Ancient Skull Fills Big Fossil Gap

A skull recently unearthed in eastern Africa and belonging to the same evolutionary lineage as modern humans ranks as a "one from a million" addition to the hominid fossil record.

The approximately 1-million-year-old specimen—consisting of much of the braincase and parts of the face and jaws—represents the only substantial *Homo* cranium from between 1.4 million and 600,000 years ago.

At least one feature of the cranium looks like later *H. sapiens*, although in several other ways the specimen veers toward *H. erectus*, concludes a team led by geologist Ernesto Abbate of the University of Florence in Italy. If correct, their analysis indicates that skeletal traits typical of *H. sapiens* began to emerge about 300,000 years earlier than many scientists had thought.

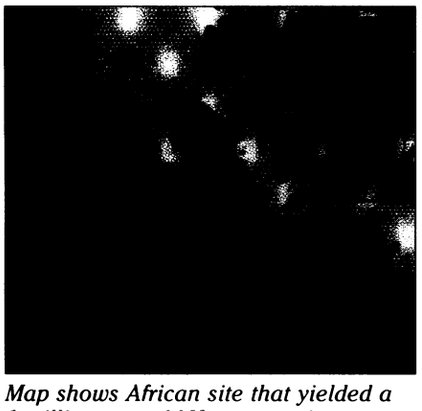
"The main point is that we have a well-founded date of about 1 million years for this *Homo* skull," Abbate says. "It fills a big hole in the fossil record."

Cleaning and restoration of the skull are still under way. The researchers have refrained from assigning it to a species until they can compare it in detail to other ancient *Homo* craniums.

Excavation of the skull occurred between 1995 and 1997 at a site bordering a geologic formation in Eritrea known as the Danakil Depression. The site, situated about 30 miles southwest of the Red Sea near the village of Bula, also yielded a pair of teeth and two pelvic fragments assigned to *Homo*.

Bones from a variety of animals turned up in *Homo*-bearing sediment, the researchers say. These included gazellelike creatures and extinct forms of horses, rhinoceroses, and hyenas.

Several features of the Eritrean *Homo* cranium appear in African specimens assigned to *H. erectus* or *H. ergaster*, Abbate and his coworkers report in the June 4 NATURE. For example, the new find has a long, oval-shaped braincase with a considerably smaller volume than that of *H. sapiens*. Also, a visorlike bony crest runs horizontally above the eyes.



Map shows African site that yielded a 1-million-year-old Homo *cranium.*

However, the sharp angling and distinctive shape of the cranium near its midpoint strongly resemble early *H. sapiens* specimens, the investigators assert.

The Danakil cranium is missing its base, a repository of clues regarding the hominid's vocal tract structure and speech capacities.

Changes in Earth's magnetic field documented in Danakil's sediment layers, combined with previously known time ranges for extinct creatures found at the site, place the *Homo* material at about 1 million years old.

"If the dating is accurate, this is a very important find for the hominid fossil record," comments anthropologist Ian Tattersall of the American Museum of Natural History in New York.

No scientific consensus exists on how to identify fossil members of *H. sapiens*, Tattersall adds. The Danakil skull displays few obvious anatomical links to *H. sapiens* and maintains a murky evolutionary status, he contends.

"This is a terrific find, and the dating looks good," remarks anthropologist Tim D. White of the University of California, Berkeley. "It establishes the Horn of Africa as a key area for unraveling *Homo* evolution."

White calls the evolutionary analysis of the Danakil cranium conducted by Abbate's group "very preliminary."

The new find should help to address controversies in *Homo* evolution, the Berkeley scientist notes, such as whether *H. erectus* was a direct ancestor of *H. sapiens* and whether a number of ancient *Homo* species existed simultaneously (SN: 5/31/97, p. 333). —*B. Bower*

Small comet theory melts under scrutiny

In science's version of an old-fashioned pillory, seven independent teams assailed the hypothesis that thousands of house-size snowballs plow into Earth's atmosphere each day.

At a meeting of the American Geophysical Union last week, the chairman of a session on this controversial topic issued a warning only half in jest. "I don't want any hitting in the trenches. No fighting, no biting," said Thomas M. Donahue of the University of Michigan in Ann Arbor.

Despite the admonition, the numerous critiques drew flashes of temper unusual at such conferences.

The small comet hypothesis was first proposed in 1986 by space scientist Louis A. Frank of the University of Iowa in Iowa City. Frank, along with Iowa's John B. Sigwarth, raised the idea after finding what he called "atmospheric holes" in images of Earth taken by the Dynamics Explorer 1 satellite. The holes were dark blemishes in the otherwise bright background of ultraviolet radiation emitted by the upper atmosphere.

To explain the spots, Frank proposed that 25,000 small, fluffy comets of almost pure water were bombarding Earth each day and disintegrating in the atmosphere. These clouds of water vapor show up as dark blotches on the images because they block atmospheric radiation from reaching the satellite, he said.

Although most researchers originally dismissed the idea, Frank captured both positive and negative attention last year when he presented corroborating evidence from new instruments on NASA's Polar satellite (SN: 5/31/97, p. 332; 12/20 & 27/97, p. 389). Ultraviolet images taken by Polar showed the presence of atmospheric holes, but they bypassed some problems in the original data.

At the meeting in Boston last week, Frank offered additional observations to bolster his hypothesis. Analysis of the satellite images suggests that the number of dark spots varies with the time of day and the season, following the same cycle as meteors. Other researchers quickly challenged the new findings.

Frank reported that small comets strike the atmosphere most often in the morning. That timing fails to match their purported path in space, says Alan W. Harris, an astronomer at NASA's Jet Propulsion Laboratory in Pasadena, Calif. "That's just completely backwards."

According to earlier reports by Frank, the speedy comets move in the same direction as Earth and overtake it. If that were true, the comets should plow into Earth's trailing edge and therefore hit in the evening, Harris says.

He and his colleagues hunted for direct evidence of the comets but came up empty-handed. The team used the Spacewatch telescope in Arizona, an instrument built especially to look for objects near Earth. A decade ago, one Spacewatch researcher reported observing bodies fitting Frank's descriptions, but other investigators associated with the project dismissed these observa-

tions as noise.

The detector on the present telescope is considerably more sensitive than the older version, so the hypothesized comets should show up much more clearly now, if they exist, says Harris. The telescope has found none thus far, he reports.

The comets have also eluded the Navy's string of radar installations spanning the southern United States. Stephen H. Knowles and his colleagues at the Naval Research Laboratory in Washington, D.C., examined data collected by this radar fence over 6 weeks. The system should have captured the comets at a rate of one every few minutes, but it failed to detect any of these snowballs among the thousands of objects observed, reports Knowles.

While Frank steadfastly supported his hypothesis at the meeting, several teams offered more mundane explanations for the black splotches in the satellite images. Larry J. Paxton of the Johns Hopkins University Applied Physics Laboratory in Laurel, Md., proposed that the spots could come from clouds in the lower atmosphere.

Although the satellites' ultraviolet imagers were designed to capture only ultraviolet radiation, tests on similar systems show that they often absorb some visible light. As a result, they detect some of the sunlight bouncing off clouds, says Paxton. In fact, Frank and his colleagues last year reported seeing outlines of clouds in a few Polar ultraviolet images.

Paxton hypothesized that breaks in the clouds could show up on the satellite images as dark spots. Their numbers vary precisely with the daily and seasonal cycle of cloud cover, he says.

"I think the simplest answer is that, in all likelihood, these [small comets] don't exist. But it's going to take some more tests," Paxton told SCIENCE NEWS.

Two teams offered evidence that the dark spots could come from static in the camera systems themselves. Scientists from the University of Washington in Seattle and the University of California, Berkeley argued that Frank's analyses have been misled by electrical noise in the camera, creating the illusion of atmospheric holes where none exist.

Frank angrily rejected the criticisms, calling some of the rhetoric "detestable." In his rebuttals, he ridiculed his opponents, triggering strong responses.

The assault on the small comet hypothesis continued into another meeting session, which explored the atmospheric implications of the idea. According to Frank, if small comets exist, the tremendous amount of water they carry would force scientists to reconsider the origin of water on Earth.

Satellite measurements of the middle atmosphere, however, show it to be extremely dry. If the small comets do exist and are moistening the atmosphere, they would have to be much rarer than Frank has hypothesized, calculate researchers from the University of California, Irvine; Hampton (Va.) University; and the Naval Research Laboratory.

The weight of the current criticism is swaying some researchers who last year voiced cautious support for Frank. "I think Frank's been seriously challenged," says Donahue. "There's a strong likelihood that it is instrumental [noise]. That's the way the wind is blowing." —*R. Monastersky*

Hubble takes first image of possible planet

The dim white dot that Susan Terebey and her colleagues spied in images of a nearby star-forming region could easily have been dismissed as a background star. The astronomers were intrigued, however, by the object's location—at one end of a long, luminous trail. At the other end lies a pair of newborn stars.

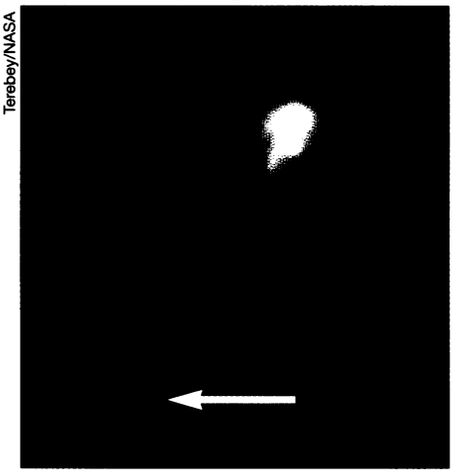
The team suggests that the youthful pair are parents and that the white dot is their runaway offspring—a planet with two to three times the mass of Jupiter speeding away at 10 kilometers per second. If that speculation is correct, then the images, recorded by the Hubble Space Telescope, will go down in history as the first ever taken of a planet outside the solar system. Terebey, president of Extrasolar Research Corp. in Pasadena, Calif., unveiled the pictures last week at a press briefing in Washington, D.C.

Although researchers have inferred the presence of eight planets outside the solar system, their evidence is based solely on wobbles in the motion of the stars the planets are thought to orbit.

To image the object, Hubble's near-infrared camera penetrated the dust in a star-forming region in the constellation Taurus, 450 light-years from Earth. The argument that the body, designated TMR-1C, is a planet rests on its proximity to the luminous, 200 billion-km-long trail that leads directly to the two young stars. Terebey's team says there's only a 2 percent chance that the object is a distant star that happens to lie at that position.

The researchers say the trail represents dust pushed out of the way as the planet was kicked out of its birthplace and went barreling into space. In this scenario, the planet is about the same age as the stars, a few hundred thousand years old. Given the planet's age and luminosity, theory suggests that TMR-1C has a mass several times that of the largest planet in the solar system.

Those numbers would seem to pose a puzzle, says Alan P. Boss of the Carnegie Institution of Washington (D.C.). Theorists have generally believed it takes a two-step process lasting 10 million years for a giant planet like Jupiter to form. First, bits of dust and ice lying in a disk around a young star assemble into a solid core. Then, the core snares enough gas from the disk to make a full-fledged, massive planet. In a model described by Boss in the May 14 NATURE, however, parts of the disk clump directly into a large ball of gas and dust heavy enough to form a giant planet in as little as 1,000 years.



Terebey/NASA

Arrow indicates an object that could be the first extrasolar planet imaged.

Boss' model requires that very young stars have relatively dense disks. In a report accepted for publication in NATURE, Luis F. Rodriguez of the National Autonomous University of Mexico in Mexico City and his collaborators find such compact disks in a star-forming region known as L1551. Rodriguez declined to discuss the article but noted that "our results and those of Terebey *et al.*, if fully confirmed, open new avenues in the issue of planet formation in binary systems."

Adam S. Burrows of the University of Arizona in Tucson cautions that the crudeness of stellar models and observational uncertainties make it difficult to estimate the mass and age of TMR-1C. For example, if the object lies in an unusually dusty region of Taurus, its true luminosity—and mass—might be underestimated. It's possible, in fact, that the object might be massive enough to qualify as a kind of failed star called a brown dwarf.

After studying the object's spectra, researchers expect to determine whether it has the mass and composition of a star, a brown dwarf, or a planet. —*R. Cowen*