now because the iron-rich knots are small, and previous x-ray satellites lacked the resolution to see them. Nor could optical telescopes spot the iron, because it barely shines at visible wavelengths. However, Chandra combines a powerful x-ray sensitivity with eyesight about as sharp as that of the best optical telescopes on the ground.

A team led by astronomer John Hughes of Rutgers University in Piscataway, New Jersey, used Chandra's clear vision to find that the most iron-rich blobs were at the fast-moving fringes of the expanding cloud. Such blobs, astronomers believe, could only arise deep within the core of the blast from the flash fusion of silicon atoms into unstable atoms of nickel, a process that lasts a fraction of a second and requires temperatures of at least 5 billion degrees. The nickel decays first into cobalt and then iron, driving the supernova's light display as intense radioactivity makes the explosion glow white-hot.

Hughes and his co-workers also saw plenty of silicon-rich blobs in Cas A, believed to arise from the explosive burning of oxygen atoms into silicon further out from the core at temperatures of perhaps 3 billion degrees. However, the images from Chandra reveal that the silicon-rich material is closer to the middle of the Cas A remnant than the iron-rich nuggets. "The deeper iron-rich ejecta is the last stuff that got out of the star, yet it's now the farthest from the center of the explosion," Hughes says. That argues strongly against a neat, spherically symmetric "onion-skin" explosion, in which the star's outermost layers would expand most quickly into space.

Researchers had seen hints of this asymmetry in Supernova 1987A, notes astrophysicist Stan Woosley of the University of California, Santa Cruz. Computer simulations by Burrows and others also suggest that massive instabilities in the first few seconds of a supernova blast should create "crooked fingers" of heavy elements that poke through the overlying star. However, the distribution of elements within Cas A may be more topsy-turvy than predicted by simulations. Further analysis of Cas A and other supernova remnants may help theorists re-create the exotic physics of the initial moments of the detonations. Two other powerful x-ray observatories will contribute to this effort: the European Space Agency's X-ray Multi-Mirror satellite, launched in December, and Japan's Astro-E, scheduled for launch early this year.

Chandra's observations also deepen an enduring mystery about Cas A: Why didn't 17th century observers see it more clearly? English astronomer John Flamsteed may have spied it in 1680 as a very faint "star," a description at odds with the potent radioactive energy that the explosion should have unleashed when its nickel-rich ejecta decayed into iron. "It must have been a brilliant supernova," says Woosley, who posits that "a whole lot of dust" near the star and between Earth and Cas A made it nearly invisible. Moviegoers can rest easy, however: Hollywood scriptwriters would never permit any such effect to dim the supernova now terrorizing our screen heroes in space.

–ROBERT IRION

CREDIT: NA'AMA GOREN-INBAR/HEBREW UNIVERSITY

ARCHAEOLOGY

Dredging at Israeli Site Prompts Mudslinging

A prehistoric site critical for understanding early human evolution appears to have suffered permanent damage after a local Israeli drainage authority allegedly bulldozed a big chunk of it last month. Prehistorians claim that the earthmoving, undertaken to prevent flooding of nearby farms during rainstorms, has destroyed their ability to make sense of the complex layers at Gesher Benot Ya'aqov, on the banks of the river Jordan in northern Israel. "This wanton destruction is a travesty that has caused irreparable damage to a site of worldwide significance," says archaeologist Steven Rosen of Ben-Gurion University in Beersheva, Israel. But according to the drainage official who oversaw the project, scientists are exaggerating the harm done to the site.

Happier times. A Hebrew University–led dig at Gesher Benot Ya'aqov.

While the current state of Gesher is contested, the site's importance is not. Gesher Benot Ya'aqov was first discovered in the 1930s and has been excavated several times since. Along with the nearby prehistoric site of Ubeidiya, also in the Jordan valley, Gesher is a key location for understanding how and when *Homo erectus*—an ancestor of modern humans—moved out of Africa, probably through the so-called Levantine corridor that includes Israel. "Israel and the Jordan valley are one of the great crossroads of human prehistory," says Clive Gamble, an archaeologist at the University of Southampton in the Unit-

ScienceScope

Inside Candidate A new name tops the list of potential future directors of the National Institutes of Health. Two high-level officials at different NIH institutes in Bethesda, Maryland, say that Gerald Fischbach, director of the National Institute of Neurological Disorders and Stroke (NINDS), is in the running to succeed Harold Varmus. Fischbach chaired the neurobiology departments at Harvard Medical School and Massachusetts General Hospital in Boston before taking charge of NINDS in July 1998. Through an assistant, Fischbach declined to discuss the rumor.

Wish Granted National Science Foundation director Rita Colwell has an extra bounce in her step, the result of winning White House approval for a double-digit budget increase. *Science* has learned that President Clinton's 2001 request, to be unveiled on 7 February, will include a boost of roughly 15% for the $4 billion agency. Congressional approval would mean the biggest spending increase for NSF in a decade and more than double the 6.6% raise the agency got this year.

NSF's budget is expected to highlight four areas. Three are ongoing efforts, in training, information technology, and biocomplexity, while the fourth—nanotechnology—is part of a new Administration initiative. The White House also has given the green light to EarthScope, which would create a mobile seismic network and probe California's San Andreas fault (*Science*, 26 November 1999, p. 1655), and to NEON, a string of high-tech field stations for ecologists (*Science*, 10 December 1999, p. 2068).

Small Spark Managers of the overbudget National Ignition Facility (NIF) at last have something to smile about. An independent panel appointed to get the laser fusion project "back on track" (*Science*, 10 September 1999, p. 1647) released a report this week that gives a qualified thumbs-up to the facility. The panel did find that the $1.2 billion project has "significant" managerial shortcomings, including inadequate oversight and emergency funds. However, says chair John McTague, "the panel has not uncovered any mechanical or technical obstacles that would prevent completion of NIF."

Some observers are less sanguine. The panel has underestimated the engineering challenge of getting a pellet of hydrogen to fuse and release energy, argues the Natural Resources Defense Council's Chris Paine, who contends that the report "is making an open endorsement for a system of potentially infinite cost."

ed Kingdom. "A site like Gesher provides crucial information on the skills and capabilities of the earliest hominids as they came out of ... Africa." During recent excavations at Gesher, stone tools such as hand axes and cleavers found in layers dated to 780,000 years ago were very similar to those at African sites of the same age. "The destruction of a site like Gesher is the destruction of a vital piece of our global heritage," Gamble says.

However, the Kinneret Drainage Authority had argued for years that it needed to dredge a stretch of the Jordan near the Gesher site to prevent regular flooding of the nearby Hula valley and its farmland. "Our main concern was to protect human life," says Aitan Sat, the drainage authority's managing director. While not disputing the dredging project's necessity in principle, officials at the Israel Antiquities Authority (IAA) had insisted that any operation must leave Gesher unharmed. Thus they were shocked late last month to find that the drainage authority had proceeded, without their knowledge, with a week of dredging in mid-December. The IAA applied for a court injunction to stop any further work, which was granted and has now been made permanent.

But it may be too late to undo the damage. According to prehistorian Na'ama Goren-Inbar of Hebrew University in Jerusalem, who has led recent excavations at Gesher, the bulldozers obliterated "several hundred meters" of the 2.5-kilometer-long site, including portions of the riverbank immediately north and south of her own 50-meter excavation. Goren-Inbar, who has visited Gesher on foot and flown over it by aircraft since the dredging took place, says that the workers left the dirt and sand in heaps by the river. "Strata which contain fossil remains, manmade stone artifacts, and a lot of organic material were all destroyed," she claims. "We will never be able to scientifically study this material because it is now out of context." Sat disputes that characterization. "They are lying about the amount of damage," he says, insisting that his crew dredged only in the river and not on the banks. Sat says that despite attempts at negotiations between his authority and the IAA, the IAA would not compromise on dredging in the Gesher area. "They were preventing me from doing my job."

Recent excavations at Gesher had only begun to tap into a wealth of exceptionally well preserved plant and animal remains, which have allowed scientists to begin reconstructing the prehistoric climatic conditions and ecology, says Goren-Inbar. Thus experts in human evolution will be lamenting the destruction for a long time to come. "Sites like Gesher are found very rarely," says Gamble. "This is not a record that should be discarded into a drainage ditch."

–MICHAEL BALTER

KOREA

Billion-Dollar Project Kicks Off New Century

SEOUL, SOUTH KOREA—Korean geneticist Yoo Hyang Sook is going fishing this month at the U.S. National Institutes of Health and at Washington University in St. Louis. What she hopes to hook is a few collaborators for research on the genes associated with stomach and liver cancer, the most common forms of cancer in Korea. Her project is one of the first out of the gate in a 10-year, multibillion-dollar effort to bolster Korean science.

Government officials hope the new initiative, called the 21st Century Frontier Research Program, will be more successful in generating new knowledge—and new products—than its predecessor, the Highly Advanced Research (HAN) Project that is nearing the end of its 10-year run. And requiring Yoo and other project leaders to link up with foreign researchers—as well as giving them the freedom to select those collaborators and manage the entire project—is a key element in the plan.

Roboscientist. Park Chong Ho demonstrates a cyber-glove used to operate a robot, work that will be extended in Korea's new 21st Century Frontier Research Program.

CREDIT: COURTESY PARK CHONG HO

The HAN project, begun in 1992, was supposed to be a springboard for Korea to catch up with advanced nations. (Its nickname is the "G7 project," after the group of seven countries that meet annually to discuss global economic and trade issues.) It funded 18 teams conducting research on everything from agrochemicals to nuclear fusion. Although the results have helped Korean companies to commercialize such products as high-definition television sets and 256-megabyte DRAM chips, the project fell short in other areas, including fusion and high-speed rail transportation. One of the major stumbling blocks, say officials at the Ministry of Science and Technology (MOST), was the shortage of homegrown talent. "For HAN, we thought that we could do it ourselves. [But] we found that outsourcing subprojects is better," says Yang Sung Kwang, a deputy director at MOST. That's why the 21st Century Program will include much more foreign collaboration.

The new program, which begins in stages from now until 2002, is expected to support 20 large projects at a total cost of roughly $3.5 billion. Like the HAN projects, it will be a mix of basic and applied research, but with a greater focus on environmental protection and such quality-of-life projects as improved geriatric care. Candidate areas include communications, new materials, biodiversity, molecular engineering, hydrogen power, and earthquake early warning systems. The annual budget for each new project, not yet set, is likely to mirror the average $8.7 million given to each HAN project.

The first two projects, announced in November, are Yoo's and a program led by robotics scientist Park Chong Ho to develop miniature integrated devices for medical applications and wearable computers. While Yoo is in the United States inspecting the human genome project and advances in DNA chip technology, Park will jet to Germany and Switzerland seeking assistance on everything from miniature batteries and communications components to endoscopic medical devices. His goal is to make Korea one of the top five countries in both researching and finding uses for such microsystems. "Without foreign experts, I think [that goal] is not possible," says Park.

One big difference between HAN and the new program is that a single leader will be firmly in control of each project and be given a relatively free hand to allocate resources. That's a big departure from HAN's piecemeal system, in which the central government selected and managed subprojects directly but did not hold anyone accountable for the overall direction of the research. To keep focused on their research, project leaders must sever ties with other institutions—Yoo left the Korea Research Institute of Bioscience and Biotechnology in Taejon and Park left The Korea Institute of Science and Technology in Seoul to head up their new projects—a demand not imposed on HAN scientists.

MOST will evaluate each project every 3 years, rather than annually, to reduce paperwork. But Yang says it will expect to see "visible, clear, and quantitative" evidence that project managers are accomplishing their goals. MOST officials promise that the government will pull the plug on foundering projects, but they expect some resistance in taking such measures. "That kind of competitive culture is not popular [with scientists]," says Yang about a society that places