to have been relatively small. And because small bodies contain far less organic mass than do large ones, the likelihood that life on earth was sparked extraterrestrially is diminished, according to Anders.

The recent results also make the picture of the world after a nuclear war (SN: 12/22 & 29/84, p. 397) even more bleak. Although not directly comparable (because the impact is thought to have been 10,000 times more powerful than a nuclear war), "The ghastly experiment done by nature 65 million years ago," says Anders, produced soot much more efficiently than has been assumed in past studies of post-nuclear fires — indicating that the resultant cooling produced by a nuclear war would be more pervasive and long-lasting than projected. "Even the pessimists were not pessimistic enough about nuclear winter," he concludes. —*S. Weisburd*

Shuttle 4's secret debut

Atlantis, fourth member of America's space shuttle fleet, made its debut Oct. 3 when it took off on only the second classified, military, manned space flight in the history of the U.S. space program. Four days later, after what was widely reported to be the deployment of two DSCS III communications satellites for the Defense Department, the craft landed safely at California's Edwards Air Force Base.

The satellites, said to be resistant to jamming and to the electromagnetic pulse (EMP) of nuclear blasts, are believed to have been deployed to geostationary orbit atop a single rocket, from which they would then separate to their assigned positions.

Atlantis, lighter in weight than the three other shuttlecraft, has also been strengthened to handle the higher rocket thrust required for launchings to polar or near-polar orbits from the West Coast, where a Defense Department shuttle-launch facility is now being built at Vandenberg Air Force Base in California. □