

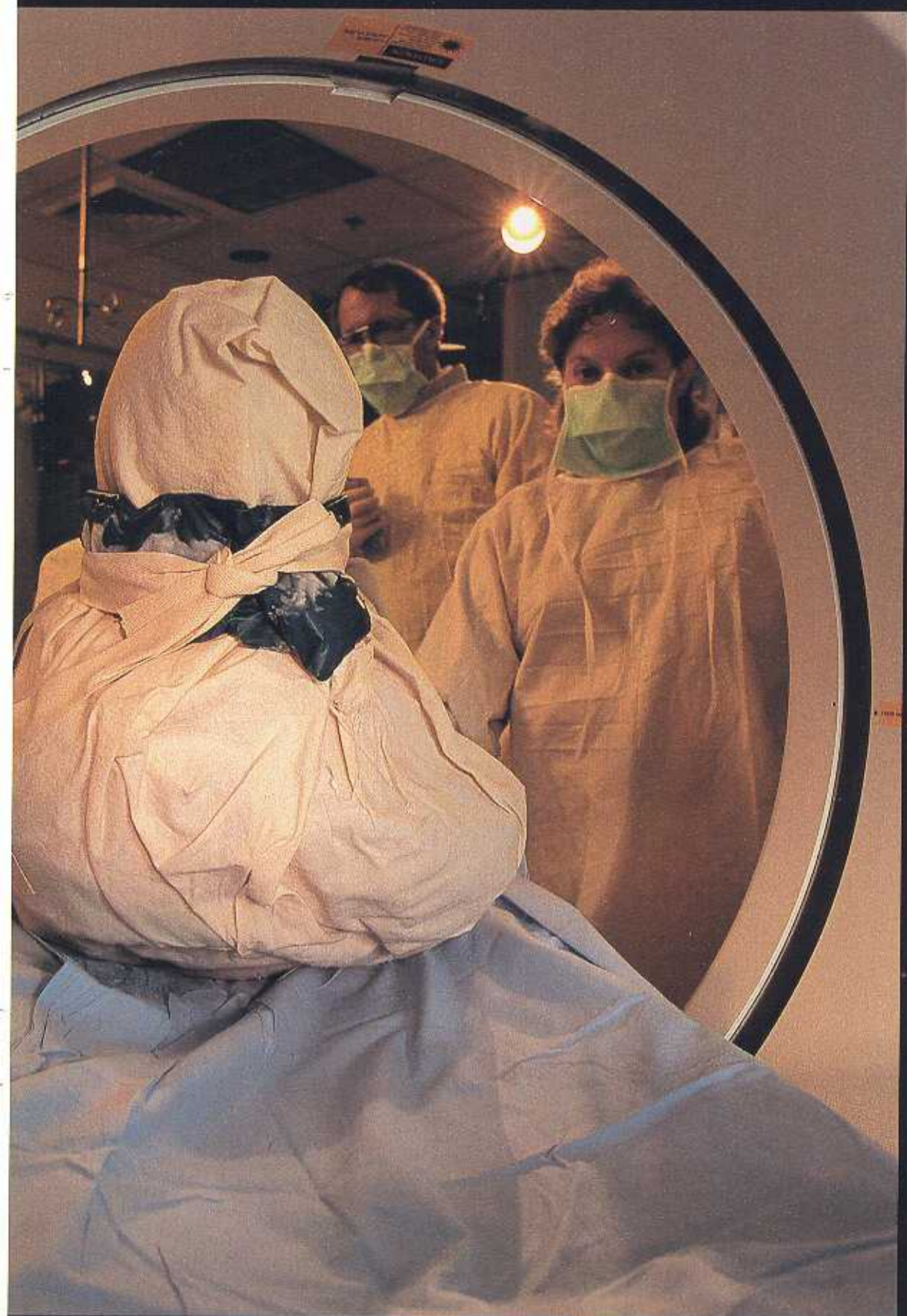
Sharp eyes
of science
probe the

Mummies of Peru

By JOHAN REINHARD

Wrapped for travel, the Inca maiden featured in last June's issue (inset) glides into a Johns Hopkins Hospital CT scanner guided by author Johan Reinhard and a technician. Startling computer images would soon show how she died.



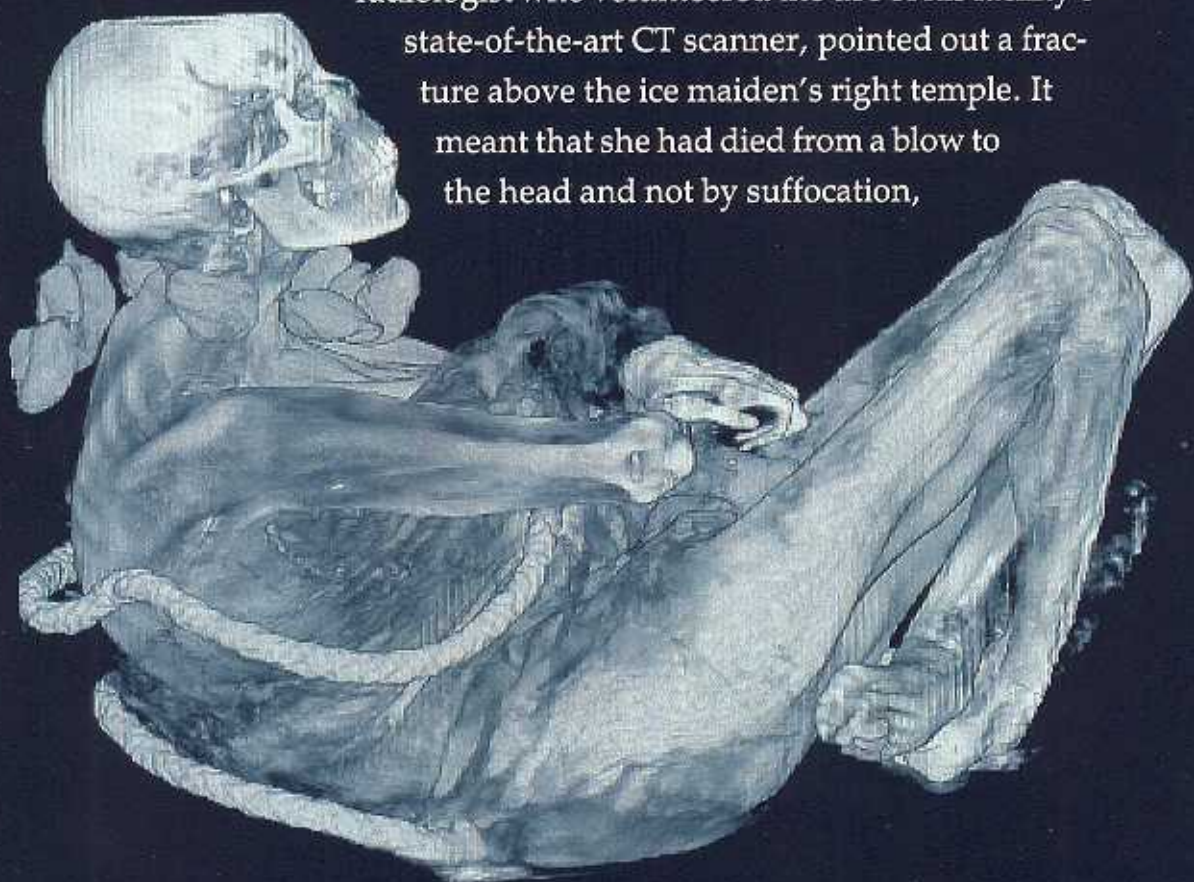


Since I last wrote about the Inca ice maiden, telling how my climbing partner and I found her frozen body high on a Peruvian peak and brought her down to the safety of a freezer at Catholic University in Arequipa, the girl who gave her life in sacrifice five centuries ago has made another unimagined journey. As a result she is, in a sense, being discovered all over again.

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Last May, with permission from the government of Peru, we arranged for the mummy to travel to the United States in a special container donated by the Carrier Corporation. At Johns Hopkins Hospital in Baltimore, radiologists made computed tomography (CT) scans of her body—spectacular three-dimensional x-ray images published here for the first time—and pathologists took tissue samples (right) for analysis. Some findings were announced immediately; others are still coming in. We have also learned more about one of the two other sacrifices found on Nevado Ampato volcano (page 42).

I'll never forget the moment when Elliot Fishman, the Johns Hopkins radiologist who volunteered the use of his facility's state-of-the-art CT scanner, pointed out a fracture above the ice maiden's right temple. It meant that she had died from a blow to the head and not by suffocation,



as I had previously thought. This came as less of a surprise to José Antonio Chávez, the Peruvian co-director of the Ampato mummy project, who weeks earlier had noted something irregular about her right eye socket.

After the CT scans were made, Edward McCarthy and Patricia Charache, pathologists at Johns Hopkins, took a number of needle biopsies—small samples of tissue from different parts of her body, including the stomach and knees. Analysis of the samples allows us to fill in details about her diet and health. “She ate a meal of vegetables within six to eight hours before dying,” says McCarthy, who has asked a forensic expert to identify what those vegetables were. Biopsies from her knees indicate that she had the bones of a normal, healthy teenager.

We had hoped the biopsies would also provide cell nuclei containing DNA, making it possible to trace the ice maiden’s maternal and paternal lines



JOHNS HOPKINS HOSPITAL (FACING PAGE); MARIA STENZEL

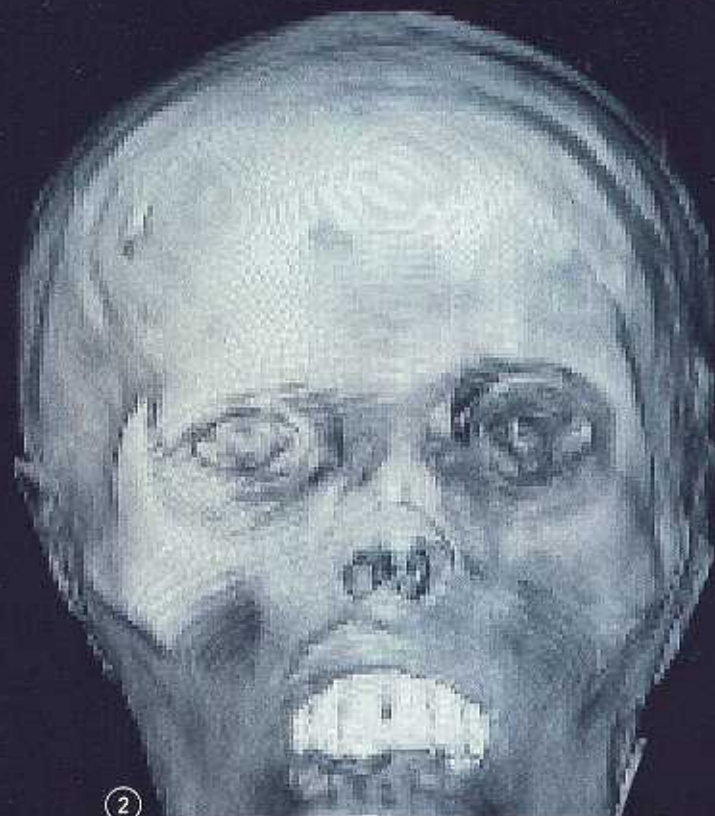
of descent and perhaps even to locate her living relatives. But all the nuclei had dissolved, which suggests that her body did not freeze immediately after she died. Our hopes for establishing genetic links now rest with mitochondrial DNA isolated from her heart, skin, and muscle tissue by scientists at the Institute for Genomic Research in Rockville, Maryland. Mitochondrial DNA, found outside the nucleus, is passed down only on the female side.

We have barely begun to understand the children of Ampato, and when the time is right, I look forward to making additional reports of our findings.



Digital dissection shows results

The diagnosis is swift: A blow to the right side of the head cracked the skull and caused a massive hemorrhage. "As soon as the image came up on the screen, we knew what had happened," says Elliot Fishman, director of diagnostic imaging, who pointed out details to the author (below, foreground) and



his Peruvian colleagues José Antonio Chávez and Hilda Vidal. Computed tomography—creation of video images from x-rays—allows as close a study as an autopsy without destroying the mummy. These 3-D figures are a combination of 691 CT scans. "In retrospect you can say, 'Aha! That eye is sunken and

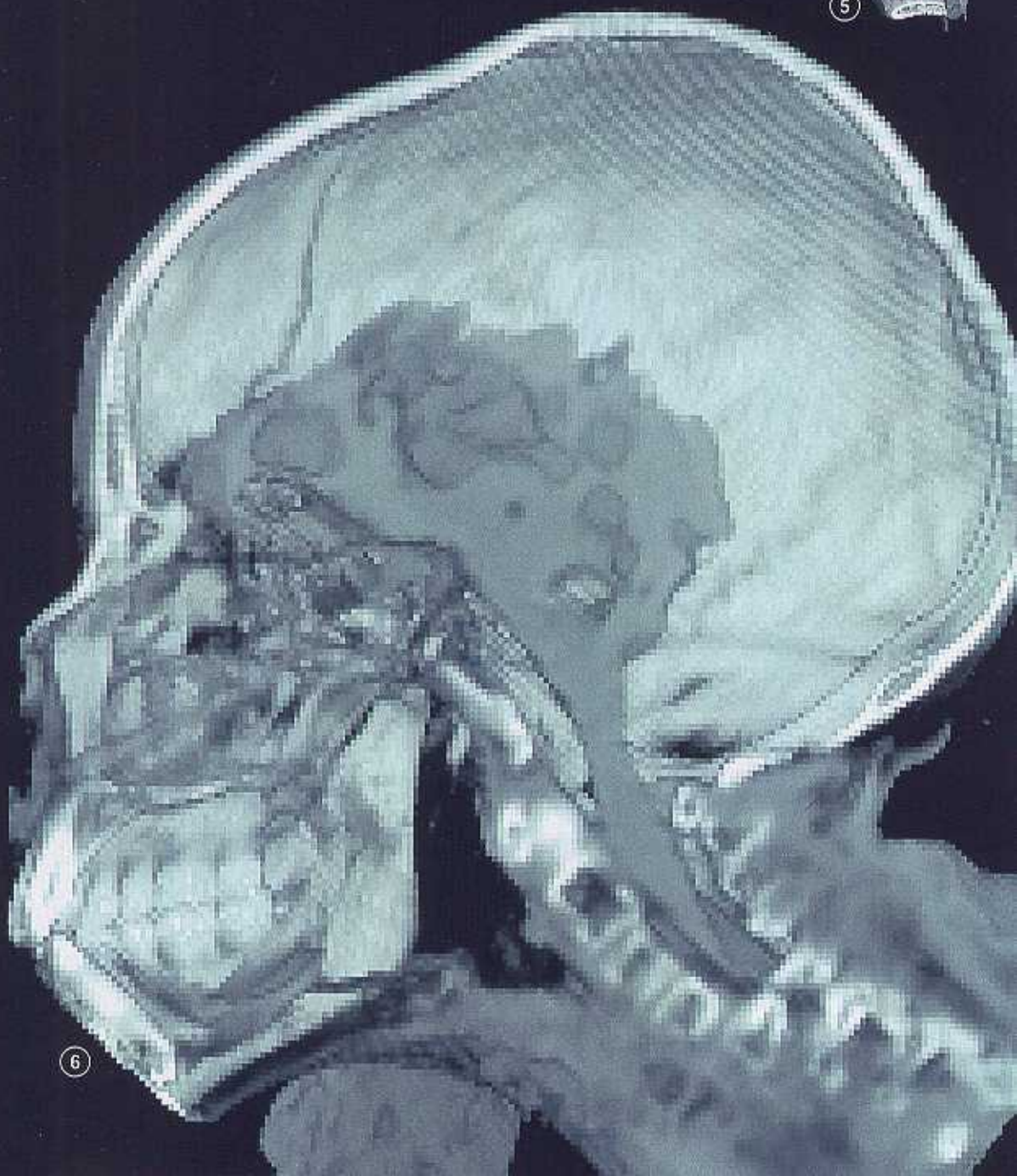
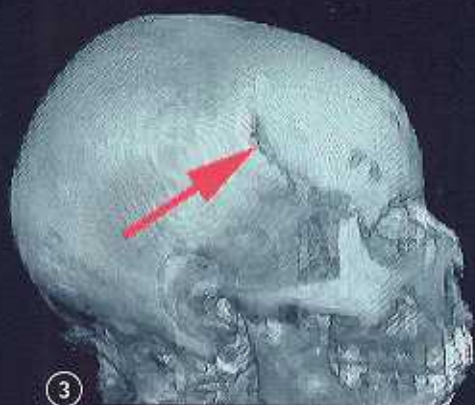
the orbit is deformed,'" notes Fishman of the ice maiden's face (1). "But it's like a diagnosis in a live person—after you have the answer, it's easy."

Front and side views (2 and 3) reveal a fracture about two inches long, marked by a red arrow. Inside the skull (4) sits the dark shape of the brain, pushed to the side by blood five centuries ago. Fishman sees similar cases today: "It's typical of someone who has been hit by a baseball bat."

A split view (5), rotated to display the spinal cord (6), reveals its surprisingly good condition—proof of fairly fast and sustained freezing. What the scans did not uncover is also important: Neither bones nor teeth show signs of disease or malnutrition. The Inca chose a perfectly healthy girl—about 14 years old and four feet ten inches tall—as a gift to their gods.



STEPHEN ALVAREZ (TOP LEFT); MARIA STENZEL (ABOVE); JOHN HOPKINS HOSPITAL



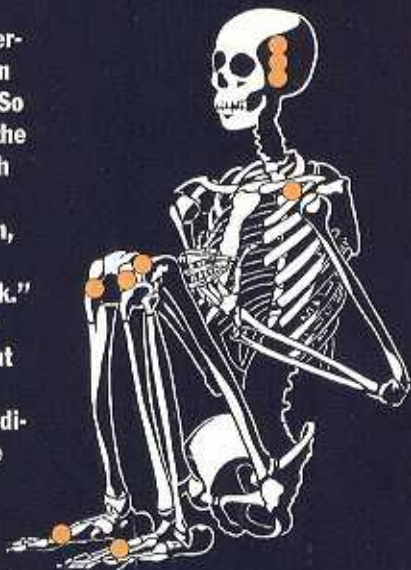
A burial struck by lightning

Bare bones protrude from one of the two graves uncovered on Nevado Ampato's high plateau in October 1995. There archaeologists found offerings around the remains of a child who was about ten years old when sacrificed and seated in the ice-cold earth for eternity.

Still partly locked in frozen earth (bottom right), the skeleton bears burns made by lightning. "To my knowledge, no one has ever seen lightning damage in 500-year-old bones," says John Verano, a physical anthropologist from Tulane University who examined the bones in Arequipa, where they remain. So far he has plotted damage to the skull, a rib, both legs, and both feet (right). "When we can reassemble the entire skeleton, we'll get a better idea of the specific path the lightning took."

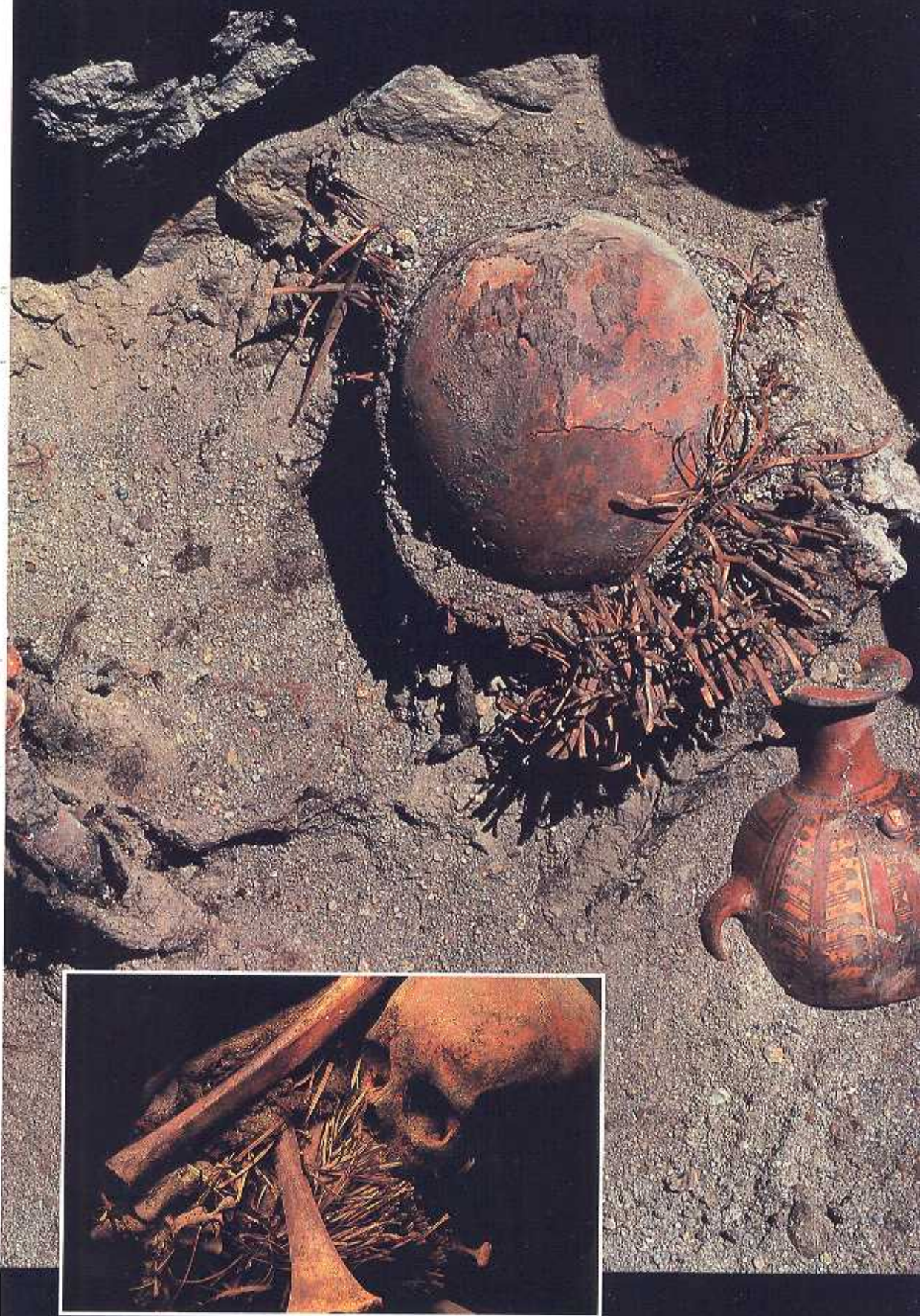
The child was too young for the bones to reveal the sex, but other evidence indicates this was a boy. Around the head radiated reeds that once hung like fringe from strings—likely a headband worn only by Inca males. Also, the remnants of clothing show no signs of *tupus*,

the pins that would hold together a female's dress and shawl. A silver male figurine about four inches tall (below), also blasted by lightning, rested near the mummy's thighs. Does this parallel the female figurines that accompanied the ice maiden on the summit? Continuing study, medical tests, and future excavations promise answers to this and other questions surrounding Ampato's mummies. □



CHRISTOPHER A. KLEIN, NATIONAL GEOGRAPHIC ARTIST (TOP); STEPHEN ALVAREZ





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