

shuttle funding, this amount represents a seven-fold rise, and is a direct result of the Challenger disaster and of widespread reaction from various oversight groups, Congress and, belatedly, NASA itself.

The only new scientific satellite proposed for NASA's budget is the Advanced X-Ray Astrophysics Facility, to be placed in earth-orbit by the shuttle by 1996. A small but significant increase of \$16 million — to \$84 million — would boost studies of planetary-science data already in hand (in hopes of slowing a perceived mini-brain-drain of scientists and graduate students in the field before several upcoming or envisioned projects such as the Galileo Jupiter mission reach their goals). Absent is any money for a mission called the Comet Rendezvous Asteroid Flyby, whose major goal would be to spend years following a comet as it approaches and recedes from the sun.

In line with the President's recent national space policy directive (SN: 2/20/88, p.118) is \$100 million for a "Pathfinder Program" to develop advanced technologies for major space endeavors such as an inhabited moon base and human exploration of Mars.

**Geosciences:** Two-thirds of what the administration proposes cutting from the National Oceanic and Atmospheric Administration (NOAA) budget would come from slashing \$102 million from its (formerly \$282 million) R&D budget. To make those R&D cuts, NOAA would terminate or reduce scores of projects, including the National Undersea Research Program, which provides funding for the *Alvin* submersible and the *Aquarius* underwater habitat (SN: 12/19&26/87, p.391). As with NOAA's Sea Grant Program, most of these programs have been scheduled for termination before. Among the few new initiatives budgeted for NOAA is the \$15 million Global Geosciences Program to study and improve prediction of climate change.

Funding for the U.S. Geological Survey would drop \$23 million — with more than half that to come from its R&D programs. These cuts would terminate research in coastal erosion processes and reduce funding in earthquake monitoring, geologic mapping and energy resources.

**Environment:** EPA's air pollution research would increase 10 percent, or \$6.7 million, in FY '89. However, that entire increase and more would go to boost one air program: the study of stratospheric-ozone depletion. To help finance a \$7.3 million increase in ozone studies, some \$1 million would be cut from programs to develop monitoring methods for such hazardous air pollutants as benzene and carbon tetrachloride, and another \$250,000 would be excised from programs on health effects of pollutants controlled under the Clean Air Act, such as sulfur

dioxide and carbon monoxide.

DOE's research into the sources and biological effects of radon gas would climb 27.3 percent, to \$14 million. Sim-

ilarly, EPA's research into technologies for reducing indoor radon levels would increase 36 percent in FY '89 — some \$1.1 million. — J. Raloff with staff reports

## An earlier dawn for modern humans?

Burnt flints from a cave in Israel have yielded evidence that anatomically modern humans were living in the Middle East around 92,000 years ago, about 50,000 years earlier than most previous estimates, according to a team of French and Israeli scientists.

The new date suggests that a primitive form of modern humans inhabited southwest Asia before the Neanderthals, whose remains in the same region date to approximately 60,000 years ago, say Helene Valladas of the National Research Center in Gif sur Yvette, France, and her colleagues. This supports the notion that modern *Homo sapiens* originated in Africa and colonized the globe, report the scientists in the Feb. 18 NATURE, while other groups, such as the Neanderthals, became extinct. Neanderthals probably migrated to the Middle East from Europe as Ice Age glaciers descended, add the researchers, but were not ancestors of modern humans.

Valladas and her co-workers used the recently developed thermoluminescence dating technique to analyze 20 charred flint flakes from an Israeli cave called Qafzeh, near Nazareth. The flakes were in the same layer of earth as modern human bones that were excavated 15 years ago, and may have been charred in a hearth or campfire.

The thermoluminescence technique is based on the principle that when some substances, such as ceramic and stone, are heated, radioactive isotopes are released in the form of light, thus resetting a predictable cycle of radioactive decay. By reheating the artifacts and measuring radioactive decay products in the light emitted, researchers can estimate the time elapsed since heating last took place.

If the dates from Qafzeh are accurate, writes anthropologist Christopher Stringer of the London-based British Museum in an accompanying editorial, Valladas and her co-workers are correct to question the conventional view that Neanderthals preceded modern *H. sapiens* in southwest Asia. Furthermore, he says, the findings reinforce the view that Neanderthals were a separate species rather than a closely related subspecies of *H. sapiens*.

By 90,000 years ago, suggests Stringer, *H. sapiens* may have split into a southern group, represented by fragmentary fossils from a South African site tentatively dated at between 80,000 and 110,000 years old, and a northern group

whose remains extend from Ethiopia to the Middle East.

Wherever the original "Eden" for modern humans might be, says Stringer, it remains unclear why it took 50,000 years for the Qafzeh people to spread into Europe — first inhabited by the Neanderthals about 125,000 years ago — and eastern Asia.

A more fundamental question, says anthropologist Erik Trinkaus of the University of New Mexico in Albuquerque, concerns the accuracy of the thermoluminescence dates for Qafzeh. "To my knowledge, there is no independent way to verify the new dates," he says, "and geochemists disagree on the accuracy of thermoluminescence dating."

If primitive modern humans did inhabit southwest Asia 90,000 years ago, their relationship to the Neanderthals becomes more difficult to explain, adds Trinkaus. Of the two populations, Neanderthals appear to have been the poorer foragers, so how could they have effectively competed for food with an established group of *H. sapiens*? If Neanderthals and modern humans lived in the same region without competition, how did two populations exploiting the same resources with similar tools coexist for so long in an area about the size of Rhode Island?

Although these are puzzling questions and thermoluminescence dating is not foolproof, "I have no basis to argue with the [Qafzeh] dates at this point," says anthropologist Fred Smith of the University of Tennessee in Knoxville. "The Near East may have been a population contact zone for modern humans and Neanderthals."

But there is evidence for anatomical similarity between Neanderthals and early *H. sapiens* in central Europe, notes Smith, which argues against Stringer's contention that Neanderthals were a separate species.

Milford Wolpoff of the University of Michigan in Ann Arbor accepts the new Qafzeh dates and expands on Smith's suggestion of a population contact zone. In his view, "This is the first direct evidence that Neanderthals could breed with people from other parts of the world." Combining that with the evidence for anatomical similarity between the two populations, he suggests that Neanderthals and early *H. sapiens* were distinct races that interbred and produced the line of fully modern *H. sapiens* around 40,000 years ago.

— B. Bower