SCIENCE NEWS of the week

Mass Extinctions and Sister Stars

Several months ago, two scientists from the University of Chicago reported that roughly every 26 million years, something so perturbs the planet that many life forms disappear forever. No earthly physical or biological mechanism is known to occur at 26-million-year intervals. The answer, they suggested, lies far afield, in the solar system or galaxy, or elsewhere in the cosmos (SN: 10/1/83, p. 212). Now, several groups of scientists have come up with explanations for the mass extinction cycles. One hypothesis is that the periodic passage of the sun through the arms of the Milky Way disturbs the comets whizzing within the solar system, sending some of them vaulting toward the earth. Another idea is that the sun has a sister star that exists either in the visible or invisible (infrared) parts of the light spectrum. When its orbit brings the star closest to the sun, its gravity too would upset the comets, leading to blinding, and deadly, comet showers on earth.

The Milky Way hypothesis, advanced by Michael R. Rampino and Richard B. Stothers of NASA Goddard Institute for Space Studies in New York, focuses on the known excursions of the solar system through the arms of the galaxy — star-laden fingers that lie along the galactic plane. The solar system makes this passage about every 33 million years, give or take 3 million years. The scientists suggest that the extinctions occur as the solar system penetrates medium to large-sized clouds of interstellar molecular dust. These clouds could pollute the earth's upper atmosphere with hydrogen or, more likely, could upset the gravity of the comets in the inner solar system, causing some of them to hit the earth. Such impacts are widely believed to have catastrophic effects on the earth's atmosphere and biota (SN: 1/12/80, p. 22; 11/14/81, p. 314).

When the Goddard reseachers examined the statistical data on extinctions compiled by David Raup and John Sepkoski of Chicago, they included only the nine strongest extinction events of the 12 identified. The mean time interval between those mass extinctions is about 30 million years—about the same interval as the encounters with galactic arms.

The other prevailing hypothesis supports the long-recognized possibility that the sun is a binary star, traveling through space with a small but faithful companion. Daniel P. Whitmire of the University of Southwestern Louisiana in Lafayette, and Albert A. Jackson IV of Computer Sciences Corp. in Houston suggest that the 26-million-year cycle is caused by the movements of a black or brown "dwarf" — an invisible star with a mass about seven percent that of the sun. Every 26 million years, they say, the star's highly elliptical orbit brings it closest to the sun. Its gravity disturbs the cloud of comets that is most dense in our solar system's center.

In 1981, J.G. Hills of Los Alamos National Laboratory in New Mexico reported that a star could pass through this comet cloud and cause comets to rain through the solar system. "What is new is doing it with a companion and doing it periodically," Whitmire says. Based on Hills' data, every time the companion comes into the densest part of the solar system's comet cloud, a billion comets or more would streak past the earth during the shower's million-year duration. About two dozen of these could be expected to hit the earth.

Other researchers—Richard Muller and Marc Davis at the University of California at Berkeley, and Piet Hut of the Institute for Advanced Studies in Princeton, N.J.—also theorize that the sun is part of a double star system, saying that the star is faint but visible and has a more regular orbit than Whitmire and Jackson propose. "The double star system is the only plausible model," says Muller, who calls the companion star "Nemesis." Muller and his colleagues also considered the idea that the extinctions are caused by the solar system's motion through the galactic plane, but discarded it because, he says, the timing is wrong. "We happen to be in the middle of the galactic plane right now, so one would expect an extinction," he says. The most recent extinction revealed by the fossil record occurred about 11 million years ago, leaving about 15 million years until the next can be expected.

Researchers hope to identify a star that travels with the sun, with the mass and orbit needed to explain the extinction cycles. In the meantime, the evidence that mass extinctions are caused by impacts of the earth with large extraterrestrial bodies is stronger than ever. Rampino and Stothers, and Muller and Walter Alvarez, also at Berkeley, have established that the craters that pockmark the planet also formed in cycles. Rampino and Stothers say the craters are spaced at 31-million-year intervals; Muller and Alvarez say the craters formed every 28 million years. But for now, the essential message is that some of the most notable disappearing acts in life history, including the one 65 million years ago when the dinosaurs last were seen, occurred at about the same times that foreign bodies hit the earth.

— C. Simon

USAF cancels July shuttle mission

The first all-military mission of the space shuttle had been set for last November, until, with about six months to go, the U.S. Air Force canceled it. Now a second USAF shuttle reservation, this one for July, has also been canceled—and for the same reason. In both cases, the problem has been uncertainty about the cause of a malfunction with the Air Force's Inertial Upper Stage (IUS) booster rocket, which last April failed to properly raise the orbit of a National Aeronautics and Space Administration tracking satellite that had been successfully deployed from the shuttle.

The Air Force thinks it understands the problem — a breakdown of an insulation system that allowed an oil seal to collapse, causing a rapid leak that led to the jamming of one of the IUS rocket nozzle gimbals. But confirmation is needed. In December, an IUS was test-fired to establish the temperatures to which the various nozzle components are exposed. Later this month, the test will be repeated under simulated space conditions, and a third test in May is to check out proposed modifications. The next USAF shuttle reservation is in September, designated mission 41-H (the canceled July slot was 41-E).

But NASA, too, is anxious for the IUS to be successful, particularly for launching additional Tracking and Data Relay Satellites (TDRS) like the one that endured last April's faulty ride. TDRS-1 was finally raised to its intended orbit (by three months of careful firing of its own steering jets), but the lack of a second TDRS required major replanning of the elaborate Spacelab mission of shuttle flight 9. The TDRSs are also vital to such future missions as the Landsat D′ earth-observation satellite, scheduled for launch (not on the shuttle) next month.

Assuming that the Air Force's IUS tests pan out, the second TDRS is now set to be deployed from shuttle mission 51-C in December, with a third slotted for mission 51-E in March of 1985.

Meanwhile, NASA is worried about problems with a shuttle-borne upper-stage booster of another sort, the Payload Assist Module, or PAM. Two communications satellites deployed from the shuttle earlier this month (SN: 2/18/84, p. 100) suffered nearly identical PAM malfunctions that left them in hopelessly low orbits. Such upper stages are the satellite-owner's responsibility, not NASA's, but nervousness among potential paying customers could be a threat to the agency's money-making business in commercial satellite launches.

Four more satellites are scheduled to be PAM-launched from the shuttle this year, the first of them (for Canada) in June, and NASA officials express optimism that the problem will be solved without causing delays. And as for customers thinking of switching to Europe's Ariane rocket for a launch, Ariane is booked solid through the end of next year.

—J. Eberhart