



## PALEONTOLOGY

## Altering the Past: China's Faked Fossils Problem

A booming fossils market has resulted in a flood of “improved,” reconfigured, and composite specimens; many are finding their way into China's museums

**BEIJING**—Frozen in time, the 5-meter-long ichthyosaur embedded in dark limestone seems to be darting after prey in a turbid Triassic sea. But look more closely at the startlingly lifelike skeleton here in the Geological Museum of China, and you will see that something isn't quite right. The beast's lower jaw and shoulder girdle are visible, which requires a ventral view—but the lower body is a lateral-dorsal view. Such an odd juxtaposition can mean only one thing, says Li Chun, a marine reptile expert here at the Institute of Vertebrate Paleontology and Paleoanthropology (IVPP): The centerpiece of the museum's prehistoric life exhibit is a composite of two individuals, and possibly more.

Specialists and collectors around the world have long decried the flood of sham fossils pouring out of China. But *Science* has learned that many composites and fakes are now finding their way into Chinese museums, especially local museums. “The fake fossil problem has become very, very serious,” says Peking University paleontologist Jiang Da-yong. Li estimates that more than 80% of marine reptile specimens now on display in Chinese museums have been “altered or artificially combined to varying degrees.”

Geological Museum officials are not inclined to remove the fishy ichthyosaur,

from southwestern China. “Farmers prepared the specimen. They might have made some mistakes when they put it together, but it is not a fake. You can call it a kind of model,” says Lu Liwu, director of prehistoric life research at the museum.

Nevertheless, Li is concerned about what he deems a misleading display. “This is a national museum,” he says. Another Geological Museum exhibit, a pair of huge dinosaur eggs embedded in siltstone, is also a sham: Large chunks of the shell are not the original material, says Li. Lu says the museum intends to add signage to clear up any misconceptions. Outside of Beijing, curators are not so conscientious. Chinese and Western paleontologists concur that many provincial museums are chock-full of composites, chimeras, and other phony fossils. But several contacted by *Science* said they are reluctant to speak out. “We would seriously jeopardize our own opportunities to work with our Chinese colleagues on very important material,” says one Western paleontologist, who requested anonymity.

One consequence of the fakery is an erosion of trust in museums, which are supposed to enlighten—not con—the public. Scholars, too, pay a price: They waste time sifting authentic specimens from counterfeit chaff.

**Crack me up.** Archaeoraptor turned out to be a bird-dinosaur chimera, not a missing link.

And a genuine blockbuster fossil can be destroyed by attempts to enhance its appeal. “A fake part in a fossil ruins the value of the entire specimen,” says Ryosuke Motani, a paleontologist at the University of California, Davis. “Even though the genuine part of the same specimen may provide important information that is otherwise unknown,” he says, “skepticism emerges as to whether we can trust it or not.”

“Normally we know right away if a fossil is fake, although it can take some time to be sure,” says IVPP Director Zhou Zhonghe. But fraudulent specimens can end up in the peer-reviewed literature. For example, the holotype—for which a species is named—of *Typicusichthysaurus tsaihuae*, a marine reptile from southwestern China, is “a forged specimen” with carved features, says Motani. (Li and other paleontologists agree with that analysis; the team that described the species could not be reached for comment.) More controversially, an IVPP paleontologist asserts that a 2009 report in the *Proceedings of the National Academy of Sciences (PNAS)* describing a new species of early cheetah is based on a forged skull; he has demanded a retraction. The authors insist the skull is authentic and stand by the report, as has the journal.

Stamping out sham fossils will require a crackdown on how fossils are collected and sold in China. A new law that comes into force next month aims to protect fossils of high scientific value (*Science*, 17 September, p. 1453). But experts doubt that the law will pose a sufficient deterrent: Forging fossils is simply too lucrative, they say.



**High fidelity.** Zhao Lijun's exhibition in Zhejiang has won praise for its authenticity.

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The art of faking fossils has a long history. Perhaps the most infamous fraud is Piltdown Man, a skull, unveiled in 1912, that was touted as a missing link between humans and apes. It was exposed as a hoax in 1923, when a German anatomist determined that Piltdown was a chimera: a modern human skull and an orangutan jawbone. In another notorious case in the annals of bogus fossils, noted paleontologist Friedrich von Huene described in 1966 a juvenile *Leptopterygius* from Germany. Von Huene, 91 at the time, had not realized that the ichthyosaur was a total fabrication: Its “bones” were carved from the substrate.

China, too, has suffered a Piltdown moment. “Archaeoraptor,” purported to be a missing link between birds and dinosaurs, made its debut in the November 1999 issue of *National Geographic*. Rumors that the skeleton, unearthed in northeastern China’s Liaoning Province, was a fake began to swirl even before publication, says Zhou. Archaeoraptor was later thoroughly discredited as a chimera consisting of the body of *Yanornis martini*—a primitive fish-eating bird—and the tail of *Microaptor zhaoianus*, a feathered dinosaur.

Now, an IVPP paleontologist fears that a prestigious peer-reviewed journal has published a fake. In a 13 January 2009 report in *PNAS*, Per Christiansen of the Zoological Museum in Copenhagen and Ji H. Mazák of the Shanghai Science and Technology Museum presented a nearly complete skull of a primitive cheetah, which they have said was unearthed from a fossil layer in Gansu’s Linxia Basin dated to around 2.2 million to 2.5 million years ago. Christiansen and Mazák describe a “unique combination of primitive and derived traits” that places the species, which they named *Acinonyx kurteni*, as “the most primitive cheetah known to date.”

When IVPP’s Deng Tao saw the *PNAS* paper, he says, “I knew immediately the skull was a fake.” Deng says the published photos show that several features of the skull had been concocted from bone or plaster. For example, he wrote in a 16 January 2009 letter to *PNAS*, “the parietal area is glued by some bone pieces to imitate the skull of a modern cheetah, but the forger did not make the parietal crests.” With that one slip-up, Deng says, the forger “gave the game away.” According to Deng, who has collected fossils in Linxia every year since 1998, it is common there to encounter dealers peddling fake skulls. “Unqualified collectors are often cheated,” he wrote to *PNAS*. Because the paper’s “unfounded” conclusions are “based on a fossil forgery,” Deng urged the authors or the journal to retract the paper. IVPP’s Qiu Zhanxiang, an academician and top specialist

on mammalian fossils, says he concurs with Deng’s opinion that the skull is a composite and that the paper should be retracted.

Mazák, whose birth name is Huang Ji, told *Science* that the skull is genuine and that Deng’s concerns amount to a “scientific dispute” because the *PNAS* paper did not cite Deng’s 2004 description of a primitive cheetah from Linxia, *Sivapanthera linxiaensis*. Mazák declined to explain how he obtained the skull, and Christiansen, now at the Zoological Garden in Ålborg, Denmark, did not respond to requests for comment. In a 4 Feb-

ruary 2009 letter to Deng, *PNAS* declined to publish Deng’s letter and stated that his observations “can be explained by sloppy preparation, incomplete preservation of the skull, or as characters that differ from Deng’s expectations that are based on an a priori hypothesis of relationship or ancestry.” Deng says he has not pursued the matter further because Mazák has declined to give him access to the skull.



**Pièce de contrefaçon.**  
IVPP’s Li Chun with a composite ichthyosaur at the Geological Museum of China.

ever, snap up fossils with inept or derisory expert advice. As a result, Li says, many “local museums are full of fakes.”

One remedy is for museums to create closer ties with academics; few now have paleontologists on staff. A rare success is “Sea Monsters,” a yearlong exhibition of marine reptile fossils that wrapped up last month at ZMNH. Zhao joined IVPP’s Li and others in the field for a few summers to collect fossils for the exhibit; other specimens were on loan from IVPP. “Without IVPP’s cooperation, we would not have been able to do this,” says ZMNH Director Kang Xi Min.

Another boost would be a training program for fossil preparators. And preventing fake fossils from contaminating the scientific literature, says IVPP’s Xu Xing, “can be easily avoided by careful and experienced scientists.” But Li and others admit they don’t have a strategy for combating the root of their ills: a legion of fakers assiduously despoiling China’s paleontological riches. “Our fossils are some of the best in the world,” says Li. “But they are being destroyed, and there is little we can do about it.”

—RICHARD STONE