

government and the scientific community. Before his death in 1998 due to an illness, he was especially delighted to see the building and successful operation of the Beijing Electron-Positron Collider in the IHEP in the 1980s and 1990s, the result of a collaboration between the United States and China in high-energy physics.

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Zuoyue Wang

ZHU KEZHEN (Chu Coching, Chu Co-ching, or Chu K'o-chen in Wade-Giles; *b.* Shaoxing County [now Shangyu County], Zhejiang Province, China, 7

March 1890; *d.* Beijing, China, 7 February 1974), *meteorology, climatology, geography, education, science policy.*

Zhu was a founder of modern meteorology and geography in China who made significant contributions to the studies of typhoons, rainfall patterns, phenology, geographic regions, and, especially, historical climate change of China. He also played a prominent role in science policy, higher education, natural resources surveys, the history of science, and popularization of science in China in the twentieth century.

Early Years and Education. Zhu's father, Zhu Jiaxian, was a rice merchant in Shaoxing and his mother Gu Jinniang, a devout Buddhist, ran a busy household with six children. Kezhen was the youngest in the family. Like many of the prominent figures in Chinese history who originated in the region, Zhu was reared in an environment that valued scholarship and a sense of Chinese nationalism. There he received his elementary education in Chinese classics before entering a western-style middle school in Shanghai in 1905. Four years later he enrolled in the Tangshan School of Railroads and Mines in Tangshan, Hebei Province, to study civil engineering. In 1910, he became one of about seventy students from all over China who passed a set of competitive examinations and were selected for study in the United States with the support of the so-called Boxer fellowships, which derived from the returned surplus from the indemnity that China had agreed to pay the United States following the Boxer unrest in 1900.

Arriving at the University of Illinois at Urbana-Champaign, in 191~~1~~⁰, Zhu chose to study agriculture due to its importance to China. But he soon realized that the American way of farming—what he perceived to be large-scale and employing African Americans as slavelike plantation workers—would not work back home. Thus he shifted to meteorology as his field of graduate study at Harvard University in 1913, after graduating from Illinois. Working with Robert DeCourcy Ward and Alexander G. McAdie, Zhu quickly demonstrated both his scientific talent and capacity for careful scholarship in the new field. While still a graduate student, he published several papers on Chinese rainfall, typhoons, and Chinese contributions to meteorology. His abiding interest in the history of science in China was in part stimulated by his interactions with the historian of science George Sarton, then at Harvard. Zhu also became a leader in the newly established Science Society of China, with its headquarters first at Cornell University and then at Harvard. He wrote several articles on Chinese meteorology in the society's journal *Kexue* (Science), which was published in Chinese in China as a way to spread scientific knowledge. In 1918, Zhu received his PhD with a dissertation on "A

New Classification of Typhoons of the Far East” and soon thereafter set sail for home.

Pioneering Meteorology and Geography in China. Back in China, Zhu started his teaching career in fall 1918 at Wuchang Advanced Normal School (now Wuhan University) in Wuhan, Hubei Province, where he taught meteorology and geography. In early 1920 he married Zhang Xiahun, a schoolteacher, and together they would have three sons and two daughters. In fall 1920, Zhu moved to Nanjing Advanced Normal School in Nanjing, which was expanded and renamed the National Southeastern University a year later. With the arrival of Zhu and several other leaders of the Science Society, Southeastern soon boasted some of the best science faculty in the nation. They helped reestablish the Science Society in China as the largest and most important Chinese scientific organization as well as a symbol of their pursuit to “save China through science” and through an expansion of autonomous civil society institutions. Zhu became one of *Kexue’s* most prolific authors, writing more than fifty articles from 1916 to 1950, and would later serve as its editor and the president of the society. In his writings, Zhu not only sought to popularize science but also to critique government policy and promote scientific research and education.

Meanwhile, at Southeastern, where he became professor and the founding chairman of the Department of Geosciences in 1921, Zhu trained modern China’s first generation of meteorologists and geographers. Prominent alumni included the agricultural climatologist Lü Jiong and the human geographers Hu Huanyong and Zhang Qiyun. In this connection, Zhu wrote some of the earliest textbooks in meteorology and geography in China. In 1924, Zhu helped found the Chinese Meteorological Society. His own research on reconstructing Chinese climatic changes from the abundant historical and phenological records also gained momentum, resulting in several publications, including one on “Climatic Pulsations during Historic Time in China” in *Geographical Review* in 1926.

Zhu’s career went into a transitional phase in the late 1920s as China came near the end of the chaotic warlord period. In 1925, disgusted by a political fight over the presidency of Southeastern, Zhu left the university for the Commercial Press in Shanghai to work on its *International Encyclopedia*. The next year, he went north to Nankai University in Tianjin as a professor of geography before returning, a year later, to Southeastern, which was now expanded and renamed, first the Fourth Zhongshan University in 1927 and then the National Central University in 1928. As the Nationalist government brought a measure of national unity to the country, it established the Academia Sinica in 1927 to centralize Chinese scientific

resources. The academy’s first president, Cai Yuanpei, had long been the president of Beijing University and a strong supporter of the Science Society; he immediately recruited leaders of the society, including Zhu, to head many institutes of the academy.

In 1928, Zhu became director of the Institute of Meteorology in Nanjing while retaining his positions at Southeastern. He quickly built the institute up as an important site for meteorological research. Viewing weather forecasting as an important part of reasserting China’s sovereignty, he pushed for the establishment of a national network of dozens of standardized weather stations, including one in Tibet, trained a large number of observers to staff them, and gradually took over the function from foreign-controlled stations in the country. In 1929, he left Southeastern to focus his energy on the new institute but continued to give some lectures there. In this period Zhu also expanded his research into Chinese monsoons, floods in the Tianjin area, weather in Nanjing, the division of China into climatic regions, and aridity of North China.

President of Zhejiang University. Zhu’s career and life took a sharp turn in 1936 when Jiang Jieshi (Chiang Kai-shek), leader of the Nationalist government, personally recruited him to take the helm at Zhejiang University (Zheda for short in Chinese) at Hangzhou, Zhejiang, the native province for both men. Under his leadership, the university, despite difficult conditions, greatly strengthened its faculty not only in meteorology and geography, but also in other fields, such as mathematics, physics, biology, and the humanities.

The year after his arrival, the Japanese invasion forced him to lead the university on a perilous long march inland, settling eventually at a mountainous site in Zunyi, Guizhou. Zhu’s integrity and devotion won him deeply felt respect and loyalty from all members of the university community. In turn, Zhu saw to it that research and teaching continued unabatedly in the face of overwhelming adversities. Indeed, by the end of the war, Zheda emerged as one of the best universities in China, impressing visitors such as Joseph Needham, who worked as a scientific liaison for the British Mission in China.

These remarkable achievements came at a great personal sacrifice to Zhu: his second son, Zhu Heng, and his wife fell ill and died within days of each other in 1938, delivering one of the worst blows of his life. His own scientific research also took a back seat to his wartime administrative duties even though he continued to head the Meteorology Institute. The only area of scholarship in which he remained active was the history of Chinese science, with two classic papers on ancient Chinese astronomy and on why ancient China did not produce a

systematic natural science; he believed that overtly utilitarian values of the Chinese agricultural society suppressed the curiosity-driven pursuit of science. Learning of Needham's budding interest in ancient Chinese science, Zhu helped him with materials, knowledge, and contacts. He remarried in 1940, to Chen Ji, and together they would have one daughter.

The end of World War II brought welcome relief to Zhu and his university, which returned to Hangzhou, but not the peaceful, stable political environment everyone had hoped for. A civil war soon broke out between the Nationalists under Jiang and the Communists under Mao Zedong. A majority of students and professors in many universities, including Zheda, had long resented the corruption and political repression of the Nationalist regime; many of them now began to view the Communists' cause with sympathy. Zhu Kezhen, who considered himself a liberal, not a communist, often found himself caught between the government that became increasingly oppressive and the radical students whom he tried to protect. Eventually, like many other leaders of the Science Society, Zhu became disillusioned with the Nationalists and cast his lot with the Communists, hoping that they would focus on national reconstruction once victorious.

Thus in May 1949, when Jiang sent for Zhu to retreat with him to Taiwan as the Communist forces advanced toward Hangzhou, Zhu declined. Instead, he resigned the presidency of Zheda and went into hiding in Shanghai to avoid possible assassination by Nationalist agents. Soon he was invited by leaders of the new government to participate in science policy making in Beijing, including the establishment of the Chinese Academy of Sciences (CAS), which was based on the institutes of the Academia Sinica and of the Peking Academy that did not move with the Nationalists to Taiwan.

Vice President of the Chinese Academy of Sciences. In late 1949, Zhu was appointed vice president of the CAS in charge of geosciences and biosciences. In this position, he played a leading role in both the development and utilization of these scientific disciplines in the 1950s and early 1960s. For Zhu, the key to a successful science and technology policy was balance and integration—between basic and applied research, between advancing disciplinary development and serving national needs, between different disciplines, and between economic development and environmental protection. The latter was most clearly revealed in his shaping of national surveys of natural resources, on the basis of which he cautioned the government against focusing on “conquering nature” without first understanding the potential ecological consequences of such actions.

In this period, he also supervised the founding of the Institute of Oceanology in Qingdao under the leadership of marine zoologist Tong Dizhou (T. C. Tung) and the marine botanist Zeng Chengkui (C. K. Tseng), the Office of the History of Natural Sciences in Beijing, as well as a number of institutions in geosciences. He coauthored a well-received book on phenology (the study of the relationship between climate and periodic biological phenomena) and a major article on agricultural climatology. His call for closer ties between climatology and agriculture earned him an audience with Mao himself in 1964, the same year he was admitted to the Communist Party.

Zhu consistently advocated China's participation in international scientific communication, both within and without the Soviet bloc. In the mid-1950s, Zhu chaired the Chinese National Committee on the International Geophysical Year (IGY) and negotiated China's participation in the global cooperative project. When the International Council of Scientific Unions, sponsor for the IGY, admitted Taiwan as a separate member in the project, however, Zhu had to withdraw China's participation in the IGY to avoid a “two Chinas” situation. Nevertheless, the National Committee continued to operate under Zhu's leadership to collect geophysical data and to carry out a limited exchange of information with the Soviet Union. Zhu also advocated China's eventual participation in research and exploration at the Arctic and Antarctica, partly because of their impact on the climate in China. The dream was finally realized by the end of the twentieth century.

Never an outspoken political activist, Zhu survived the various political purges under Mao relatively unscathed. His eldest son, Zhu Jin, a schoolteacher, however, was persecuted during the “Anti-Rightist” campaign in 1957 and died four years later at a labor camp. During the Cultural Revolution from 1966 to 1976, Zhu and most other senior scientists in the CAS were “sidelined” by radical Maoist Red Guards; he avoided further harm due to protection by Premier Zhou Enlai. In turn Zhu was able to help some of his former associates and students by offering them supporting evidence from a diary he had meticulously kept for much of his adult life when they came under suspicion. When the worst phase of the Cultural Revolution passed in 1970, Zhu and other scientist-leaders of the CAS made a push for the revitalization of scientific research and education that had been almost completely halted earlier. In this they received crucial backing from Zhou. The reopening of China-U.S. relations during President Richard Nixon's visit in 1972 provided further momentum to Zhu's efforts, as did the visits of prominent Chinese American scientists in this period, many of whom had been Zhu's students in the 1930s and 1940s.

It was in this context that Zhu completed his last major scientific work, titled “A Preliminary Study on the Climatic Fluctuations during the Last 5000 Years in China,” published in 1972. Drawing on his lifelong examination of China’s uniquely rich archaeological, historical, and phenological records, Zhu made a graph of fluctuation of the mean annual temperature in China from 3000 BCE to the 1970s. To his surprise, it corresponded remarkably well with those derived from studies of the heights of the snow line in Norway and from the oxygen isotope profile of the Greenland ice sheet, leading him to speculate that the variation was global in nature and that the cold wave moved east (Pacific coast of Asia) to west while the warming trend moved west to east. In this and several earlier studies he also noted a warming trend in the twentieth century.

Zhu was elected an academician of Academis Sinica in 1948 and a divisional member of the Chinese Academy of Sciences in 1955—highest academic honors in China. He was also elected president of the Chinese Geographical Society and the Chinese Meteorological Society.

On the evening of 6 February 1974, Zhu made, as he had done every day for the last sixty years, an entry in his diary about the day’s weather. A few hours later he died of pneumonia.

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Zuoyue Wang

ZOSIMOS OF PANOPOLIS (*b.* Panopolis [now Akhmīm], Egypt; fl. c. 300 CE), *alchemy*. For the original article on Zosimos see *DSB*, vol. 14.

Unanimously recognized as the greatest of the Graeco-Egyptian alchemists, Zosimos was a prolific author whose texts have survived only in tiny scraps. His very complex manuscript tradition raises many questions that remained unresolved as of 2007. Imbued with gnosticism and hermetism, Zosimos may be said to have raised alchemy to the most sophisticated level that it attained in antiquity by impregnating technical preoccupations with mysticism for the sake of spiritual salvation.

Biographical Data. With the exception of the *Suda*, where Zosimos is said to be Alexandrian, all sources call him Panopolitan or Theban (i.e., born in the Thebaid). This discrepancy has puzzled modern scholars who, following Johannes Albertus Fabricius, consider that Zosimos, born in Panopolis, lived in Alexandria. Actually, nothing prevents scholars from assuming that Zosimos may have spent at least part of his life in his native city.

Zosimos is thought to have been active around 300 CE, for he quoted Julius Africanus, who died after 240, and mentioned the Serapeum in Alexandria, which was destroyed in 391. Furthermore, Zosimos perhaps alluded