# Iridium may illuminate mass extinctions

The dinosaurs, which once dominated the earth, disappeared very swiftly, leaving room for tiny shrewlike creatures to crawl out of shelter and start on the road to mammalian domination of the planet. This devastating demise is not unique in the records of paleontology: There are other instances of quite rapid mass extinctions of biological species, and, although there is still controversy, many paleontologists find that these mass extinctions came cyclically, every 26 million or 28 million years.

One suggestion for the cause of such periodic extinctions is changes in living conditions following impacts of celestial debris — comets or asteroids — on the earth. Walter Alvarez of the University of California at Berkeley and Luis Alvarez, Frank Asaro and Helen V. Michel of UC's Lawrence Berkeley Laboratory (LBL) raised the suggestion after finding layers of iridium in sediments associated with some of the extinctions. Iridium is rare on earth, but more abundant in such cosmic visitors. The periodicity suggested that the hits were triggered by the orbital passage of a companion star to the sun, and Richard Muller, Carl Pennypacker and Jordin Kare of LBL are now looking for it (SN: 9/1/84, p. 134). At the same time Luis Alvarez, Asaro and Michel are about to embark on a systematic study of sediment samples from all over the world to build up a comprehensive catalog of iridium deposits and so check such questions as periodicity.

To do this they had to design and are now about to start building a detecting apparatus that will process samples more quickly and cheaply than is now possible. Detection depends on the technique known as neutron activation analysis. The sample is bombarded with neutrons that energize the atomic nuclei in it. The nuclei give up the energy by emitting gamma rays. Every different nucleus yields gamma rays of a characteristic energy or energies and so identifies itself. Iridium emits two energies of gamma rays, 316,000 and 468,000 electron-volts (eV).

The standard procedure is to record the 468,000 eV gammas. However, the samples are usually contaminated by a lot of cobalt, which emits 1 million eV gammas. These will pass through the detector, leaving behind 468,000 eV, and so make a formidable background. Thus the measurement is statistically touchy and time-consuming. An alternative is chemical purification to remove the cobalt, but that adds expense and time. It can take hours, even a whole weekend, to process one sample.

The new detector will process a sample in 10 minutes. It will depend on coincidence counting of the two energies characteristic of iridium emission. The sample will stand between two counters, one tuned for 316,000 eV, the other for 468,000. In addition there will be a large anticoincidence counter tuned to the 1 million eV emission of cobalt. When, at the same time, the first two detectors record a positive signal and the anticoincidence counter records nothing, the apparatus will say "iridium."

It is not easy to engineer such a coincidence procedure, and reportedly there was some dubiety about its practicality, but Luis Alvarez has apparently convinced doubters. With the new apparatus, he says, diggers anywhere on land or underwater can encapsulate a sample in aluminum, crimp on the top and send it in. Samples will be put in quartz tubes and irradiated in a reactor at the University of Missouri in Rolla that is more powerful than the one at Berkeley. The iridium detector will have an automatic dropper that will read a sample's number, weigh it, determine the amount of iridium and then kick it out to make room for a new one.

The apparatus is expected to cost about $200,000. The researchers have $85,000 in hand, Luis Alvarez says, and they are starting construction. If they do not get all the rest of the money, they can leave off some of the more refined "bells and whistles," such as the automatic dropper, and still have a workable machine.

"Such an interesting project," he muses. "It could tell us why we're here — why dinosaurs no longer dominate the earth."

*—D. E. Thomsen*

# Galileo: Side trip to an asteroid?

A U.S. spacecraft may pay the first-ever visit to an asteroid before the end of 1986, depending on a decision that must be made by the National Aeronautics and Space Administration (NASA) by the end of this month. It involves adding a side trip to the Jupiter-bound flight of Galileo, a sophisticated orbiter and atmospheric probe scheduled for launching in May of 1986, and it could beat other proposed U.S., Soviet and European asteroid missions by years. Yet NASA's imminent decision is anything but certain.

Asteroids, largely between Mars and Jupiter, have been cited as a major research goal by such groups as the National Academy of Sciences and the NASA-chartered Solar System Exploration Committee. Since Galileo will be passing that way anyway, a computer search of the 3,500 or so asteroids with known orbits was run about a year ago at Jet Propulsion Laboratory (JPL) in Pasadena, Calif., to see if the spacecraft would pass within 30 million kilometers of any of them. Fewer than half a dozen, it turned out, would fill the bill, and when those were checked to see if any would permit close flybys without using up too much fuel or conflicting, for example, with Galileo's later trips past the major Jovian satellites, only one clear choice remained.

That one, however, says Clark Chapman of the Planetary Science Institute in Tucson, Ariz., cochairman of a working group that has been studying the possibility, is "a piece of great good fortune." It is a 200-kilometer chunk called 29 Amphitrite, sixth largest of a spectral class ("S") that some researchers believe may represent the cores of former planets whose heavy constituents sank to their centers before collisions with other objects stripped off the remaining rocky outer layers. The heart of a world, in other words, laid bare to view.

The visit, however, poses problems. One is that the detour would delay Galileo's arrival at Jupiter by three months, from August to November of 1988, adding not only to the spacecraft's required survival time but also to the cost of sustaining the project's scientific and engineering teams. Even more troublesome, says project manager John Casani of JPL, is that Galileo would pass the asteroid in December of 1986, barely seven months after launch, leaving an uncomfortably short time in which to check out and calibrate the spacecraft and the "scan platform" carrying its cameras and other movable instruments. Furthermore, he adds, the flight team would have to know about the change by Oct. 1 of this year, in order to complete Galileo's data-management system in time and modify or create anew the revised mission's software.

Overall, the asteroid excursion would cost about $20 million — only a few percent of the mission's overall cost — of which less than half would need to come from NASA's present budget (though that, too, is a problem). But because of the possible consequences of mission redesign, says Casani, "I have strongly recommended to Geoff [Briggs, head of NASA's Solar System Exploration Division] against [that] option, even if he could get the money that was needed."

There is a second option, however, also endorsed by the working group, which would be to avoid using the tricky scan platform, merely tracking Amphitrite from fixed instrument angles as Galileo sweeps by. It still means arriving three months later at Jupiter, but with considerable science and photography of the asteroid and without at least some of the pressure on the flight team. Stay tuned.

*—J. Eberhart*

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