RUSSIAN SPACE SCIENCE

Mars Loss Could Sink Planetary Probes

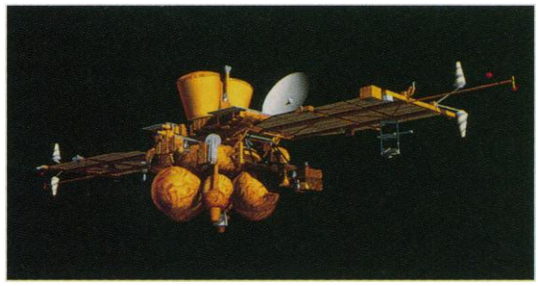
The big splash in the Pacific Ocean last Sunday was more than the remains of a Russian satellite—six tons of instruments, radioactive fuel, and other hardware—that failed to leave Earth orbit on its journey to Mars. The crash also appears to have sunk the once proud Russian planetary science community, leaving astrophysics with the upper hand in the competition for scarce funds from Russia's space program and planetary scientists wondering if they will ever get another chance to explore the solar system.

"There has been a fight between the astrophysical community and the planetary people," says planetary scientist Lev Mukhin, senior science and technology counselor at the Russian embassy in Washington. "Our downfall is their win." Adds Roald Sagdeev, former chief of Moscow's Space Science Institute (IKI), who is now at the University of Maryland, "This particular mission to Mars encountered serious opposition from the very start, even from within the space science community. The feeling is, 'We told you not to spend money on planetary probes.' "

Mars '96 consisted of an orbiter, two landers, and two soil penetrators, each equipped with instruments provided by an international team of researchers (*Science*, 15 November, p. 1075). The probe's failure not only has doomed those instruments, but it also has dampened expectations for the wave of spacecraft slated to rendezvous with the planet next year. "[Mars '96] will not represent a loss to the two U.S. missions, but we are going to lose a great deal of science," says space science chief Wes Huntress of NASA, which launched the Mars Global Surveyor satellite on 7 November and hopes next month to send Mars Pathfinder on its way.

The loss of the satellite is a major blow to the cash-strapped Russian space program. The Russian portion of the mission cost $122 million, while European countries contributed $180 million in research equipment. Shortly after the failure, Russian Space Agency (RSA) chief Yuri Koptev ruled out a replacement mission in 1998, and Russian officials say he added that future missions would emphasize astrophysics. Putting together a mission in time for the 1998 launch window to Mars is both technically and financially impossible, they note, adding that even a proposed 2001 mission is in jeopardy. "It's a big shock for us," laments Alexander Zakharov, IKI's scientific secretary. "I cannot tell what we will do."

Monetary assistance from outside Russia is unlikely. Researchers from other nations were saddened by the accident, but they face their own funding troubles. "We are in a budgetary situation that is not ideal," says Ives Langevin, of France's Institut d'Astrophysique Spatiale in Orsay and president of the solar system working group of the French space agency. If the Russians come up with money for a new flight, he says, participating nations might be able to build new instruments using spare parts. "But if the same countries are expected to finance the launch, then we have a much more difficult problem." Huntress says NASA will continue discussions about a U.S.–Russian flight in 2001, but he adds that the agency "would be a little nervous" about a joint effort that relies upon Russian hardware.



Out of sight. Russia's hopes for planetary science may have crashed along with the Mars '96 satellite.

For the time being, Russian officials will have their hands full trying to figure out what went wrong. The Proton rocket lifted off successfully from the Kazakh steppes just before midnight Moscow time on 16 November. But as the spacecraft entered orbit with the launcher's fourth stage, the spacecraft's engine ignited prematurely, sending the probe into a wild tumble that ended between the Chilean coast and Easter Island, according to Yuri Milov, RSA deputy director. The government has set up a special commission to determine what caused the failure, but Russian industry officials say they suspect that the real problem was that the rocket and spacecraft testing was done on the cheap. The probe also sank with 270 grams of plutonium-238 as part of its energy supply, which Milov insisted poses no danger to the environment.

No matter where the blame falls, Russian planetary scientists seem to have lost their battle to retain an adequate share of declining government funding. During their heyday in the 1960s and 1970s, the Soviets launched dozens of probes to the moon, Venus, Mars, and Halley's Comet. Although most of the Mars missions—including the 1988 flight of two probes aimed at the Martian moon Phobos—failed, the Venusian spacecraft proved highly successful, radioing back the first photos of the planet's surface.

Some scientists hope to revive those glory days by working on smaller and cheaper missions. One possibility would be to build probes that could be launched on the Molniya rocket, says Sagdeev, which is not as expensive and is more readily available than the Proton, which can carry larger payloads.

But for now, the Mars '96 failure has left Russian planetary scientists despondent. IKI chief Albert Galeev was "barely speaking" and clearly in "terrible shape" after the loss, says Sagdeev. And at IKI headquarters, the fancy postlaunch banquet in honor of the mission and its international guests grew cold after news spread of the failure. "Instead of a celebration, it turned into a funeral," says Sagdeev.

–Andrew Lawler

With additional reporting from Moscow by Andrey Allakhverdov, from Paris by Alexander Hellemans, and from Cambridge, U.K., by Daniel Clery.

MAD COW DISEASE

EU Stops Fiddling While Cows Burn

After spending billions of dollars to slaughter cattle infected with bovine spongiform encephalopathy (BSE)—"mad cow disease"—and compensate farmers for their lost herds, the European Union (EU) has launched a major pan-European research effort into the disease. Last week, the European Commission, the EU's executive arm, announced that it will set aside $63.5 million for the new program, which will focus on a trio of related disorders characterized by spongy degeneration of brain tissue: BSE, Creutzfeldt-Jakob disease in humans, and scrapie in sheep.

European politicians have long been urging the commission to launch such a program. It will closely follow a set of recommendations laid out in a report earlier this year by a scientific panel chaired by Charles Weissmann of the Institute of Molecular Biology at the University of Zurich. It will focus on five priority areas: epidemiological and social studies of these diseases; infectious agents and their transmission; diagnosis; risk assessment; and treatment and prevention.

Neuropathologist Adriano Aguzzi of the University Hospital in Zurich, Switzerland, calls the program "good news." Centralized funding is particularly necessary in the case of BSE research, he says, "because of the need for international infrastructure" to do the costly, long-term animal experiments required to study the infectivity of these diseases. "The areas identified are clearly very practically oriented," adds molecular biologist Chris Bostock

of Britain's Institute of Animal Health in Compton, Berkshire. But he cautions that the need for fast fixes "should not be at the expense of basic research." Bostock points out that the Weissmann report emphasizes that "we know very little about these diseases."

This program has been a long time in the making. The European Parliament has called several times for a pan-European research program to tackle the problem of BSE, which has been confirmed in more than 160,000 U.K. cattle, but in no more than a few hundred cattle in other European countries. And in early October, research ministers from the 15 EU member states agreed to go ahead. They even agreed on the size of the program, but they fell out over whether the money should come from the commission's internal budget or from the EU's 1994 to '98 research program, known as Framework IV. A compromise was reached last week in which $20 million would come out of current research funds and the remainder from a separate fund that can be added to this year's Framework budget in special circumstances. Research ministers will gather again on 5 December to give the final go-ahead to the project, and meanwhile finance ministers will be asked to approve the use of the special funds.

Once the program is up and running, the funds will be awarded on a competitive basis, with the division of funds among the five priority areas depending on what projects are approved, rather than an equal split. Aguzzi expects no shortage of proposals. He says that as a referee of grant proposals submitted to the Framework program, he sees many good projects turned away.

–Claire O'Brien

Claire O'Brien is a science writer in Cambridge, U.K.

PALEOANTHROPOLOGY

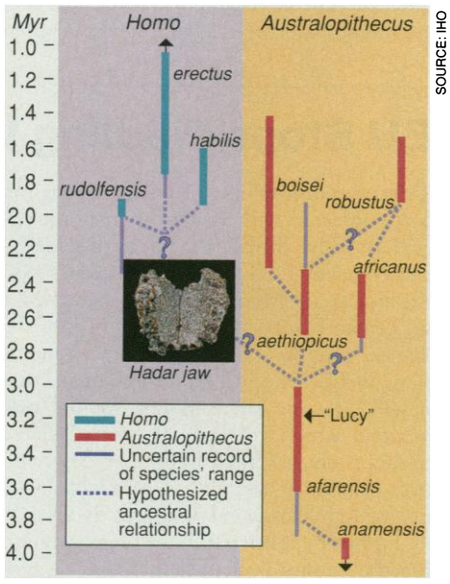
A Rare Glimpse of an Early Human Face

Sometime between 2 million and 3 million years ago on the grassy plains of Africa, the first members of our lineage were born—but they were not alone. Several different types of early humans roamed the landscape at this remarkable time, including three different species of our own genus, *Homo*, as well as several species of their apelike ancestors, the australopithecines. Yet, only a few fragments of bones and teeth illuminate the evolution of *Homo* during this critical time, making it difficult to pick out our line of descent from the bushy hominid family tree. Now, researchers have an important new fossil that will help fill in this gap.

This week, an international team of American, Ethiopian, and Israeli scientists, led by paleoanthropologists William H. Kimbel and Donald C. Johanson and geochronologist Robert C. Walter of the Institute of Human Origins in Berkeley, California, announced a *Homo* jaw that is reliably dated by radiometric techniques at about 2.33 million years old. A few other *Homo* fossils may be this ancient, but all have uncertainties in their dating or identity, making this upper jaw or maxilla "the oldest securely dated *Homo*," says University of Liverpool paleoanthropologist Bernard Wood. The new jaw, which will be published in the December issue of the *Journal of Human Evolution*, offers a tantalizing glimpse of the mysterious face of early *Homo* and gives anthropologists some hard evidence that the genus was indeed on the scene in Africa when most scenarios of human evolution predict that it should be. "If you have a hypothetical lineage leading to humans, it's a good idea to have empirical evidence supporting it," says Pennsylvania State University paleoanthropologist Alan Walker. And although this single specimen isn't enough to determine which species of *Homo* came first, it may help determine which anatomical traits were inherited from an australopithecine ancestor and which ones arose in *Homo* itself, says Kimbel.

The jaw was found in November 1994 on a barren slope at Hadar in northern Ethiopia, only 5 kilometers from the site where Johanson and colleagues discovered the famous fossil "Lucy," the most complete skeleton of the small-brained, big-jawed *Australopithecus afarensis* that lived 3.0 million to 3.8 million years ago. But when Kimbel fit together the two halves of the new jaw, he knew right away that this was no australopithecine: "It's *Homo*. There's no question about it."

For example, the new maxilla has a broad dental arch and a short, flat snout like those of younger *Homo*, rather than the projecting face and narrow palate of an australopithecine. Although one of the 10 teeth found with the jaw, a premolar, is broad like that of an australopithecine, another tooth—a first molar—is elongated and resembles that of *H. habilis*, a species that appeared about 400,000 years after the new specimen. This and other features lead Kimbel to say that the maxilla looks like *H. habilis*, but he cautions that more fossils are needed before the specimen can be assigned to a particular species. Indeed, three *Homo* species have been recognized close to this time: *H. habilis*, the more modern-looking *H. erectus* (whose African form is considered by some to be a separate species, *H. ergaster*), and *H. rudolfensis*, a species that most resembles the australopithecines and lately has been the leading contender for the first *Homo*. If the ancient maxilla could be classified, it would help sort out which species gave rise to the others—and reveal which features arose first in our genus and which were inherited from the australopithecines.



SOURCE: IHO

New relation. Upper jaw from Hadar, Ethiopia, helps fill in a crucial period in human evolution.

Another clue to the new fossil's identity might be an assemblage of 34 Oldowan stone tools found near the jawbone. At other sites, such tools have been considered the handiwork of *H. habilis*, but for now the team can't rule out the idea that another species made them.

Although questions remain about the jaw's precise identity, there is little doubt about its age. Using what most paleontologists agree is a reliable technique, the single crystal laser fusion method of potassium-argon dating, Walter and colleagues at the University of Toronto dated volcanic rock from the site at 2.33 million years ± 70,000 years.

All this gives the new specimen claim to the status of earliest *Homo*, because the other candidate fossils have problems in either their dating or their identity. For example, a mandible from Malawi is "a dead ringer" for *H. rudolfensis*, says Wood. But the date of 2.5 million to 2.1 million years is based only on other fauna, not on radiometric methods. A partial temporal bone from central Kenya is dated securely at 2.45 million years, but many researchers aren't sure that it is *Homo*.

To learn more about the species represented by the new jaw, and perhaps pin down its australopithecine ancestor, the team plans to return to Hadar next fall for more fossils. Notes Wood: "The important thing about this is we've started to discover fossiliferous strata of the right sort of age. Now that they've found one hominid, my guess is they will find more specimens. The main message is, watch this space."

–Ann Gibbons