PALEONTOLOGY IN CHINA

▶ PLAYERS

Research Kicks Into High Gear After a Long, Uphill Struggle

Talented researchers are getting a chance to practice their profession, but will the reforms and added resources be enough to attract the next generation?

BEIJING—Chang Mee-Mann has come a long way since hauling baskets of rocks and dirt to build a dam in rural China. Chang, now 64, was just beginning her career here at the Institute of Vertebrate Paleontology and Paleoanthropology (IVPP) in 1966 when the Cultural Revolution brought scientific activities to a halt. The institute was shuttered, and Chang and her colleagues were sent to the countryside. "I thought I'd never do paleontology again," she says.

But Chang bided her time. A decade later she resumed her career. Taking advantage of the increasing freedom to pursue basic research, she earned a Ph.D. in Sweden and began compiling what a colleague calls "the most comprehensive characterization of Devonian fish done by anyone." For these efforts the Chinese Academy of Sciences (CAS) named her an academician, one of China's highest scientific honors. To Mark Norell of the American Museum of Natural History in New York City, Chang is "one of the greatest Chinese paleontologists ever."

Chang's career reflects the changing fortunes of the entire field. She and her colleagues have helped bring paleontology in China from near-extinction to international prominence. Buoyed by hard work and fortuitous geology, Chinese scientists have uncovered some of the most spectacular finds of the past decade. And they may be poised to make an even bigger impact. Funding is soaring, scientific institutes are being reorganized to sharpen their focus on research, and universities are stepping up their efforts to compete for top talent. As a result, the next generation of Western-trained paleontologists appears to be well equipped to tackle new challenges. "The work we are doing still cannot be compared with that done abroad both in depth and in breadth," says Chang, but "the young people are moving in the right direction." The field still faces some internal impediments to continued growth, however: bickering among competing institutions, looting of sites by local farmers (see p. 239), and a dearth of young people willing to enter the field.

The current prominence of China's paleontology was a long time coming. Paleobotanist Zhou Zhiyan of the Nanjing Institute of Geology and Paleontology (NIGP), who received a Ph.D. in 1966, recalls the frustration of not being able to use the skills he had just acquired. "Before 1980, we all had to do things not related to paleontology," he says. But Zhou's years of waiting paid off in 1989 with a spectacular find: the oldest gingko specimen ever found, dated at 170 million to 180 million years. "Before this discovery, many scientists doubted the gingko existed in Jurassic time, but now we have a very beautiful and very convincing specimen," he says.

Digging in. Chang Mee-Mann waited decades for paleontology to be properly recognized.

Financial fuel

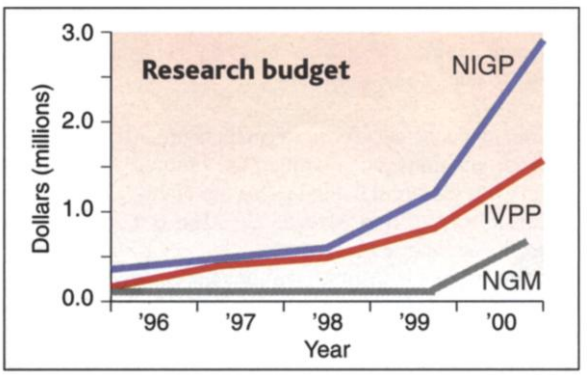
Similarly remarkable specimens are turning up just about everywhere Chinese paleontologists have gone digging. The results have attracted foreign collaborators who, in the 1980s and early 1990s, brought badly needed financing and expertise (see p. 241). The next wave of finds attracted worldwide media interest and, finally, the attention of the Chinese government. Now the Chinese side often can afford to pick up some of the expenses for international collaborations. The government, says Xu Guanhua, a vice minister at the Ministry of Science and Technology, "must find ways to increase funding for a sphere where Chinese scientists have such great possibilities."

The jump in funding has already been impressive. Between 1996 and 2000, research grants awarded to NIGP went up eightfold, to almost $3 million. In addition, the institute's annual budget for salaries and maintenance has risen by two-thirds, to roughly $625,000. The institute is also in the midst of remodeling its 1920s era buildings to restore their original marble interior trim and terrazzo floors, add air conditioning, and extend phone lines to each office instead of the present arrangement of one hall phone per floor.

Paleontology is also profiting from government programs designed to stem the country's brain drain (*Science*, 21 January 2000, p. 417). In 1999, when Zhou Zhonghe finished his Ph.D. in vertebrate paleontology at the University of Kansas, he had a publishing record that stood him in good stead for an academic career in the United States. To encourage him to return, IVPP was able to get him into the Hundred People program, which provided a plum salary and $242,000 over 3 years to get his research lab up and running. And Zhou is not alone—across the board, top paleontologists are enjoying a level of support that triggers envy among colleagues in other countries. "Even in North America, you're not getting this kind of money," says Jin Meng of the American Museum of Natural History.

Publishing prizes

The bulk of the money is flowing through three institutes that dominate the field: IVPP and NIGP, both of which come under the CAS, and the National Geological Museum (NGM) in Beijing, which is part of the Ministry of Land Resources. As scientific activity recovered after the Cultural Revolution, much of the funding flowed from the top down, split up more or less by seniority. But competitively awarded grants now predominate, with emphasis on a good track



Not dirt cheap. China's three leading paleontology institutions are enjoying tremendous growth in research budgets.

CREDITS: (TOP) E. STOKSTAD; (BOTTOM) NIGP, IVPP, NGM

record. Huang Weiwen, an IVPP paleoanthropologist, recalls a 5-year effort to get funding that succeeded only after he co-authored a *Science* paper with Richard Potts of the Smithsonian Institution in Washington, D.C. "After that, the door opened," Huang says.

Salaries, too, are now based at least in part on merit. Although base pay still depends on rank, explains NIGP director Sha Jingeng, publications, prizes won, and research grants awarded also play a role. For each paper that appears in *Science* or *Nature*, for example, NIGP pays a researcher about $600, and IVPP pays $400. That's a significant incentive, says IVPP director Zhu Min, who notes proudly that he paid out eight such bonuses in 1999.

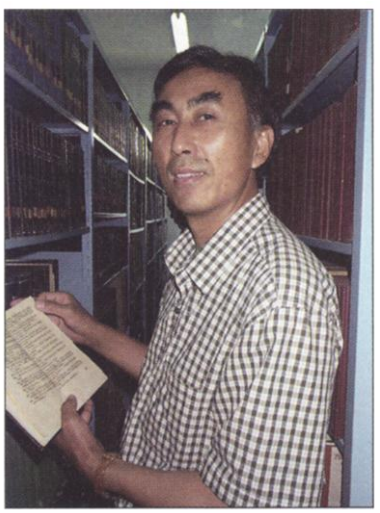
But CAS is raising the stakes as part of an academy-wide reform program (*Science*, 8 January 1999, p. 150). Officials want to consolidate institutes, reduce staff, get rid of the businesses many institutes run as sidelines, and relieve institutes of responsibility for such things as housing employees. The carrot is cash—as much as a doubling in salaries and better research support.

NIGP was one of a handful of institutes selected in 1998 as models for the pilot stage of the program. "At that time, we had 250 people, but [under the restructuring] CAS gave us only 80 official positions, including administrative staff," says Yang Qun, an NIGP deputy director. All researchers had to reapply for their positions, and those who scored highest on a rating based on performance made the cut. Those researchers not in official positions are permitted to continue their work but are not eligible for the higher salaries and grants offered through the Knowledge Innovation Program.

Change agent. IVPP director Zhu Min has applied youthful vigor to reforming his institute.

Zhu hopes his institute will be chosen in the next round, but he's not taking any chances. The number of researcher slots had already been cut in half, to 50, using a process similar to NIGP's. He also intends to spin off a cast-making business and shed responsibility for employee housing.

Zhu, 35, is an example of how CAS is aggressively moving younger people into top positions, thanks in part to the dearth of scientists in their 40s and 50s caused by the Cultural Revolution. Chang was Zhu's mentor, and he followed her into paleoichthyology, building on her work on Devonian fishes. He became director a year ago, just as a string of important papers on feathered dinosaurs began pouring out of the institute.



Valuable research. NIGP director Sha Jingeng gives staff cash rewards for articles in leading journals.

The two CAS institutes are supposed to avoid stepping on each other's scientific toes, as they have different specialties. IVPP concentrates on lower vertebrates, including fishes, reptiles, dinosaurs, and birds; mammals; and paleoanthropology and archaeology. NIGP's five research divisions are focused on invertebrates and plants, along with a significant amount of work in geology, stratigraphy, and tectonics. But when it comes to important specimens, everyone is interested. NIGP has published a paper on a feathered dinosaur, for example, that irked IVPP researchers.

Relations between the two CAS institutes and the NGM are even more tense. Ji Qiang, who has just stepped down as director of the museum to become principal scientist at the Institute of Stratigraphy and Paleontology within the Chinese Academy of Geological Sciences, has targeted many of the same hot areas of paleontology worked on by IVPP researchers and has proven adept at tracking down specimens dug up by farmers. Those attributes have generated tensions within the tightly knit community.

The two CAS institutes and the national museum have dominated the field for years. But they are now facing some serious competition from universities, which are boosting their own paleontology research efforts. In a tactic new to China, universities are also raiding the institutes for talent. Northwest University in Xi'an and the Chinese University of Geology, which has campuses in Beijing and Wuhan, are already home to notable paleontology labs. Researchers at Nanjing University are planning an international effort that would unite paleontologists with geochemists and paleoecologists to try to understand major events like the explosion of life in the Cambrian era, half a billion years ago.

One prominent paleontologist making the move into academia is Hou Xianguang, who discovered the first Chengjiang fossils in 1984. Last month he left NIGP after 22 years to join the new research center for Chengjiang biota at Yunnan University in Kunming. Hou says the university offered him "very favorable conditions for my research," including more office and lab space, an apartment, and the promise of more funding. More importantly, he's betting that a move to Yunnan will mean better access to the sites and the specimens.

Maintaining momentum

As Chinese paleontology matures, policymakers agree that it must find a way to sustain itself. One of the biggest challenges is filling the paleontological pipeline in an environment that offers far more lucrative career choices. "The lack of young students interested in paleontology is a big problem," says NIGP's Yang. Hao Shougang, head of the paleontology section of the geology department at Beijing University, says that the number of undergraduate paleontology degrees awarded annually in his department has dropped from 15 or 16 in the late 1980s to two or three. "Fewer and fewer top students are willing to dedicate themselves to paleontology," he says.

Even those who sign on tend to drop out along the way. Wu Xinzhi, an academician at IVPP, says that only two of his 10 anthropology students who went abroad over the past 15 years have come back to China to work in the field. Several shifted into careers in computers or business, he notes.

IVPP's Zhu thinks the organizational reforms and higher salaries will help lure back those who want to contribute. "Students can see that scientists can earn a decent salary. I'm optimistic," he says. IVPP's Wang Yuan offers himself as an example. Even without a government subsidy, he returned to China in 1997 after obtaining a master's degree in the United States, because "there were more chances for me in China." **–DENNIS NORMILE**

With reporting by Erik Stokstad and Xiong Lei.

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