Belt, a flux calculated to be five times that from the Oort Cloud. Stern and McKinnon told a workshop* last month that Triton now appears to have been resurfacing itself fast enough to make the average age of its surface around 100 million years old.

The most likely implication of such youthfulness, says planetary scientist Jeffrey Kargel of the U.S. Geological Survey in Flagstaff, Arizona, is that "Triton has been very active [geologically] through 98% of its history. ... If it was active 100 million years ago, it probably still is active."

Most researchers would agree with Kargel, but another pair of planetary scientists is offering evidence of an even younger age for Triton's surface. Kevin Zahnle of NASA's Ames Research Center in Mountain View, California, and Paul Schenk of the Lunar and Planetary Institute in Houston factored in the Kuiper Belt, too, but Schenk also took another look at Voyager images and counted craters again. This time, Schenk sharpened the images with the same mathematical technique used to clarify flawed images from the Hubble Space Telescope. Now he could more easily recognize true impact craters in previously cryptic terrain.

Surprisingly, Schenk found that "all the craters are on one side of the satellite." As Triton orbits Neptune, it sweeps up debris "like a car driving through a rainstorm," says Schenk, "so the raindrops all hit on one side of the car." Where the debris came from is a mystery, but Zahnle thinks the best bet is the destruction of an inner satellite in a collision with a comet. If that's all true, Zahnle and Schenk told the workshop, Triton has been resurfaced so rapidly of late that few or no KBOs have had a chance to pock it; therefore, its surface would clearly be less than 100 million years old and quite possibly less than 10 million years old. That would make it as geologically young as Europa.

Whichever age is correct, "the important thing is Triton's surface really is relatively young," says McKinnon. Given its meager supply of heat, its youthfulness requires a resurfacing agent so easily mobilized that it can modify Triton's 37-kelvin surface. Lavas of water plus agents like ammonia or methanol that lower water's melting point are a possibility, says McKinnon. They may be rising from an "ocean" 150 kilometers down, bounded above and below by water ice, he says.

Whatever has kept Triton looking young over the eons may have been at work in recent years. Astronomers Michael Hicks and Bonnie J. Buratti of the Jet Propulsion Laboratory in Pasadena reported at the workshop that telescopic observations show Triton taking on a strong reddish tint for a few months at a time. Somehow, Buratti says, "most of the surface" is being altered. "It looks like there's something geological going on." Maybe it's just Triton freshening up once again.

–RICHARD A. KERR

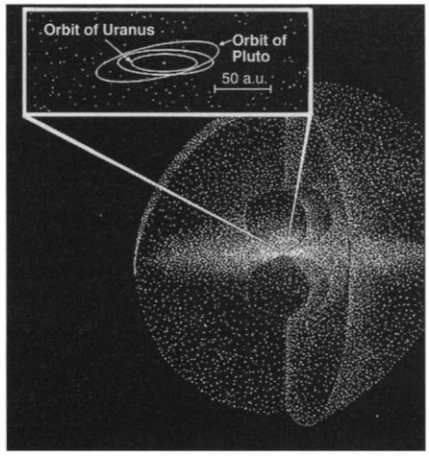
* Pluto and Triton: Comparisons and Evolution Over Time, held from 23 to 24 September in Flagstaff, Arizona. See www.lowell.edu/workshop

CREDITS: (TOP) R. STONE; (BOTTOM) DONALD YEOMANS/JPL

PLANETARY SCIENCE

Another Distant Consort for the Sun?

The age of discovery for planet-size bodies in this solar system would seem to have ended in 1930 with the discovery of Pluto. That tiny body turns out to be just the largest bit of debris remaining from the formation of the planets. Most of the smaller bits ring the sun in the asteroid belt or in the Oort Cloud, the spherical swarm of distant comets far beyond Pluto. Astronomers therefore generally take Pluto to be the end of the line for planet formation. But a small band of astronomers has kept up the search for a tenth planet, and this week, researchers announced two independent proposals for the location of yet another companion to the sun. And if they are right, it would be no Pluto-sized midget.



A tenth companion? The huge Oort Cloud of comets may harbor a relatively massive planet.

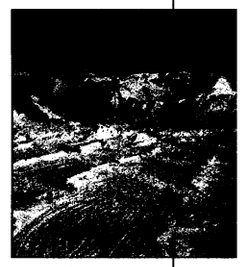
Both proposals suggest that, out among the comets of the Oort Cloud, an object several times more massive than Jupiter is orbiting some 25,000 to 30,000 times farther from the sun than Earth. Both groups argue that this unseen behemoth gravitationally perturbs Oort Cloud comets, sending them toward Earth along a distinctive sky-girdling band. But the evidence doesn't impress many other researchers. "I just don't believe it," says planetary dynamicist Harold Levison of the Boulder, Colorado, office of the Southwest Research Institute.

Attempts to track down unseen objects through their gravitational effects "has a long and not very honorable tradition," says astro-

ScienceScope

Thin ice Now may not be the best time to borrow money in Russia, but don't tell that to the Russian Antarctic Expedition (RAE). Crippled by the ruble's collapse last year, the RAE has won approval to take out an emergency loan to fund its operations during the coming austral summer.

During the Cold War, the Soviet Union maintained a vast antarctic operation, with several year-round coastal bases and the inland Vostok station. But the post-Soviet days have been bruising: The RAE must use 61% of its $5.6 million budget to finance the research ship *Academik Fedorov* and spend most of the remainder on supplies from overseas vendors. Following the ruble's plunge in August 1998, the RAE had to raid its 1999 budget to pay for last season's operations.



Vostok.

Now the government says it doesn't have the funds to keep its promise of maintaining four year-round bases. So it has authorized RAE to take out a $2.3 million loan at high interest, promising to come up with the principal by February. RAE will cobble together the interest payments from money it receives ferrying Scandinavian researchers. Says vexed RAE chief Valery Lukin, "It's a crazy situation."

Supplemental science Japan's scientists once again stand to gain from the government's efforts to stimulate the economy. Last week, the cabinet instructed ministries to draw up plans for $33 billion in additional spending on public works and "emerging technologies."

The $7.3 billion Science and Technology Agency, for example, is asking for $1.9 billion more to sweeten its efforts in information technologies, life sciences, and the environment. It also wants to accelerate work on such large projects as an ocean drilling ship and an Earth simulator for modeling climate change. Other science agencies will also request funds and it is likely that some new lab buildings and other research facilities will be financed from a pot earmarked for public works.

The ministries' requests are part of a $100 billion economic revitalization package that includes loan guarantees, local government spending, and tax cuts. The spending plan is expected to be finalized by mid-November and put into effect before the next fiscal year beginning on 1 April.

physicist Scott Tremaine of Princeton University. "It worked in 1846 with Neptune," he notes, when two mathematicians independently fingered the yet-to-be-discovered planet as the cause of unexplained squiggles in the orbital motion of Uranus. But "people have tried it since," he says, "without much success." For example, proposed tenth planets have failed to materialize, including "Planet X," which was supposed to graze the inner edge of the Oort Cloud and explain periodic impacts and extinctions on Earth (*Science*, 22 March 1984, p. 1451). A proposed stellar companion to the sun, dubbed Nemesis, has also failed to turn up so far.

Now two groups—including some veterans of Planet X and Nemesis—are again proposing a tenth major body orbiting the sun. This week at the Division for Planetary Sciences annual meeting in Padua, Italy, physicists John Matese and Daniel Whitmire of the University of Louisiana at Lafayette argued that a planet or even a brown dwarf—a massive gas ball still too small to ignite stellar fires within it—orbits through the outer Oort Cloud.

They base their assertion on the paths taken by a third of the 82 most closely studied comets observed to fall from the Oort Cloud into the inner solar system. Most comets that make it into the inner solar system are shaken loose by the galaxy's gravitational jiggling of the Oort Cloud, which Matese and his colleagues assume would send an even rain of comets falling from all parts of the sky. But the Louisiana group, which included the late Patrick Whitman, finds that about three times as many comets as expected approach in a band of the sky that circles Earth like the longest stripe on a croquet ball. And these comets, bunched in the sky, also tend to have atypically short orbits, which don't take them as far into the Oort Cloud or as close to the sun as other comets. The best explanation, the group will report in *Icarus*, is a body having 1.5 to 6 times the mass of Jupiter and orbiting the sun at a mean distance of about 25,000 times the Earth-sun distance—that is, in the heart of the outer Oort Cloud. "The [orbital] statistics are not compelling," says Matese, "but they're very, very suggestive."

Planetary scientist John Murray of The Open University in Milton Keynes, United Kingdom, also thought the bunching of comets in the sky was suggestive. In this week's *Monthly Notices of the Royal Astronomical Society*, he follows much the same trail as the Louisiana group and arrives at much the same conclusion. But he goes further, locating the putative comet perturber precisely near the constellation Aquila the Eagle.

Those familiar with the vagaries of cometary orbits remain skeptical. "There are some anomalies in the distribution" of comet orbits, says planetary dynamicist Julio Fernandez of the Institute of Astronomy in Montevideo, Uruguay, "but the statistical sample is not large enough to draw such conclusions." Tremaine agrees about the small sample size and adds that the Oort Cloud is not likely to be as uniform as Matese and Murray assume. Recent close encounters with passing stars may explain the comet clumping, he says. Levison agrees with both those criticisms and raises the possibility of observational bias, the tendency of comets to be found in a band near the plane of the solar system because that is where astronomers tend to search.

Matese, for one, rebuffs the criticisms but remains philosophical. The orbital anomalies "are not likely to be explained by chance, bad data, or selection effects," he says, but "nothing is going to be settled by most of these statistical arguments. The vast majority will remain skeptical, perhaps rightly so." Matese and Whitmire will be patient. They are still waiting for their mid-1980s proposal of Planet X to pan out; and Whitmire had his own version of Nemesis. The final resolution of their latest proposal, says Matese, may come with infrared telescopes capable of detecting the perturber's warmth, like the Space Infrared Telescope Facility, due for launch in 2001. **–RICHARD A. KERR**

BUDGET 2000

Congress Boosts NSF, Reverses NASA Cuts

The budgetary roller coaster ride for many U.S. scientists ended last week when President Bill Clinton said he would sign a bill that gives the National Science Foundation (NSF) a significant boost for 2000. The bill also grants NASA's science program more than either the Senate or the House had been willing to provide, although still less than the agency asked for. That victory, however, comes with a steep price tag for NASA: millions of dollars in pork-barrel spending.

House and Senate members who met on 7 October in a crowded chamber in the Capitol set aside $13.65 billion for NASA and $3.91 billion for NSF for the budget year that began 1 October. Both figures are close to the amount Clinton wanted. "I am delighted ... it's a win for the economy and the nation," said NSF director Rita Colwell in a prepared statement.

Legislators apparently robbed housing programs and the space station to put some money back into space science. Last month, the House had approved $240 million less than the agency's $2.1 billion request, whereas the Senate had cut the request by $120 million. Both actions were loudly protested by White House and NASA space science officials (*Science*, 24 September, p. 2045). But last week lawmakers, led by Senator Barbara Mikulski (D–MD) and Rep. Alan Mollahan (D–WV), agreed to a complicated maneuver that reduces the space science request by a mere $46 million. An additional $75 million will be spread across science, aeronautics, and technology programs, although it remained unclear early this week which programs will benefit from that money. And the lawmakers retained some $70 million in earmarks—unrequested spending—that NASA must swallow, including $15 million for a solar terrestrial observatory to be built and operated by two Maryland institutions, Johns Hopkins University and the Applied Physics Laboratory. The bill also reduces NASA's Discovery program of cheaper and faster space probes by $24 million, which NASA officials say could delay announcement of the next two missions.

Nevertheless, there was relief among space scientists. "Despite the fact we got caught up in serious budgetary give-and-take, we came out in the end with real support," says Steven Squyres, a Cornell astronomer who chairs NASA's space science advisory panel.

Lawmakers compromised on the controversial Triana mission, a $75 million effort inspired by Vice President Al Gore that would beam back pictures of the whole Earth. Work on the spacecraft will be halted until the National Academy of Sciences conducts a study of its scientific goals. NASA had planned to launch the mission at the end of next year, but agency officials expressed relief: "This is not a termination," said one.

NASA life and microgravity sciences won a boost of $21 million above the $264 million requested, whereas earth science will receive only a $4 million cut to the $1.46 billion request—a far cry from the threatened $285 million House reduction. Much of that regained money will go to NASA's Goddard Space Flight Center in Greenbelt, Maryland. "The funding will save 2000 jobs cut by the House bill," Mikulski said after the conference.

For NSF, the conferees voted a 6.6% increase, to $3.91 billion. That amount overrides a flat budget approved by the House (*Science*, 6 August, p. 813) and falls only $9 million short of NSF's requested hike of $250 million. It also restores funds for a key administration computing initiative and several new projects.

NSF may have cemented its leading role in the proposed $366 million information technology initiative by receiving all but $5 million of its $110 million request for research