

Crops take a dusting in ancient society

One of the earliest transitions to a politically stratified society in the Americas took place not among crop growers, but among villagers who hunted, fished and gathered wild plants along Mexico's southwestern coast about 3,500 years ago, according to a report in the February *CURRENT ANTHROPOLOGY*.

This finding, along with the excavation of a coastal Peruvian settlement from the same period (SN: 1/19/91, p.38), indicates that many New World coastal societies developed without relying on agricultural techniques, which anthropologists often consider essential to the growth of civilizations.

Researchers led by anthropologist Michael Blake of the University of British Columbia in Vancouver collected 1- to 2-gram bone samples from 36 human skeletons excavated from 15 archaeological sites along the west coast of southern Mexico and Guatemala. The earliest sites date to between 2700 B.C. and 1800 B.C.; the most recent date to

between A.D. 1200 and A.D. 1524.

The scientists ground up each bone sample and produced a dried gelatin for chemical analysis in a mass spectrometer. Ratios of specific carbon and nitrogen isotopes in bone signify the regular consumption of particular classes of agricultural and wild plants, as well as fish and other sea creatures.

Blake's group focused on 16 bone samples taken from "early formative" villagers, who lived in sites in southwestern Mexico from around 1550 B.C. to 850 B.C. Early formative people in Mexico transformed isolated outposts into chiefdoms, with a ruler presiding over politically united villages, the researchers contend.

Previous excavations documented the presence of large settlements, extensive public buildings, elaborate ceramics and figurines, and imported obsidian at early formative sites by approximately 1350 B.C.

Bone analyses indicate that early formative diets revolved primarily

around fishing and gathering of wild plants, the researchers note. Carbon and nitrogen values suggest the villagers consumed "very limited" amounts of maize and related agricultural crops.

Excavation of refuse pits at the Mexican sites provides a more specific inventory of the early formative diet, the investigators note. The menu included several types of freshwater fish, turtles, crocodiles, iguanas and snakes. Remains of white-tailed deer and many other land mammals and birds were also found in the ancient dumps, suggesting considerable hunting.

From 850 B.C. through the first millennium A.D., maize assumed more prominence in the diets of coastal villagers, although the basic hunting-fishing-gathering approach persisted, Blake's group asserts.

Bones from coastal Guatemalan sites reveal the greatest reliance on agricultural crops, which may help explain why those settlements grew larger than the ones 60 miles north in southwestern Mexico.

— B. Bower

Bush's '93 budget brightens civilian R&D

The federal budget President Bush sent to Congress last week had to comply with a chilling constraint: A congressional act, aimed at cutting the deficit, freezes most domestic spending at current levels. And overall, the \$76.6 billion that Bush requested for research and development in fiscal year 1993, which begins this Oct. 1, shows no increase over fiscal 1992 spending — after accounting for a projected 3 percent inflation rate.

But that sobering statistic hides a key feature. Defense R&D spending, which makes up about 59 percent of the pot, would sustain a 2 percent decrease after inflation. By contrast, civilian R&D would enjoy a modest but significant inflation-adjusted increase of 4 percent, with several R&D agencies enjoying a real-dollar boost of 1 to 8 percent.

(Percent changes noted for all subsequent budget figures are adjusted to account for the administration's fiscal 1992 inflation estimate.)

As in the past two years, Bush's budget planners sought to make a big splash in science with a colorful booklet highlighting a big budget and "unprecedented" interagency coordination in key research areas. Global change came first, followed by science education and high-performance computing and communication in fiscal 1992. For fiscal 1993, biotechnology

and advanced materials and processing have gained high status as "new initiatives."

Although Congress will likely alter Bush's spending blueprint before appropriating funds for it later this year, lawmakers have a history of supporting increases for science. Among highlights in the President's R&D budget:

- The Strategic Defense Initiative, or "Star Wars" program, would skyrocket to \$5.4 billion, a 27 percent increase.

- At \$175 million, funding for the Human Genome Project would climb 4 percent.

- The Superconducting Super Collider would get \$650 million, a 28 percent increase.

- Throughout the federal government, grants to individual researchers would rise 6 percent — to \$8 billion.

- A grants program in agricultural R&D would jump by 50 percent, to \$150 million. The administration plans to target the funds into programs on the environment; nutrition, food quality and health; plant research (including genetics); marketing, trade and policy; animal studies; and developing new products.

- Bush proposes \$1.4 billion, a 14 percent increase, for transportation R&D. Some \$470 million would fund aviation R&D, and \$28 million (a 37 percent jump) would support high-speed rail projects, including magnetically levitated trains. Together, NASA and the Defense Department would contribute \$260 million toward development of the National

FY 1993 Federal R&D Funding Budget Authority* (in millions)				
Department or Agency	1991 Actual	1992 Actual	1993 Proposed	% Change: '92 to '93
Conduct of R&D:				
**Defense-military	35,176	40,043	40,509	+ 1.2
Health and Human Services (NIH)	9,273 (8,277)	10,216 (8,953)	10,649 (9,396)	+ 4.2 (+ 4.9)
Energy	6,149	6,514	6,578	+ 1.0
NASA	7,271	7,706	8,673	+ 12.5
National Science Foundation	1,828	1,967	2,375	+ 20.7
Agriculture	1,224	1,328	1,332	+ 0.3
Interior	584	583	552	— 5.3
Environmental Protection Agency	433	496	525	+ 5.8
Other Agencies	2,173	2,240	2,432	+ 8.6
Subtotal, Conduct of R&D	64,111	71,093	73,624	+ 3.6
R&D facilities	3,082	3,498	2,933	— 16.2
Total	67,193	74,592	76,557	+ 2.6

*Derived from OMB data; all figures reflect rounding

**Does not include Energy Department's defense programs

Shading denotes budgets which, after accounting for inflation, would lose ground in comparison with last year's levels.

Aerospace Plane.

Space: NASA's R&D budget would rise 8.5 percent. Although funding for Space Station Freedom would rise 8 percent, to \$2.25 billion, the President proposes to kill a mission to fly past a comet as well as efforts to develop an advanced rocket motor for launching heavier space shuttle payloads. The proposed budget provides no funds for continuing Magellan's highly successful mission to Venus, and NASA hopes to save funds this year to keep the mission going until mid-1993 so that the craft can complete a gravity map of the planet and conduct further radar mapping. The 1993 cutoff would end the mission 1.5 years earlier than planned. And despite the recommendation of the National Research Council, the President seeks no funds for the proposed Space Infrared Telescope.

Materials and technology: Calling this "the age of tailored materials," Presidential Science Adviser D. Allan Bromley described a 1993 budget of \$1.8 billion to stimulate an effort by 10 federal agencies to support and expand existing programs and to explore new opportunities for all aspects of materials science.

The proposed budget for the new, inter-agency Advanced Materials and Processing Program (AMPP) represents a 7 percent increase for materials science from 1992 levels. Relatively small players in materials research would get the biggest percentage boosts: NASA would receive a \$29 million increase to last year's budget of \$124.5 million, in part for support of the National Aerospace Plane; the Department of Transportation would get \$15.5 million, an increase of \$6.7 million.

The National Science Foundation (NSF) and the departments of energy and defense will continue to support most materials research. But a proposed decline of \$16.7 million in the Defense Department's materials R&D budget would help reduce total support for superconducting materials from \$151.7 million to \$142.9 million. Research on metals, electronic materials and optical and photonic materials is slated to climb almost 7 percent. Research on other materials, including composites, biomolecular materials and ceramics, would climb at least 9 percent.

After past cuts and inflation, these increases barely boost materials funding beyond its level of two years ago.

Enjoying a 23 percent increase, to \$310.7 million, the National Institute of Standards and Technology (NIST) would fare even better than AMPP. Its \$67.9 million Advanced Technology Program includes \$18 million for up to 10 new projects by industry, aimed at developing technologies with commercial potential. The proposal also includes \$202 million for research within NIST — with boosts of 30 percent or more for manufacturing engineering, computer systems and technology assistance.

Son of Chiron: Now showing in space

It may sound like one of Godzilla's adversaries, but Son of Chiron is actually the nickname of a puzzling new object that astronomer David L. Rabinowitz discovered in the orbital range of Saturn. "We're stumped by it," says Tom Gehrels, director of the University of Arizona Spacewatch team in Tucson. "No one that I know of really understands what it is."

Rabinowitz, a member of the Spacewatch team, first spied the object Jan. 9, using a 0.9-meter telescope on Arizona's Kitt Peak. The initial report of this sighting and several subsequent observations by other astronomers appeared in an International Astronomical Union circular distributed Jan. 23.

So far, astronomers know little about the object, officially dubbed 1992 AD, except its size (about 200 kilometers in diameter), its elliptical path (which carries it between the orbits of Saturn and Neptune) and its color (redder than any known asteroid or comet).

This makes it just the second large, asteroid-like object found in that part of the solar system. Astronomer Charles Kowal discovered the first, Chiron, in 1977 as it circled the sun between the orbits of Saturn and Uranus. Ten years later, when Chiron swung closer to the sun, astonished scientists observed a comet-like halo, or coma, around its head (SN: 4/21/90, p.244). A coma suggests the existence of surface ice that begins to vaporize as it nears the sun.

Although astronomers have detected no coma around Son of Chiron, several

would not be surprised if one appeared. "When Chiron was newly found there was no halo," Gehrels says. "Everybody looked for it very carefully. It was only years later that it appeared."

James V. Scotti — another member of the Spacewatch team, which uses an automated telescope to scan the night sky — adds that a coat of ice probably sheathes many objects in the solar system's cold outer reaches. "Pluto, I think, if you brought it close to the sun would look like a comet," he says. "A big one, by the way."

Because the object came nearest to the sun last May, Brian G. Marsden of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass., says, "If it's going to show a coma, now is the time to look" — since it may still be warm enough to emit a cloud of water vapor.

Although they can offer some theories, astronomers frankly admit they have no idea where Son of Chiron originated. But whatever its origins, most astronomers agree that Chiron and Son of Chiron represent only a fraction of the enigmatic asteroid-like bodies that await discovery in the outer solar system.

Astronomers expect that as they discover more such objects, they will better understand the early makeup of the outer solar system and how these materials coalesced to form the planets. In the meantime, Gehrels says his team is enjoying all the ruckus over the new find. "We're having a field day with it," he laughs.

— M. Stroh

National Science Foundation: In the President's spending plan, NSF would receive a nearly 18 percent R&D increase — enough to keep the foundation on track for doubling its 1987 budget allotment by fiscal year 1994. NSF's support of inter-agency initiatives in global change, advanced manufacturing, high-performance computing and advanced materials garnered most of the increase. The proposed budget would also allocate \$48 million to continue construction of twin gravitational-wave detectors.

Global change: The Bush administration has long maintained that countries should learn more about global climate change before taking strong and potentially costly steps to counter the problem. In his fiscal 1993 budget requests, the President proposes spending \$1.37 billion for the U.S. Global Change Research Program, a coordinated effort by 11 agencies. This represents a 21 percent increase.

NASA would receive 65 percent of the global change research funds, reflecting a growing dependence on data collected by satellite instruments. The administration could run into trouble with Congress over

its \$308.4 million budget request for the Earth Observing System (EOS), an armada of sensor-laden spacecraft that would monitor the climate for a 15-year period starting in the late 1990s. Last year, Congress slashed the President's proposed EOS budget — from \$336 million down to \$188.4 million — and told NASA to fashion a cheaper program that could yield useful information sooner.

Environment: The new budget proposal slates \$18.3 billion — an 18 percent increase — for environmental programs throughout the federal government. With a 23 percent increase, the \$5.5 billion earmarked for the Energy Department's cleanup of contamination at its nuclear-weapons facilities would constitute the single largest environmental outlay. Indeed, EPA's proposed budget — including salaries and overhead — totals only \$7 billion.

Within EPA, the President has budgeted a 67 percent increase, to \$101.9 million, for activities to "aggressively" implement the new Clean Air Act amend-

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ments (SN: 11/3/90, p.277). The agency's radon-mitigation research program would also climb steeply in the coming year — 42 percent, to \$5.1 million. Superfund activities would climb 5.2 percent in the new year, to \$1.75 billion. And EPA's program for investigating the neurotoxicity of poisonous chemicals would increase 2.9 percent, to \$26.8 million.

The President proposes a 32 percent increase — to \$812 million — for federal programs aimed at conserving wetlands. The new budget would also increase funding by 47 percent, to \$42 million, for programs to develop what the White House calls “environmentally benign” vehicles.

Biomedicine/biotechnology: The new budget proposal includes a \$4.03 billion program to coordinate and spur biotechnology advances in agriculture, energy, the environment and health care across 12 federal agencies. This would represent a 4 percent increase in total spending for biotechnology.

In the health budget, the Centers for

Disease Control would receive the largest percentage increase — roughly 5 percent, to \$1.64 billion. The increase would help boost the number of children who receive immunizations against childhood diseases (\$349 million total), prevent lead poisoning among children (\$40 million total), pay for routine mammograms and Pap smears for low-income women (\$70 million total) and stem the recent surge in drug-resistant tuberculosis (\$40 million total). CDC's spending on AIDS research and prevention would increase 2 percent, to \$505 million. AIDS spending across all federal health agencies would total \$2.07 billion in 1993.

The President's budget plan for the National Institutes of Health includes a 2 percent increase for research grants, spread fairly evenly over all biomedical fields. The proposal would fund 5,800 new and competing research grants — about 200 fewer than funded this year.

Energy: Energy Secretary James D. Watkins attributed his agency's meager budget request both to the congressionally imposed spending cap and to a

reduction in “pork barreling.” A slated 12.3 percent cut in the department's defense-related R&D allows some other programs to grow. For instance, natural-gas research would jump 230 percent, to \$40 million. Other winners include alternative-fuels research — up 85 percent, to \$32 million. But fossil-fuel R&D would fall for the second year in a row, down 7.7 percent to \$825.2 million. And programs aimed at reviving the nuclear-power industry would fall almost 9 percent, to \$344.7 million. High-energy and nuclear physics programs would remain essentially flat at \$984 million, while biological and environmental research would rise 9 percent, to \$384.7 million.

— R. Cowen, J. Raloff and staff reports

Federal R&D budget: Looking good in '92

Despite a recession and an overall 4 percent cap on increases in discretionary domestic spending, federal research agencies fared remarkably well in the budget that Congress appropriated last fall for the 1992 fiscal year, which began last Oct. 1. Lawmakers allocated \$74.6 billion for R&D, a 6.8 percent increase over the fiscal 1991 budget after accounting for an estimated 4.2 percent rate of inflation.

Political battles and financial compromises that shaped the current year's R&D budget began a year ago, when President Bush outlined his blueprint for federal spending (SN: 2/9/91, p.87).

Bucking a recent trend, Congress boosted defense R&D more than it did civilian research spending, Albert H. Teich and his colleagues note in the American Association for the Advancement of Science's annual budget analysis, released last month. The \$44.1 billion for defense R&D represented a 6.9 percent jump, after accounting for inflation — and 1 percent more than the President had requested. It includes \$4.15 billion for the redesigned Strategic Defense Initiative, up \$1.2 billion from fiscal 1991. By contrast, civilian R&D received \$30.8 billion, 1 percent less than the 5.5 percent increase Bush requested.

Nearly every agency received R&D increases — which usually exceeded inflation and often matched the President's blueprint. The National Science Foundation emerged as a key winner, with an inflation-adjusted R&D increase of 11.9 percent. (The administra-

tion had sought an even heftier hike, but lawmakers shifted some proposed R&D funds to NSF education activities.)

Even many “losers” showed a modest increase. Amid criticism over several space agency programs, including development of new weather satellites and Space Station Freedom, NASA's spending limit rose to \$8.6 billion — 0.9 percent beyond inflation, but nearly 11 percent less than Bush had proposed.

Adjusting for inflation, Congress gave the National Institutes of Health (NIH) a 5 percent R&D increase, about \$200 million more than the President sought — but with a catch. NIH can't spend \$563 million, or 6 percent of its total budget (including items other than R&D, such as salaries), until Sept. 30, the last day of fiscal 1992. The maneuver effectively pushes spending of that sum into fiscal 1993. Congress imposed this constraint to ensure that the Department of Health and Human Services, which includes NIH, will not exceed its fiscal 1992 budget ceiling.

Among big winners in the NIH budget: Research on aging won a 20 percent increase over the 1991 level (mostly for Alzheimer's disease studies); support for cancer research jumped 16 percent; and funding for NIH's portion of the Human Genome Project increased 21 percent, to \$105.3 million.

Among Energy Department programs, Congress more than doubled spending on the Superconducting Super Collider. However, this \$473.7 million total constitutes some \$49 million less than the President requested. At



Artist's conception of space station.

\$169.9 million, solar energy funding shows a hefty 32.7 percent increase. Though Congress again quashed the President's efforts to severely limit coal research, its inflation-adjusted appropriation for fossil-energy R&D (including coal) still falls 10 percent below fiscal 1991 levels.

While many researchers have criticized Space Station Freedom, saying it holds little scientific merit and will siphon scarce funds from other space science projects, Congress awarded this program the full \$2 billion the President had sought — an increase of 2.5 percent. However, budget constraints forced NASA to kill plans for a solar observatory and a satellite-based biomedical research program called Lifesat.

Austere appropriations imposed a one-year delay in plans for several missions, including an orbiting X-ray telescope and the Cassini mission to Saturn. Congress also capped support for NASA's Earth Observing System — designed to monitor climate changes from space — at \$11 billion through the year 2000. Lawmakers called for a review of the program to ensure it could provide needed data to research agencies.

— R. Cowen