New signs of world upheaval at K-T

In sediments drilled from the bottom of the Pacific Ocean, a geologist has found evidence that at least two large bodies slammed into the Earth at the end of the Cretaceous period, 66 million years ago. Known as the Cretaceous-Tertiary (K-T) boundary, this time marks the extinction of a significant portion of living species, including the dinosaurs. Other scientists examining sediments from the ocean floor near Antarctica report they have discovered signs that Earth's climate cooled just prior to the boundary.

During the last decade, an often-vitriolic debate concerning the causes of the K-T extinctions has spread through the fields of geology and paleontology and into many other scientific disciplines. As has been the case with other such finds, these new pieces of evidence, presented last week at the meeting of the Geological Society of America in Denver, prompted both enthusiastic and skeptical responses.

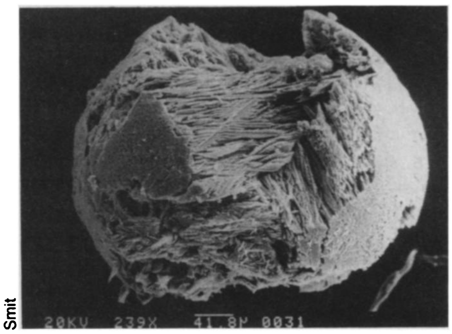
Jan Smit of Free University in Amsterdam reports finding tiny spherical objects in sediments pulled from an Ocean Drilling Project hole east of Japan. These spherules are unusual for the K-T boundary because they are the first found to contain clinopyroxene, a mineral rich in magnesium and calcium.

Smit proposes that the spherules are microtektites, little balls formed when a meteorite or comet strikes the planet and sends a shower of molten rock specks into the atmosphere, where they cool quickly and fall back to Earth.

Because of their composition, the purported microtektites suggest the extraterrestrial body crashed into a basaltic rock, probably on the ocean floor. Other pieces of evidence, such as pressure-shocked grains of quartz found around the world, point to an impact in silica-rich rock on land (SN: 5/16/87, p.309). Echoing a theory that has recently gained popularity among some scientists, Smit resolves the data diversity by suggesting that at least two bodies hit Earth.

He and his colleagues previously found spherules from the K-T boundary in other parts of the world, but these have proved problematic. They resemble microtektites in shape but contain minerals that form at low temperatures. Some researchers suggest microbes in the seafloor sediments created the spherical objects, while Smit contends they are microtektites that were altered during their long stay under thick sediment piles.

"The new thing about these clinopyroxene spherules is that they could only have formed at high temperatures over 800°C," Smit says. "Since they are definitely distinct from volcanic stuff, it's clear that they are something melted on impact, ejected from the crater and then strewn out over the whole world." He suggests that many of the other types of microtektites from the K-T boundary originally contained clinopyroxene before they were altered. Those from Hole 577 retained their true content, he says, because they sat under a thin layer of sediments.



Smit

Clinopyroxene crystals suggest this spherule was formed by impact of extraterrestrial body with Earth. Scale bar is 42 microns.

Geologist Walter Alvarez from the University of California, Berkeley, sees Smit's spherules as more evidence in support of multiple crashes. A single meteor may have split into pieces as it neared Earth, or distinct bodies could have hit the planet within thousands of years of each other, says Alvarez, who along with his father, Luis Alvarez, first proposed in 1980 that impacts caused the K-T extinctions.

But Bruce F. Bohor of the U.S. Geological Survey in Denver contends the clinopyroxene spherules do not necessarily imply a second crash. Because rocks on land contain some basaltic material, a single impact could have created both the shocked quartz and the spherules, he says.

Also at the Denver conference, Lowell D. Stott and James P. Kennett from the University of California, Santa Barbara, presented evidence that 200,000 years before the K-T boundary, Earth's climate suddenly cooled. They studied Ocean Drilling Project sediments from Antarctica's Weddell Sea. To get a temperature record of the water at the end of the Cretaceous period, they analyzed oxygen isotopes in the preserved shells of one-celled ocean organisms.

The oxygen isotopes indicate that before the marine K-T extinctions, the surface and bottom waters near Weddell warmed briefly and then cooled by 1° to 2°C. While the bottom waters rewarmed after the boundary, the surface waters never regained their higher temperatures. These new findings, in conjunction with records from other oceans, indicate that Earth's climate cooled immediately before the boundary. Still, says Stott, this does not help scientists decipher which of the rival catastrophes — impacts or volcanic eruptions — caused the K-T extinctions. *— R. Monastersky*

Subsea volcanoes found near Hawaii

Using a high-resolution sonar to shoot pictures of the ocean bottom, geologists have discovered extensive young lava flows several hundred kilometers from the Hawaiian islands. The find may force scientists to revise their ideas about the volcanic system that formed this island chain in the mid-Pacific.

"These were totally unknown until last April," says Mark Holmes of the U.S. Geological Survey (USGS) in Seattle, Wash. "The surface area of the flows that we've mapped is twice the size of the subaerial [above sea level] portions of the major Hawaiian islands, so it's really a phenomenal amount of material that's erupted."

These findings emerged from a continuing USGS project to map the Exclusive Economic Zone, the 200-mile-wide border extending from all U.S. coastlines. At its heart, the project relies on the GLORIA sidescan sonar, which uses sound waves to create detailed pictures of the seafloor. Holmes and his colleagues reported their discoveries last week in Denver at the meeting of the Geological Society of America.

The lava flows appear on the sonar images because they are young and covered only by a thin veneer of sediment. The relatively rough lava surface reflects more sound energy than the surrounding seafloor, which is topped by a thick sediment layer.

Based on samples dredged from the bottom as well as the lack of cover on the lava, researchers believe some of the flows may date back only 50,000 to 200,000 years, which is younger than most eruptions along the major Hawaiian islands, Holmes says.

According to widely accepted theory, the Hawaiian islands and the chain of Emperor seamounts to the northwest all formed as the Pacific plate passed slowly over a stationary "hotspot" in the Earth's upper mantle, which is fed by a plume of molten rock rising from deeper in the mantle. The island of Hawaii is now leaving the hotspot while a new volcano, Loihi, is starting to grow through underwater eruptions southeast of the "big island."

Until now, though, scientists thought the hotspot fed a small geographic area that corresponds to the main axis of the islands, so new islands would pop up all in a line, says Holmes. If these recently discovered lava flows are linked to the hotspot, then volcanic plumbing in the area reaches outside the classical hotspot boundary. By pulling up samples of the basalt erupted in the flows, scientists will be able to date the flows and compare this material to that found on the islands. *— R. Monastersky*