to a letter last month signed by 200 researchers, including most of the 15 members of Italy's National AIDS Commission, asking the government to commit the funds. Sirchia and Fini did not respond to repeated requests from *Science* for comment.

The government's foot-dragging could cripple a program in which key discoveries in HIV research have been made, say scientists, including insights into how the virus interacts with the immune system. "Italian researchers have made substantial contributions to basic and clinical research on HIV/AIDS," says Anthony Fauci, director of the U.S. National Institute of Allergy and Infectious Diseases in Bethesda, Maryland. Italian researchers have published about 9600 papers on AIDS in international journals since the national program began 15 years ago. If the funds are not forthcoming, those contributions could begin to dry up.

"My laboratory, as well as many others, is already in a very critical condition," says immunovirologist Guido Poli of the San Raffaele Scientific Institute in Milan, who's still waiting for money he was awarded for 2001. If the Italian AIDS community were to starve for lack of funds, says Fauci, it "would be a significant loss to the global HIV research effort." –MICHAEL BALTER

PALEONTOLOGY

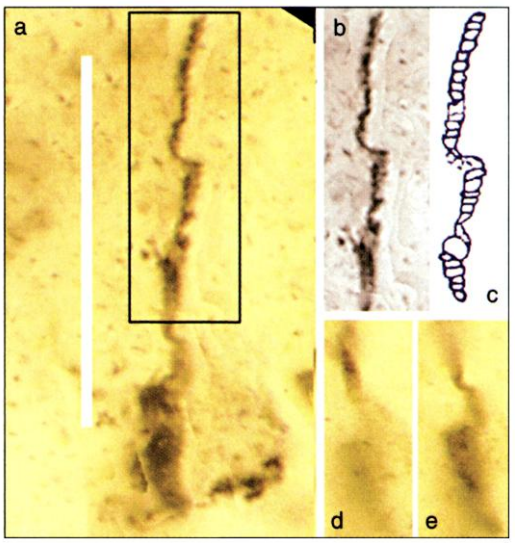
Earliest Signs of Life Just Oddly Shaped Crud?

The search for fossils in rocks formed before the Cambrian explosion of life 540 million years ago "has been plagued by misinterpretation and questionable results," leading paleontologist William Schopf of the University of California, Los Angeles (UCLA), once noted. Now Schopf's own claim for the oldest known fossils—fossils that have entered textbooks as the oldest ever found—is under attack as a misinterpretation of intriguingly shaped but purely lifeless minerals.

A paper in this week's issue of *Nature* argues that the microscopic squiggles in a 3.5-billion-year-old Australian chert are not fossilized bacteria, as Schopf claimed in a 1993 *Science* paper (30 April 1993, p. 640), but the curiously formed dregs of ancient hot-spring chemistry. "There's a continuum [of putative microfossils] from the almost plausible to the completely ridiculous," says lead author Martin Brasier, a micropaleontologist at the University of Oxford, U.K. "Our explanation is that they are all abiogenic artifacts."

If true, the analysis calls into question the fossil record of life's first billion years. It would also raise doubts about the judgment of Schopf, the man chosen by NASA to set the standard for distinguishing signs of life from nonlife at the press conference unveiling martian meteorite ALH84001 (*Science*, 16 August 1996, p. 864). But Schopf says that such speculation is unwarranted. "I would beg to differ" with Brasier's interpretation, he says. "They're certainly good fossils."

The absence of simpler, smaller predecessors to the complex Cambrian biological record was a problem that bothered Charles Darwin. But paleontologists have since found uncontestable fossils in rocks as old as 2 billion years. They include multicellular algae and cyanobacteria, which could produce oxygen through photosynthesis. But the earlier record is sparser and far messier. Of the half-dozen groups of microfossils claimed to come from the Archean eon (before 2.5 billion years ago), Schopf's group was the star. It was not only the most diverse, with 11 distinct taxa of organisms, but Schopf also thought it contained some fossils that were probably cyanobacteria. At 3.465 billion years, it was also the oldest, coming just 400 million years after the last lethal bombardment of the young planet (*Science*, 25 June 1999, p. 2111).



A new view. By compositing in-focus views from a range of depths, a putative microfossil described by William Schopf (b, c) extends and balloons into (a).

Brasier's paper, the first serious reanalysis of Schopf's 1993 paper, rejects the suggestion of photosynthetic bacteria. From both chemical analyses and geological mapping near Marble Bar in northwestern Australia, Brasier and seven colleagues conclude that the so-called Apex chert containing the putative fossils was deposited not on the floor of a shallow sea but below the sea floor in the throat of a hot spring. Both lines of evidence, the group says, show that Schopf's samples came from a conduit that eventually clogged with chert and other minerals deposited from the hot brine it carried toward the sea floor. Photosynthesis below the sea floor seems unlikely, Brasier notes.

Examining Schopf's sections of chert, which had been archived at the National Museum of Natural History in London, Brasier saw the same segmented, wormlike threads of dark organic matter pictured in the paper. But he saw a great deal more when he raised or lowered the microscope's focal plane to bring rock above and below into focus. A long, stringy "microfossil" with supposedly sharp terminations at either end in Schopf's image instead continued downward from one end, ballooning to many times its original width (see figure). Some strands seemed to branch, unlike chains of bacterial cells. Other structures ranged from vaguely suggestive of life to inscrutable jumbles of dark organic matter. "We found so many intermediate, chaotic forms," says Brasier. "Parts that would look like a bacterium [at one focal depth] took on weird shapes" at other depths.

Brasier and the team suspect that they were seeing organic matter shaped into sometimes provocative but meaningless forms by hot-spring minerals as they grew and transformed on cooling. The organic matter might be the remnants of heat-loving bacteria that lived in the vents but went unpreserved, the group concludes. Or it might have been synthesized under high temperature from volcanic gases under the catalytic prodding of the metals found in the chert.

Schopf accepts the reinterpretation of the site as the root of a hot spring and concedes that none of his fossils are cyanobacteria. Schopf had always relied on early, far less detailed geologic mapping by others that assumed the Apex chert was a sea-floor deposit, and he hadn't done any chemical or mineralogical analysis. But he says that Brasier's interpretation of the dark shapes "is just a mistake; they haven't the experience looking at Precambrian microfossils, or such a depth of focus confuses them." The very unbacterial branching of chains of bacterial cells, for example, is actually folding of chains, says Schopf.

Schopf has some support in the Precambrian community. "There's always a process of sorting out signal from noise," says Malcolm Walter of Macquarie University in Sydney, who has published with Schopf. "You illustrate only the well-preserved things," he says, and leave the messier structures found by Brasier unillustrated.

Other Precambrian paleontologists side with Brasier. "I thought it was a very persuasive paper," says Andrew Knoll of Harvard University. The structures illustrated by Schopf as microfossils, he says, are "part of a

CREDIT: M. BRASIER *ET AL.*, *NATURE*

greater galaxy of structures that clearly are not biological." Bruce Runnegar, a colleague of Schopf's at UCLA, was never fully convinced by Schopf's original evidence. "They're suggestive" of life, he says, "but there's no absolutely distinctive morphology."

Whether the textbooks get rewritten will depend on an analysis of material from new sites, says Walter. "I doubt if it will be resolved by more clever work on these samples," he says. "It gets resolved by more work on more rocks. There are plenty more rocks out there." –RICHARD A. KERR

ASTRONOMY

Stellar Flares Illuminate Young Sun's Outbursts

A nursery of unruly stars in the Orion Nebula has yielded the best look yet at our sun's baby album. Based on data from NASA's orbiting Chandra X-ray Observatory, it appears that the sun threw more tantrums than expected, in the form of powerful x-ray flares that zapped the surrounding disk of gas and dust. These flares may have seeded the early solar system with fragile radioactive isotopes. However, it remains likely that some of the unstable compounds also drifted into our sun's domain from nearby exploding stars.

More than 4.5 billion years of evolution have erased all traces of the sun's youth, so astronomers dig into that past by studying similar stars elsewhere. X-ray satellites had spotted outbursts from a few very young sunlike stars, but it wasn't clear whether such flares were universal. Chandra has put those doubts to rest with images of what researchers call "the richest field of x-ray sources ever obtained."

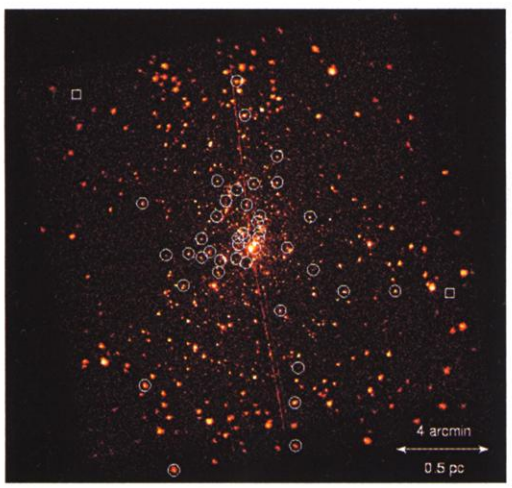
Chandra stared at a tight cluster of nearly 1100 x-ray blips at the heart of the Orion Nebula, the middle "star" in Orion's sword. Astronomer Eric Feigelson of Pennsylvania State University, University Park, and his colleagues identified 43 stars in this patch with masses between 0.7 and 1.4 times that of our sun and ages from 300,000 to 10 million years. Of those solar mimics, all but two actively emitted x-rays—and most of them flared during the 23-hour Chandra exposure.

The ferocity of the eruptions surprised Feigelson. The Orion flares were about 30 times more powerful and 300 times more frequent than the most intense flares unleashed by our sun today. The team's analysis will appear in *The Astrophysical Journal* and is posted on the astrophysics preprint server (xxx.lanl.gov/abs/astro-ph/0202046).

The study confirms that the sun was outrageously energetic as an infant, others say. "The statistics are overwhelming," says astrophysicist Donald Clayton of Clemson University in South Carolina. And, because x-ray flares boost protons and other particles to near the speed of light, Clayton notes, "the early sun was an intense accelerator of solar cosmic rays. We no longer have to postulate."

Indeed, Feigelson thinks the sun, in its first million years, seared the solar system with a flux of high-energy particles 100,000 times greater than today. "They were like machine-gun bullets," he says. "They would have created radioactive isotopes readily." The radiation blasted chunks of atomic nuclei from mineral grains wafting through space as the solar system condensed, he explains. Such nuclear reactions could have spawned calcium-41, aluminum-26, manganese-53, and other isotopes that decay in a million years or so. The offspring of those fleeting compounds are locked in the oldest meteorites; the new findings would help explain the puzzling timing of how the isotopes existed just as asteroids formed.

At a recent Chandra meeting,* Feigelson's team emphasized solar radiation as the main process over a rival theory that a nearby supernova fertilized the solar system's embryonic cloud with rare isotopes. However, the paper's primary reviewer insists that the story isn't so simple. Magnetic fields may have steered particles from the x-ray flares into space above and below the gas and dust in the chaotic early solar system, says astronomer Alastair Cameron of the University of Arizona in Tucson. Mineral grains probably grew quickly, he adds. If so, nuclear reactions were confined to the outer rinds, where they wouldn't have yielded much radioactive material. Moreover, Cameron notes, at least one isotope—iron-60—could not have arisen via the stripping action of cosmic rays, because it has more neutrons



Hot flashes. X-ray flares from sunlike baby stars in Orion point to a fiery youth for our sun.

CREDITS: (TOP TO BOTTOM) INTERNATIONAL FUND FOR ANIMAL WELFARE; NASA/E. FEIGELSON *ET AL.*/PENNSYLVANIA STATE UNIVERSITY

* "Two Years of Science with Chandra," 5–7 September 2001, Washington, D.C.

ScienceScope

Marine Research? Japan hasn't won many friends with its new plan to boost whale research. Government officials have told the International Whaling Commission (IWC) that Japan plans to kill 100 more whales this year under its controversial research whaling program, drawing protests from conservation groups.

Japan already kills 160 minke (below), Bryde's, and sperm whales annually in the North Pacific—and 400 minkes in the Antarctic—under a "research" exemption to a decades-old global ban on commercial whaling. It now wants to expand the Pacific hunt by 50 minke and 50 sei whales. The addition of the sei whales is particularly controversial, because the United States considers the species endangered. But the sei's status is based on outdated data, and fresh samples are needed to see if a growing population is competing with human fishers, argues Seiji Ohsumi, director general of the Institute of Cetacean Research in Tokyo.

Scientists are split over the value of such research, and many argue that there are nonlethal means of collecting the necessary data (*Science*, 29 September 2000, p. 2264). And the World Wildlife Fund says Japan should not be allowed to expand whaling "under the cynical guise of science." The IWC's Scientific Committee will review the plan in May, and Ohsumi says his institute will consider any recommendations before the hunt begins in June.

The Beat Goes On Mechanical heart makers got some good news this week. Advisers to the Food and Drug Administration (FDA) voted 8–2 in favor of a proposal from Thoratec in Pleasanton, California, to use its implanted heart pumps as a "destination therapy" for patients whose own hearts are failing. This could bring a long-sought change in FDA policy, which currently allows such pumps only as a "bridge to transplant" in the few patients lucky enough to be on the waiting list for a donated natural heart (*Science*, 8 February, p. 1000). If FDA agrees—and it usually goes along with advisory panels—it may grant Thoratec permission to sell its devices to some of the 100,000 U.S. patients with end-stage congestive heart failure. And the decision could open the way to other artificial hearts.