PALEONTOLOGY IN CHINA ▶ PROBLEMS

Internal Fights, Looting Hinder Work in the Field

A wealth of opportunities is cheapened by black market sales and internecine squabbles over site access and specimens

MAOTIANSHAN, YUNNAN PROVINCE—With its spectacular fossils, a well-trained cadre of researchers, and increasing funding, China could be the ideal place for paleontology in the 21st century. But scientists face a trio of problems: squabbles over access to sites and control of fossils, a lack of cooperation in the community, and widespread fossil looting. "It is a loss not only for China, but for the world," says Chang Mee-Mann, a senior paleontologist at the Institute of Vertebrate Paleontology and Paleoanthropology (IVPP).

A striking, two-story building down the road from the world-class site here offers mute testimony to what can happen when bureaucracies don't see eye to eye. The Chengjiang Field Station, boasting dorm rooms, work spaces, and a grand exhibition hall, was supposed to be a home away from home for scientists from the Nanjing Institute of Geology and Paleontology (NIGP), some 2000 kilometers to the northeast. But the 2-year-old facility has remained empty until recently, a victim of disagreement over stewardship of the site.

Local authorities have been reluctant to permit further digging at two of the most famous and productive Chengjiang sites—Maotianshan and Haikou. They want to preserve the site as a tourist attraction and worry, in the words of one scientist, that further digging will leave "nothing for visitors to see." For NIGP scientists, however, closing off the site means leaving valuable fossils in the ground. A compromise is being worked out, says NIGP's Sun Weiguo, that would allow digging under "a long-term program to preserve the sites." Meanwhile, the building is now open and digging at other Chengjiang locations will soon resume.

Although provincial authorities clearly get to decide who digs, ownership of the fossils is unclear. A single sentence in a national law apparently gives authority over vertebrate fossils to the State Administration of Cultural Heritage, but a 1998 government reshuffling apparently shifted control to the Ministry of Land Resources (MLR). Confusion over the extent of its prerogatives can slow down research, however. Last summer, IVPP lost 2 months of work at an exceptionally rich site in western Liaoning Province after local MLR representatives halted digging and demanded the return of fossils previously collected from other sites. Work resumed after negotiations, but who will wind up with the specimens has yet to be clarified. National regulations now being drafted may resolve which agencies control sites and fossils.

Building ties. The new Chengjiang field station sat empty for 2 years until authorities agreed on how to both preserve sites and dig.

CREDITS: (TOP TO BOTTOM) E. STOKSTAD; D. NORMILE

Group rivalry

Outside China, one institution typically takes the lead in investigating a site and coordinating research efforts with those of other institutions. In return, the lead institute gives all qualified researchers a chance to study the collected specimens. In China, such coordination is lacking, and some researchers do not respect each other's turf. "We only know what other groups are doing because we all hire the same farmers to do the digging," says Yunnan University's Hou Xianguang about activity at the Chengjiang sites.

This lack of communication has led to embarrassing redundancies. In 1999, Gao Keqin and others from IVPP named a newly discovered aquatic reptile *Hyphalosaurus*. At the same time, Li Jianjun and colleagues of the Beijing Natural History Museum named its mirror image *Sinohydrosaurus*, completely unaware that they were working with the counterslab of the same specimen. "This sort of confusion arises because there are so many groups out there not cooperating," says Hou.

"Not cooperating" doesn't begin to describe the friction between IVPP and Ji Qiang, former director of China's National Geological Museum. Relations soured after Ji switched from Paleozoic marine life and plunged into the debate over the origin of birds, a primary research focus at IVPP. Ji says the competition for specimens and scientific recognition "is very good for research, because before 1996 there was only one voice on the origin of birds—IVPP's voice."

Tensions between the two institutions, including the sharing of fossils, reached the breaking point early last year. In an article in a Hong Kong newspaper, Ji criticized IVPP researchers for their work with the now infamous *Archaeoraptor* fossil, sensationalized in *National Geographic* but later proved to be a fraud (*Science*, 22 December 2000, p. 2221). In particular, Ji said that IVPP researchers had studied the specimen even though it had been smuggled out of China, a cardinal sin for Chinese paleontologists.

Not so, says IVPP's Xu Xing, who replied in the Chinese press that he began studying *Archaeoraptor* only after it was clear it would be returned to China. That explanation is supported by the magazine's account of how it was duped. In the same newspaper article, Xu noted Ji's co-authorship of papers on two allegedly smuggled specimens of the primitive bird *Confuciusornis* in German and Austrian museums.

Self-protection. Zhou Zhonghe and other paleontologists hope this warning sign will discourage fossil thieves.

Recent developments, however, may have calmed the waters. This month Ji will step down as director of the Geological Museum and return to the Chinese Academy of Geological Sciences, which is also under the MLR. Ji says his new post, principal scientist at the Institute of Stratigraphy and Paleontology, will give him a chance "to rejuvenate the paleontological research work" in the academy. Researchers hope the move paves the way toward better relations between the museum and IVPP.

Illegal fruits

A bigger problem than professional spats over jurisdiction may be the fact that many specimens are sold illegally to collectors. Scientists can never fully know what has been lost from looting and smuggling, but there are hints. In the early 1990s, dozens of dinosaur eggs, many with intact embryos, were unearthed in China and soon became hot items at fossil and

curio markets worldwide. Today, says IVPP's Zhou Zhonghe, "all the best specimens of eggs with embryos are now outside China."

The immense value of specimens to farmers eager to escape the grinding poverty of rural China almost ensures that the looting will continue, however. Local governments are hard-pressed to protect the widely scattered sites, and police and officials can be bribed. Even the threat of a death sentence, so far levied only against those who have plundered cultural relics, isn't enough to deter the illegal trade.

This presents scientists with hard choices. Although it is illegal to buy specimens with government money, Ji says that the Geological Museum has used a system of indirect payments. "We ask the farmers to donate fossils to the museum," he explains. "Then, the museum gives them awards." The first specimen of *Sinosauropteryx*, for example, netted the donor $750 in 1996.

Director Zhu Min admits that IVPP reluctantly employs the same tactic, but only as a last resort. Staying above the fray, he notes, means that "scientifically valuable specimens will not be in the hands of genuine researchers." At the same time, IVPP's Chang says that specimens bought from farmers "have lost much scientific information, such as the layer, location, and the association with other fossils." Looters rarely save fossil fragments, which may be valuable to scientists but not to collectors. Indeed, attempts to cement unrelated bits and pieces together are so common that a recent monograph on *Confuciusornis* included a section on how to spot doctored specimens.

Some localities have gotten serious about protection, with Yunnan officials posting full-time guards at some of the most prominent Chengjiang sites. In 1997, the secretary-general of the local Communist party personally supervised filling the quarry with boulders to protect it during the off-season. And in Guizhou Province, the local government has paid for highway patrols.

But added security doesn't eliminate the problem. "It means peasants now dig less. But they haven't stopped," says IVPP's Li Jinling, flipping through photographs of plundered outcrops. "I feel very sad for Chinese science." **–DENNIS NORMILE**

With reporting by Erik Stokstad and Xiong Lei.

PALEONTOLOGY IN CHINA

▶ PARTNERS

Fruitful Collaborations Follow a Two-Way Street

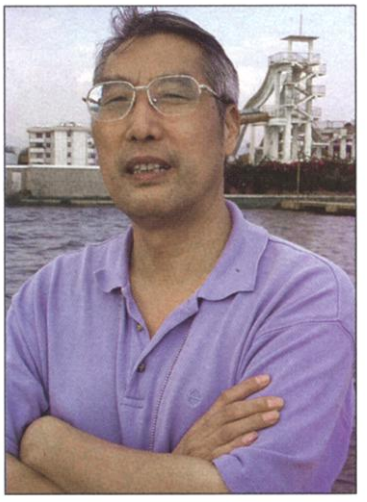
Chinese scientists now hold many of the cards as foreigners seek access to a buried pot of fossilized gold

NANJING—Twenty years ago, Jin Yugan was one of a handful of Chinese paleontologists allowed to collaborate with Western scientists. It wasn't easy. A senior stratigrapher at the Nanjing Institute of Geology and Paleontology (NIGP), Jin spent up to 6 months before each trip meeting such bureaucratic requirements as advance approval for every piece of correspondence. But the hard work was worth it, Jin says, because Chinese scientists were desperate for outside information, help with publishing papers in English, and the acclaim that flowed from such collaborations.

Today, communication is a lot easier, and it's the rest of the world that is beating a path to Jin's door. Jin has even cut back on his overseas travel to spend more time analyzing his data on the Late Permian mass extinction, which is eagerly awaited by collaborators. The boost in government support also has given Jin and others "more opportunities and greater choice in finding collaboration partners," adds Yang Qun, deputy director of NIGP.

The new arrangement is a far cry from the 1920s and '30s, when foreign teams trooped around the country and then shipped home the best specimens. The war and the creation of the People's Republic ended that type of one-way interaction, and it wasn't until 4 decades later, after China began turning westward, that the next major influx of foreign scientists occurred. A series of expeditions called the Sino-Canadian Dinosaur Project began in 1986 and helped to open the door. Fueled by $100,000 in annual funding from the Canadian Ex Terra Foundation, scientists excavated more than 60 tons of fossils and identified many new species. "I felt sure that we could work with the Canadians on an equal footing," says Chang Mee-Mann, then the director of the Institute of Vertebrate Paleontology and Paleoanthropology (IVPP) in Beijing. IVPP's Doug Zhiming and Zhao Xijin co-launched the expeditions with Philip Currie of the Royal Tyrrell Museum of Paleontology in Drumheller and Dale Russell, then of the Museum of Nature in Ottawa.

As China's scientific infrastructure expands, however, the preferred mode of interaction is smaller teams built upon mutual interests. "Personal connections in China mean everything," says Chris Beard of the Carnegie Museum of Natural History in Pittsburgh. Large or small, foreign collaborations must work through a Chinese host to win approval for their scientific activities. The increased wealth of their Chinese counterparts is another, welcome change. "On a trip a couple of months ago, once we paid our airfare, they paid for everything else," says Will Downs of Northern Arizona University in Flagstaff, who is working with IVPP on early mammals.



Traveling man. NIGP's Jin Yugan has more offers from foreign collaborators than he can handle.

CREDIT: D. NORMILE

The demand from the West is so great that there is a shortage of top Chinese paleontologists available to work with. Researchers at the IVPP "are just completely overbooked, all of them," says Downs. But not all Chinese scientists are equipped to enter into collaborations. "First you have to know what you're doing," says IVPP's Xu Xing, who studies feathered dinosaurs. "We don't just want to have our name out [in the newspapers]."

Sun Weiguo, who studies early multicellular animals at NIGP, notes that some Chinese scientists seek fame merely on the basis of their access to key fossils. "If the majority of work is done by foreign scientists," adds Xu, "that's not good for Chinese science." Similarly, Chinese scientists complain about Westerners who give lip service to scientific collaborations to obtain access to the samples.

True collaborations avoid those problems, says Doug Erwin of the Smithsonian Institution in Washington, D.C., who has worked with Jin. "If you collaborate as equals, then you can have a wonderful time." And there's no excuse not to do it properly, adds David Dilcher of the University of Florida, Gainesville. "The door is open wide for good, constructive, collaborative research," he says. **–XIONG LEI**

With reporting by Li Hui, Dennis Normile, and Erik Stokstad.