

## WEB TOOLS

## Searching Museums From Your Desktop

As ecological marauders, house finches may not be in the same league as waterway-choking zebra mussels or landscape-strangling kudzu vines. But they, too, are ruthless invaders. Ever since a handful of these Western U.S. natives were let loose on Long Island in 1940, their descendants have steadily penetrated America's heartland, stealing habitat from other birds. To map the interloper's re-



**Net profit.** New strategy for tapping museum collections yielded this map of the distribution in Mexico of a bird called the mountain trogon.

lentless spread, A. Townsend Peterson and David Vieglais of the University of Kansas Natural History Museum in Lawrence might have steeled themselves to the arduous task of collecting decades' worth of finch facts and figures, stored in three museums in different formats. Instead, they used a new tool Vieglais had invented that allowed them to cull the information in a matter of minutes. From this data deluge the duo developed a model that predicted, in retrospect, the meeting of eastern and western finch populations in Kansas in the 1980s.

The finch model illustrates the power of a new virtual database to put an enormous data trove at researchers' fingertips. Rather than spend weeks or months pestering curators and searching disparate databases, with a few mouse clicks scientists can now troll the holdings of six museums\* using an expanded

version of the software program Vieglais developed. Called The Species Analyst,<sup>†</sup> it was released as a prototype last month on the Web. "It's a virtual world museum," says Peterson, one of the project leaders.

Expected to expand to 40 institutions or more by year's end, the network linked by The Species Analyst could become a potent way to bring museum and survey data to bear on pressing policy needs, such as tracking the ecological effects of climate change, designing preserves for endangered species, or managing deleterious invading species like the hardwood-chomping Asian longhorn beetle.

"What many of us have been talking about for well over a decade is beginning to be doable: pulling together collections of data seamlessly and being able to apply the data set to science or policy questions on the fly," says environmental policy expert Len Hirsch of the Smithsonian Institution.

The idea behind The Species Analyst is to pull up records from all kinds of biodiversity databases, including those compiled using incompatible software. It taps about 1.5 million records so far, using a computer program written according to a standard protocol (Z39.50) that libraries have long used to share bibliographic databases. The Kansas team's tool sends a query to each database, then pools the data it gets back. Putting the Web site to work is easy: Just tick any of the boxes next to each of the nine collections now on the Web, type a search term such

as species name, and hit the query button. In seconds the site will produce a world map showing where the plant or animal has been found, along with a table—available as an Excel spreadsheet—that lists each specimen in the museums' collections and the date, collector, geographic coordinates, and so on.

The data can be merged with habitat and climate information, thanks to new software developed by David Stockwell of the San Diego Supercomputer Center (SDSC). And with \$3 million in grants over the next 3 years, mostly from the Commission for Environmental Cooperation, a U.S.-Canadian-Mexican group, and the U.S. National Science Foundation (NSF), The Species Analyst is laying plans to link to other repositories, including GenBank, the federal DNA sequence database.

Museum researchers have some qualms about the extent to which data will be accessible to all comers. According to Vieglais, some scientists want their data excluded until they've had a chance to publish papers. And the network will restrict access to certain information that—if it falls into the wrong hands—could harm species. For in-

stance, ornithologist Leo Joseph of the Philadelphia Academy of Natural Sciences worries that revealing the locations of rare parrots could aid wildlife traffickers.

With these restraints in place, tools like The Species Analyst "should figure significantly" in an NSF effort to set up a network of biodiversity observatories for studying interactions among species (*Science*, 25 September 1998, p. 1935), as well as become a popular resource for most any ecologist, says Kansas Natural History Museum director Kris Krishtalka. There's no question, adds Joseph, that the Web is bringing museum collections into "a very different era." —JOCELYN KAISER

## SPACE ASTRONOMY

## Heaven Can Wait, NASA Tells X-ray Telescope

Deciding that it's better to be safe than sorry, NASA has indefinitely grounded a \$2 billion space telescope until the U.S. Air Force completes its inquiry into an errant launch last month involving the same rocket motor that will place the telescope in its final orbit. It's the latest in a long line of delays for the Chandra X-ray Observatory, originally set to go up last August as the third in a suite of four great NASA probes.

The 5-ton telescope is designed to capture images of supernovas, black holes, galaxies, quasars, and other celestial objects that are more than 20 times sharper than previous x-ray images. It will also be employed to search for the mysterious dark matter that is thought to constitute most of the mass in the universe. But on 26 April NASA decided to scrap a planned 9 July flight aboard the space shuttle Columbia after the Inertial Upper Stage it plans to use for Chandra apparently misfired, leaving a \$250 million military spy satellite in a useless orbit. An Air Force official estimated that it could be 6 months before the problem

CREDITS (TOP) DAVID STOCKWELL/SDSC; (BOTTOM) NASA



**Waiting game.** The Chandra observatory could spend several months in limbo at the Kennedy Space Center.

\* Smithsonian Institution; University of Kansas Natural History Museum; Museo de Zoología, Universidad Nacional Autónoma de México; Museum of Vertebrate Zoology of the University of California, Berkeley; University of Michigan Museum of Zoology; University of Nebraska Museum

<sup>†</sup> chipotle.nhm.ukans.edu/nabin

is identified, noting that “we’ll take as long as necessary to isolate the cause.”

Although frustrated by the delay, astronomers have not criticized NASA’s decision to play it safe. Unlike the Hubble Space Telescope, Chandra cannot be rescued by astronauts because it will orbit far beyond the shuttle’s operating range. However, the delay may cause Chandra to lose its place in NASA’s queue because Columbia, the only shuttle equipped to launch Chandra, is due for a major overhaul later this year. If the error isn’t found before the Columbia is taken out for refurbishing, “it could delay the launch for at least a year,” says Fred Woitalik, Chandra program manager at NASA’s Marshall Space Flight Center in Huntsville, Alabama. In the meantime, Chandra costs NASA \$6 million a month while it cools its heels in a warehouse at the Kennedy Space Center in Florida.

The silver lining in Chandra’s cloudy life is that the delays haven’t jeopardized its scientific mission. Chandra may miss out on time-dependent observations such as peeking at a comet due to make its appearance later this year or a coobservation of Jupiter together with the Galileo spacecraft, says Harvey Tananbaum, director of the Chandra X-ray Center at the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts. “But the results will be just as spectacular,” he promises, when it’s finally lofted into orbit.

—MICHAEL HAGMANN

With reporting by David Malakoff.

## PLANETOLOGY

### Craters Suggest How Venus Lost Her Youth

For a planet, volcanism is the secret to a youthful appearance, because it smooths the surface with fresh lava. Venus stopped getting these fiery beauty treatments long ago, and after the Magellan spacecraft flew by the planet in the early 1990s, some researchers concluded that the end was abrupt. Magellan’s cloud-penetrating radar saw half a billion years’ worth of impact craters pocking the plains created by earlier lava flows. Almost all of those craters looked like bare, raw scars untouched by any later lava flows, implying that the volcanic outpourings had shut down in a geological moment. Some researchers found it hard to swallow the idea that Venus had given up its volcanic activity so suddenly, however, and now they may have new reason to wonder.

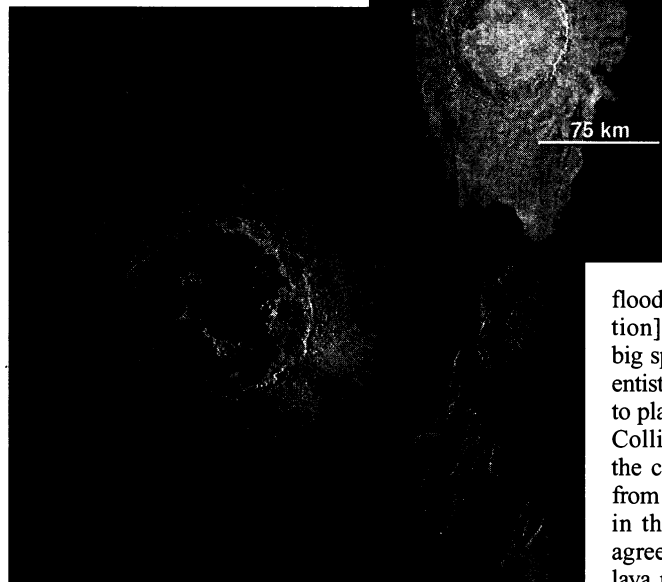
A new analysis of Magellan radar images by planetary geologists Robert Herrick of the Lunar and Planetary Institute in Houston and Virgil Sharpton of the University of Alaska, Fairbanks, suggests that many venusian craters have in fact been altered by later lava flows, reopening the possibility that Venus

was active after the supposed shutdown. The idea that global volcanic activity shut off in just 10 million or even 100 million years “is clearly wrong,” says Herrick. Most researchers aren’t so convinced, but “it’s exciting,” says planetary radar specialist Ellen Stofan of University College London and the Jet Propulsion Laboratory (JPL) in Pasadena, California. “I think they’re on the right track.”

Earlier analyses of the Magellan images seemed to show that only 5% to 10% of craters had been flooded by lava, suggesting that the Venusian volcanoes had shut off like a faucet. Entire planets weren’t supposed to do that, but geophysicists soon managed to come up with any number of theories to explain it, from a sudden freezing of the surface to cyclic sinking of crustal plates (*Science*, 5 March 1993, p. 1400).

Yet many craters did look as if

**Fresh and flooded.** A bright crater (right) escaped lava flooding, but a darker one (below) may not have.



flooded craters. “Their [elevation] numbers show a pretty big spread,” says planetary scientist Jeffrey Plaut of JPL. And to planetary geologist Geoffrey Collins of Brown University, the craters look very different from flooded craters elsewhere in the solar system. Herrick agrees, but says that venusian lava may have been more viscous and less voluminous than

Sharpton say they can see lava not only filling crater interiors but also flooding around seemingly pristine craters. On average, both the crater floors and surrounding terrain were higher, relative to crater rims, than the floors or surroundings of bright-floored craters. “That must mean these things are not only being filled on the inside, but they’re being surrounded on the outside too,” says Herrick, implying that Venus’s volcanoes did indeed ooze lava during the past 500 million years. “It’s going to change thinking about the whole planet.”

Other researchers are not quite so sure, but many are impressed with the analysis. “It’s clearly a significant finding,” says planetary geologist Mari-beth Price of the South Dakota School of Mines and Technology in Rapid City. Stofan’s inspection of Magellan images is also suggesting that more of the craters are flooded by lava than had been thought, she says. “It seems some of [the stereo] data are pointing the same way.”

But other scientists note that venusian craters of variable elevations may be masquerading as lava-flooded craters. “Their [elevation] numbers show a pretty big spread,” says planetary scientist Jeffrey Plaut of JPL. And to planetary geologist Geoffrey Collins of Brown University, the craters look very different from flooded craters elsewhere in the solar system. Herrick agrees, but says that venusian lava may have been more viscous and less voluminous than that found on, for example, the moon, which might make venusian flooding less obvious.

A closer look around the craters may help settle the debate, says planetary geologist George McGill of the University of Massachusetts, Amherst. He inspected Magellan images of 17 of Herrick and Sharpton’s supposedly flooded craters and says he spotted telltale surface features, such as tiny craters from impact ejecta, near some of them. These nearby features must have been there when the original crater formed, he notes, and would have been obliterated by any flooding. A more complete count of such features may reveal whether the onset of Venus’s old age was jarringly abrupt or more gracefully measured.

—RICHARD A. KERR