China's unsinkable scientist

After years of struggle on behalf of ocean science, Wang Pinxian is taking a key role in China's plans to expand marine research.

BY JANE QIU

Wang Pinxian began his scientific career in the shabbiest of conditions, spending long winters in an abandoned Shanghai workshop with no heat. He washed and screened samples of sea-floor sediment in a rice bowl, and struggled with a microscope that would barely focus. The most important book on his shelf was a Russian encyclopaedia of palaeontology, which helped him to identify microfossils in the samples pulled up from off the coast of China.

"It's an extraordinary way to start a career in oceanography," says Wang, laughing as he recalls those days half a century ago. He fell in love with the tiny creatures that served as windows to Earth's distant past, and he dreamed of using the fossils to help to develop the scientific capacity of his country.

Wang, now a marine geologist at Tongji University in Shanghai, slowly rose up the ranks. He eventually earned a position in the Chinese Academy of Sciences and served as a member of the Chinese national legislature. For decades, the 74-year-old, outspoken scientist has used his position to lobby Chinese leaders to devote more resources to marine science, but those arguments have fallen on deaf ears — until recently. With China facing an increasing need for energy and minerals, it is now taking an interest in the deep sea. In its next five-year budget, which will be announced in March, the country will boost funding for oceanography, particularly in exploration, research and deep-sea technologies.

That rising tide has also lifted Wang's fortunes. Last July, he was awarded a US$22-million grant from China's National Natural Science Foundation to lead studies into the geology and biology of the South China Sea. The project starts this week with an inaugural meeting in Shanghai.

"The South China Sea is a haven for oceanographers and climate researchers," says Wang. Sitting between Asia and the Pacific Ocean (see map), the sea is a crossroads for currents that influence the climate of the entire globe. It also helps to control the Asian monsoon system, which feeds the water supplies for billions of people on the continent. Wang's project aims to uncover information about the prehistoric climate and investigate how the ocean basin formed. At the same time, it will study the microbial community in the deep sea, which has an important role in the cycling of carbon between long-term storage in sediments and its release into the ocean and atmosphere.

Born in 1936 in Shanghai, Wang grew up during a tumultuous period in Chinese history — living first through the Sino–Japanese War and then the Chinese Civil War from 1945 to 1949. After the Communist Party founded the People's Republic of China, the young government began

H. ZHENG

to send promising students to Russian universities, and Wang earned the opportunity in 1955 to attend Moscow State University. There he studied geology, which China regarded as a priority because of its practical value in finding mineral resources and oil.

The experience had an enduring effect on Wang. He excelled in Russian and thrived under the scientific training in Moscow, where he was fairly safe from the severe economic and social turmoil sweeping his home country. But when Wang returned to China in 1960, his tendency to speak his mind drew the ire of officials who publicly rebuked him. He voiced concerns about the widespread famine in China at a time when the economic policy known as the Great Leap Forward was widely portrayed as a great success. "These things just didn't make sense to me at all," he says.

Because of the extreme economic hardships at the time, Wang's training initially seemed irrelevant in China, especially during the Cultural Revolution — a violent political and social movement that began in 1966. But China was eager to find fossil-fuel reserves, so Wang was called up by the government in 1972 to analyse calcareous microfossils in marine samples, in the hope of identifying petroleum deposits.

Although he had access to only basic equipment in his Shanghai workshop, Wang toiled away and eventually published the book *Marine Micropaleontology of China*, first released in Chinese in 1980 and then in English[1]. Wang co-authored all of its 17 papers, and developed an international reputation for his scholarship. The book helped to connect Chinese oceanography to research elsewhere — at a time when little was known about marine geological science in China.

DEEP CONCERNS

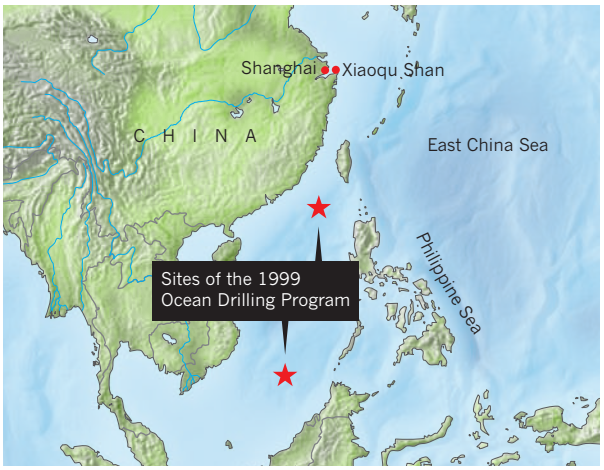
The work also attracted international interest in Chinese marine regions, and Wang helped to convince the international effort known as the Ocean Drilling Program (ODP) to conduct the first deep-sea drilling expedition in the South China Sea. Wang co-led the 1999 effort, known as ODP Leg 184, which drilled 17 holes on the southern and northern continental slopes of the sea to explore the history of the east Asian monsoon.

The South China Sea occupies a crucial position between the world's highest mountains in the Himalayas and the deepest spot on the Earth's surface, the Mariana Trench in the western Pacific Ocean. Erosion of those nearby mountains causes sediments to accumulate rapidly on the sea floor, providing a detailed record of the regional climate over the past 45 million years, during which time India has collided with Asia and raised the Himalayas.

"The South China Sea promises some of the most fascinating geological records on Earth," says Carlo Laj, a palaeoceanographer at the Laboratory of Climate and Environmental Sciences in Gif sur Yvette, France. Laj met Wang during the ODP expedition and the two men have collaborated in subsequent French–Chinese palaeoceanography cruises in the South China Sea.

EYE ON THE TROPICS

The ODP expedition was a turning point in Wang's research career. On the basis of the South China Sea records, he and his colleagues found that the chemistry of the region has gone through significant changes in the past 1.6 million years. The sea-floor cores contain fossilized plankton shells that can be used to measure the ratio of the isotopes carbon-13 to carbon-12 in ancient sea water. This can be used to deduce information about different reservoirs of carbon, including atmospheric carbon dioxide and the organic matter from marine organisms. Wang found that the carbon ratio fluctuated in step with variations in Earth's orbit — such as the eccentricity of its route around the Sun. And the ratio peaked before two expansions of polar ice sheets, suggesting a possible connection[2].



These orbital cycles are the pacemakers of Earth's climate and are thought to trigger ice ages by reducing the amount of sunlight reaching high northern latitudes during summer. But Wang's work helped to focus attention on the tropics, and raised the possibility that orbital cycles could cool the planet by altering processes in the low-latitudes — such as the weathering of rocks — that in turn cause major changes in the carbon system.

He also conducted research on the East Asian monsoon and its broader connections. He and other researchers have found the fingerprint of orbital cycles within monsoon records from the South China Sea and many other parts of the globe[3]. Instead of regarding monsoons as separate regional phenomena, Wang and others embrace a 'global monsoon' concept, which refers to a large-scale churning of the atmosphere throughout the tropics and subtropics. In studies of the palaeoclimate, "Pinxian was one of the first to put monsoon in a global context", says Laj. "That was extremely original and insightful." Wang's work helped to earn him the Milutin Milankovic Medal for long-term climatic research from the European Geosciences Union in 2007.

With the influx of funding and interest from the Chinese government, Wang has big plans for the future. Beyond the eight-year South China Sea project, his team is working with the government to establish a sea-floor observatory off the coast of Xiaoqu Shan, an island southeast of Shanghai. The observatory will record important features of the ocean, including temperature, salinity and sedimentation rates. Wang would ultimately like to build a network of ocean-floor observatories in the South China Sea similar to those off the coasts of the United States and Canada. "This is the only way we can truly understand the oceans," he says.

Looking back, Wang is surprised that he has managed to thrive under a political regime that usually deals harshly with dissent. Recently, he has openly criticized some entrenched powers in Chinese society. Three years ago, he complained that the election of Chinese Academy members was not based entirely on academic achievements, and that members enjoyed disproportionate authority and privileges. Wang's remarks sent shock waves across China's scientific community; even some of his good friends turned against him.

And Wang has not limited his critiques to scientists. He was a member of the National People's Congress — China's top legislature — from 1986 to 1992, and has questioned the procedures through which some political decisions are made.

Although he has enjoyed a fruitful career, Wang is concerned about the future of science in a society that has endured so many political upheavals. He says that excessive commercialization and a deficit of moral values have led to rampant scientific misconduct. China, he says, "will need to make some hard decisions and instigate further reforms, especially to its science system".

Taking the long view, though, Wang recognizes that his country has made tremendous progress since the days he laboured in that frigid Shanghai workshop. "Things will change with time," he says. "Let's hope." ■

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2. Wang, P., Tian, J., Cheng, X., Liu, C. & Xu, J. *Geology* **31,** 239–242 (2003).
3. Wang, P. *Chin. Sci. Bull.* **54,** 1113–1136 (2009).