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THE HISTORY OF THE DISCOVERY AND INITIAL SEED DISSEMINATION OF *METASEQUOIA GLYPTOSTROBOIDES*, A “LIVING FOSSIL”

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ABSTRACT

Ever since the “living fossil”, *Metasequoia glyptostroboides*, was discovered during the 1940s in China, accounts of its mysterious discovery and introduction throughout the world have been told many times in different languages. However, information has often departed considerably from the true story. This paper represents a synthesis of more than 1000 original letters, manuscripts and publications both in Chinese and other languages, and addresses two main questions about details of the story: (1) how was the living fossil really discovered, and (2) who introduced the seeds into the U.S.A. and the rest of the world? Several controversies surrounding the course of events are revisited. An appendix summarizes the names and academic positions held by botanists who played a key part in the tree's discovery.

Key words: *Metasequoia glyptostroboides*, China, discovery, seed introduction.

INTRODUCTION

The discovery of living *Metasequoia glyptostroboides* Hu & Cheng (Taxodiaceae; known as dawn redwood, Chinese redwood, or water fir, the latter a literal translation of the Chinese name, shui shan) during the 1940s in China was considered one of the greatest botanical discoveries in the twentieth century (Chaney 1947, 1948, 1951; Hu 1948; Hu and Cheng 1948; Merrill 1948a, b; Chu and Cooper 1950; Florin 1952; Li 1964; Fulling 1976; C. K. Wang 1981; Bartholomew et al. 1983; Cheng 1984; Hendricks and Sondergaard 1998; Ma 2003a, b; Ma and Shao 2003). Unfortunately, the records documenting the tree's discovery and introduction over the past sixty years (1943–2003) are neither complete nor accurate in detail, and sometimes even wrong. Important questions regarding this ancient species still exist in China and the U.S.A. today: Who really discovered this tree? When, where, and how was it found? Who really introduced the seeds into the U.S.A. and the rest of the world? Did Ralph Works Chaney bring seeds back with him when he returned from China in the spring of 1948?

Over the past four years, I have collected more than 1000 documents, including letters, manuscripts, original publications not only from China, the original place of this tree's discovery, but also worldwide. In 2002, after attending the First International *Metasequoia* Symposium in Wuhan, Hubei, I was able to visit Chongqing, Nanjing, and Beijing, China. I collected original documents and met the people who know this story well. I also visited related institutions and libraries and collected contemporary publications. With these materials in hand, I have attempted to unravel several long-standing arguments and provide more de-

tail than ever before about the relevant issues. An appendix at the end of this paper summarizes the names and academic positions held by those who played a key part in the story of the discovery of *Metasequoia*.

INITIAL COLLECTION

As with many discoveries in science, the discovery of *Metasequoia* took place in very much a serendipitous manner. So it was when Mr. Chan Wang was on his way in July 1943 to Shengnongjia in northwestern Hubei Province from Chongqing (formerly Chungking), the wartime capital of China. Chan Wang stopped at Wan Xian on the way due to illness where he learned of a strange tree growing in Moudao (formerly Modaoxi, Ma et al. 2000). He obtained this information from Lung-Hsing Yang, the principal of Wan Xian Agriculture High School. Because of this, C. Wang changed his original route and arrived in Moudao in three days. He then collected a specimen of the unknown tree on July 21, 1943 (C. Wang 118). However, due to his administrative responsibilities and limited time, he did not pay much attention to his collection. After returning from his trip he identified the specimen as *Glyptostrobus pensilis*, and deposited it in the herbarium (C. Wang 1948; Ma 2003a, b; Ma and Shao 2003).

Wang's specimen undoubtedly was the first collection of living *Metasequoia*. Unfortunately, the collection date was wrongly recorded as 1944 (Hu 1948; Merrill 1948a; Cheng 1984), and this error was perpetuated by many others worldwide (Chaney 1948, 1949, 1951; Florin 1952; Wyman 1953; Dupouy 1955; Li 1957, 1963, 1964; Bean 1973; Fulling 1976; C. K. Wang 1981; Lu 1986; T. W. Hu 1990; Spongberg

1990; Sand 1992; Shao et al. 2000). Some authors showed the date as 1945 (Merrill 1948*b*; Miki 1948; Just 1949; Evinger 1957; Gorrie 1965; McGourty 1965), and even 1946 (Miki 1949). Although I have been unable to determine why these errors were made, it is with certainty that I can state that the discovery was made in 1943 and not later (Ma 2003*a, b*; Ma and Shao 2003).

MATCHING THE LIVING TREE WITH THE FOSSIL

In the summer of 1945, Mr. Chung-Lun Wu, an assistant teacher at the National Central University, while waiting for a United States visa to continue his studies at Yale Forestry School, went to the National Bureau of Forest Research to study its conifer collection. What followed are two different stories regarding his connection with the discovery of *Metasequoia*.

Chung-Lun Wu's biography was recorded before his death by his student, Mr. YouXu Jiang, a prominent forest ecologist in the Chinese Forestry Academy (CFA) at Beijing. According to this biography, C. L. Wu happened to note that a specimen in C. Wang's collection (#118) was not *Glyptostrobus pensilis*. With C. Wang's permission, C. L. Wu took one sheet of the specimen with two cones back to Professor Wan-Chun Cheng of the National Central University for further identification (Jiang 1985). This was the only record left by C. L. Wu before he died. After writing to Y. X. Jiang, I was able to confirm that this account was based on C. L. Wu's personal recollections, and it had been checked by C. L. Wu prior to printing. Consequently, almost all of the reports from China state that C. Wang gave C. L. Wu a sheet of *C. Wang 118* with two cones (Hu 1948; Hu and Cheng 1948; Cheng 1984).

In another version of the story the role of C. L. Wu is less clear. In C. Wang's only publication regarding this tree, C. Wang makes no mention about the transfer of a specimen to C. L. Wu, stating instead that W. C. Cheng visited his institution and identified his specimen as *Chieniodendron sinense* (C. Wang 1948). Hence, W. C. Cheng probably first learned of the new taxon from the sheet C. L. Wu gave to him, then followed it up by visiting C. Wang's institute for identifying others (Ma 2003*a, b*).

In the early spring of 1946, W. C. Cheng from Chongqing sent his student, Mr. Chi-Ju Hsueh, for an official collection of *Metasequoia*, now aware of the fact that it may be a new taxon. Chi-Ju Hsueh followed C. Wang's directions (Hsueh 1985) and traveled twice, in February and May, from Chongqing to Moudao. This happened before the National Central University moved back to Nanjing in June after the war. Chi-Ju Hsueh made his collections (*C. J. Hsueh 5* on 20 February 1946, which was designated the type specimen

of male strobili; and *C. J. Hsueh 51* on 18 May 1946) from the same tree as C. Wang in 1943 (Hu and Cheng 1948; Hsueh 1985; Fig. 1). At this time, W. C. Cheng confirmed that this was indeed a new taxon.

That same spring, soon after he returned from his wartime job at Nanchang, Jiangxi Province, Dr. Hsen-Hsu Hu, then director of the Fan Memorial Institute of Biology at Beijing (formerly Peiping), received unusual conifer fragments from W. C. Cheng and a request for his opinion about the new discovery. Hsen-Hsu Hu, then the leading authority on Chinese plants, immediately noted that it was indeed a new taxon. In a letter to the Earl of Rosse at Birr Castle, Ireland, on 22 April 1946 (before he matched the living material with *Metasequoia*), H. H. Hu suggested this species should be named *Pingia grandis* (Nelson 1998). Then, H. H. Hu showed his fragments to Mr. Shu-Hsia Fu, his assistant in the Institute, who in turn found a paper by S. Miki (1941) describing the fossil genus *Metasequoia*. Shu-Hsia Fu showed the paper to H. H. Hu (Ma 2003*a, b*). This was when H. H. Hu realized that the new conifer was actually the same as Miki's fossil genus *Metasequoia*. In communication with Dr. R. W. Chaney, H. H. Hu told him that he had found a living example of *Metasequoia* on 9 May 1946 (Chaney 1949). Hsen-Hsu Hu reported this discovery in his first paper on the living species of *Metasequoia* in China (Hu 1946). However, due to the civil war in China, H. H. Hu and W. C. Cheng did not formally describe the living *Metasequoia* until May 1948 (Hu and Cheng 1948).

In the autumn of 1947, with funding from the United States, W. C. Cheng (now in Nanjing, not Chongqing, as reported in Merrill 1948*a, b*; Fulling 1976) sent another assistant, Mr. Ching-Tsan Hwa (not C. J. Hsueh, as reported in Hu 1948; Merrill 1948*a, b*; Fulling 1976), to collect seeds and investigate the vegetation in the area where *Metasequoia* had been discovered. Ching-Tsan Hwa arrived at Moudao on 12 September and made his first collection from the type tree (*C. T. Hwa 2*, designated type specimen of the female strobilus). Around late September, C. T. Hwa learned from local residents that there were many more trees of the species around Shui-sha-pa (a village name in *Metasequoia* Valley, Cheng and Chu 1949; Chu and Cooper 1950; Fig. 2). Ching-Tsan Hwa returned to Nanjing in November with about 2 kg of seeds collected from both Moudao and *Metasequoia* Valley (native distribution area of *Metasequoia* in Lichuan; Fig. 3). These seeds were sent out of China around Christmas of 1947 and arrived in the United States, elsewhere in Asia, and Europe in late December 1947 and/or early January 1948 (Fulling 1976; Ma 2003*a, b*).

Miki discovered the new fossil genus in 1938 and confirmed it with additional collections in 1940 (Chaney 1951) after he had received his Ph.D. from Kyoto

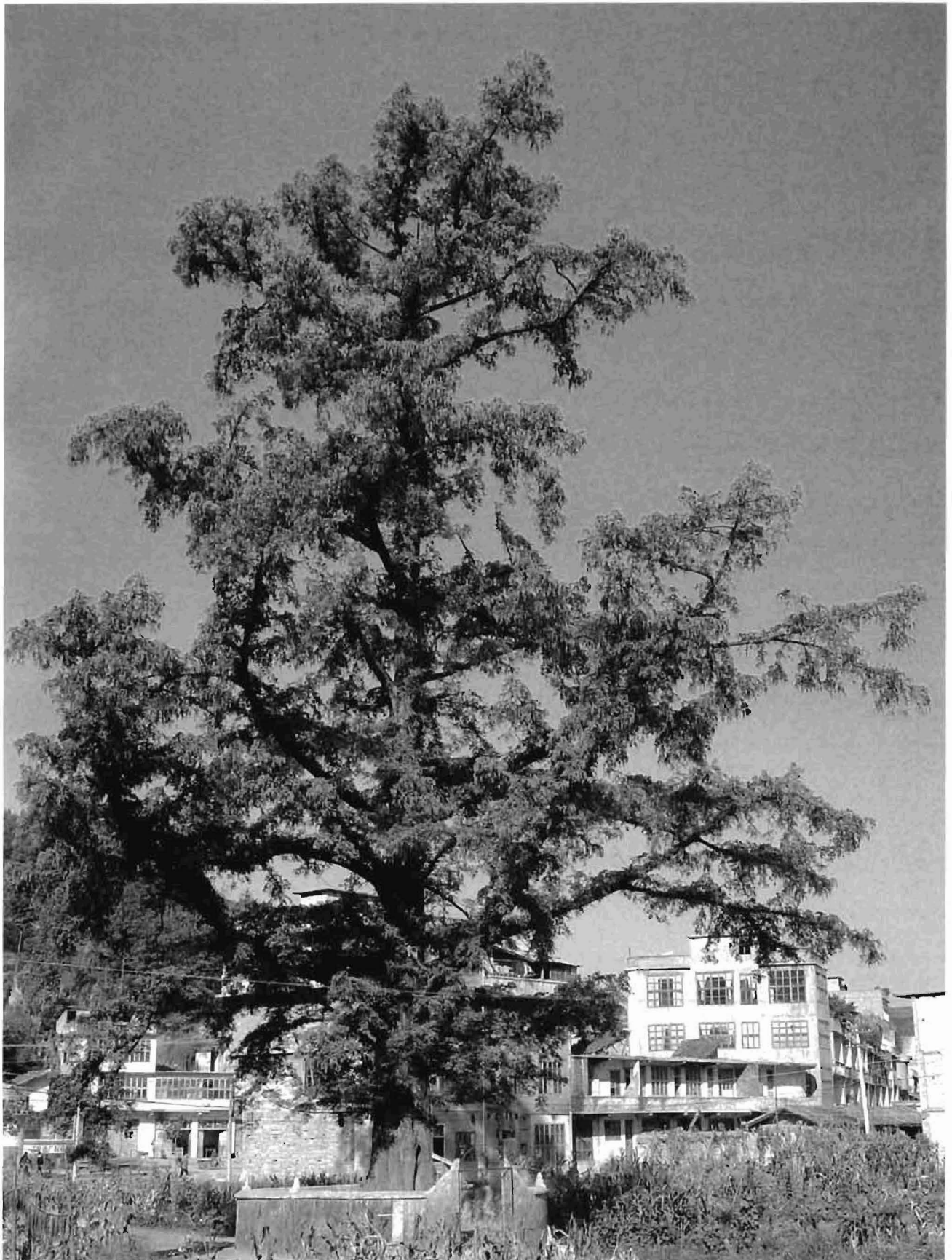


Fig. 1.—Type tree of *Metasequoia glyptostroboides* growing in Moudao, Lichuan, Hubei. This tree is ca. 400 years old and measures about 35 m in height and 2.4 m in diameter. Photograph by author, 24 September 2003.

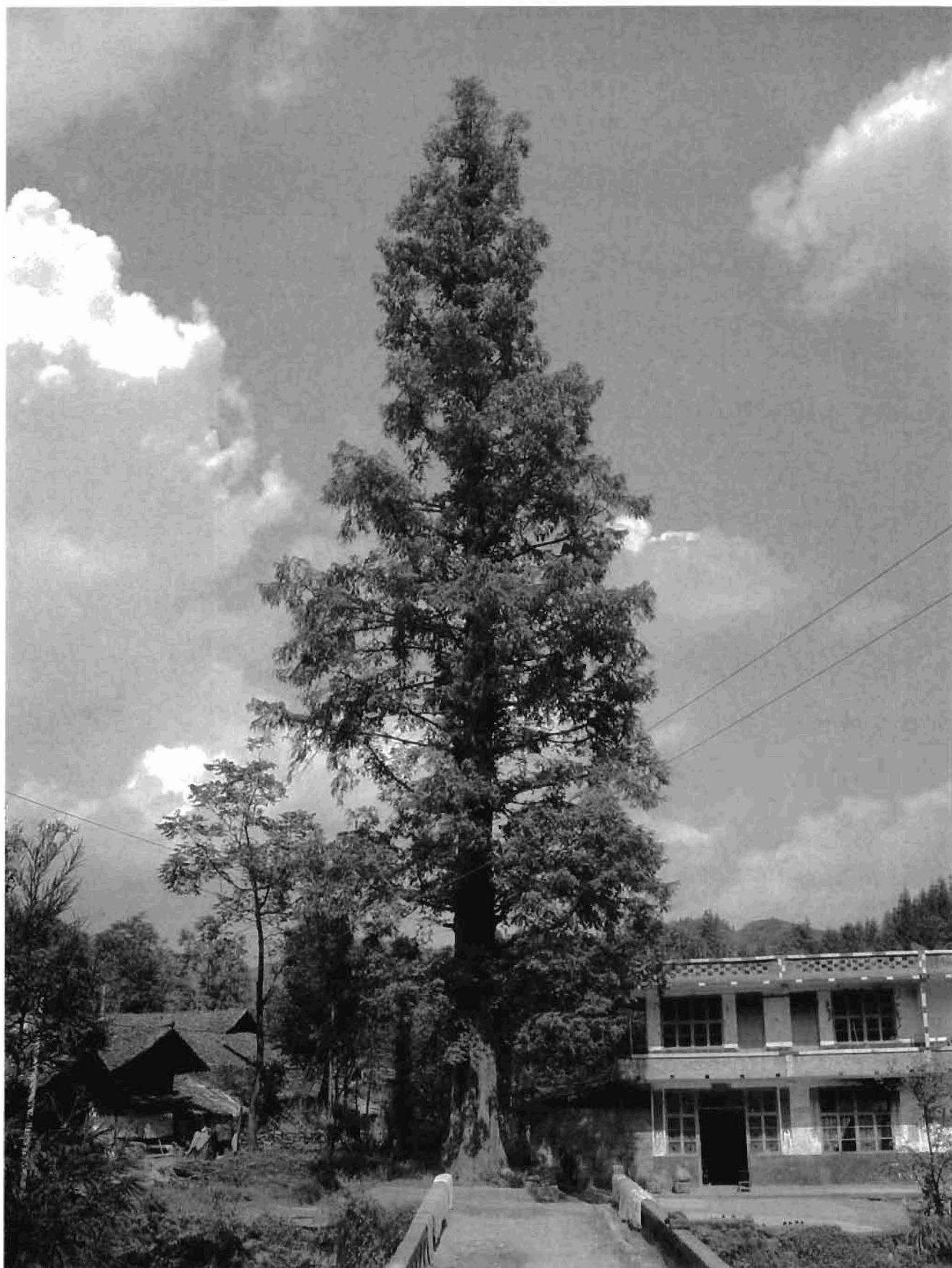


Fig. 2.—Highest tree of *Metasequoia glyptostroboides* seen growing in Lubeiba, Xiaohe, Lichuan, Hubei. This specimen is ca. 400 years old, and measures about 40 m in height and 2.3 m in diameter. Photograph by author, 23 September 2003.



Fig. 3.—Native habitat of *Metasequoia glyptostroboides* at Shui-shan-ba (Shui-sha-pa), Xiaohu, Lichuan, Hubei. Photograph by author, 23 September 2003.

University in 1939. However, he did not publish his findings until 1941 (Miki 1941). Few reprints were sent out at the time his paper was published because of the war (Saito 1995). Fortunately, H. H. Hu at the Fan Memorial Institute of Biology did get one copy of Miki's paper (Saito 1995), a surprising fact given the war going on between the Japanese and Chinese at that time. After the war ended in 1946, most botanists and paleobotanists around the world were unaware of Miki's publication. Indeed, Chinese scientists matched the living plant with the fossil described by Miki only a few years ago!

EXPEDITIONS

Following the report about the living *Metasequoia* (Hu 1946), both W. C. Cheng at Nanjing and H. H. Hu at Beijing communicated with Dr. Elmer Drew Merrill, then the director of the Arnold Arboretum of Harvard University (letters held at the Botanical Library of Harvard University; BLHU). As a worldwide authority on Asian plants, E. D. Merrill was contacted

regularly by Chinese scholars, including W. C. Cheng and H. H. Hu, even before his career at the Arnold Arboretum. After Merrill received a *Metasequoia* specimen in late 1946 (exact date of receipt not available) and again in the summer of 1947, he did his best to support Chinese scientists interested in collecting *Metasequoia* seeds. Just as he had done before with other collecting missions he sent money to China and had specimens sent back to the United States. With his critical help, a fund of \$250 (equivalent to about 9,750,000 Yuan [Chinese Currency] based on the war-time exchange rate), was set up for a seed collecting expedition (Fulling 1976). Later that same year the seeds were collected by C. T. Hwa. By Christmas of 1947, *Metasequoia* seeds were sent out of China. The first shipment arrived at the Arnold Arboretum just a few days after the new year in 1948 (Merrill 1948a, b).

When Dr. Ralph Works Chaney, then Director of the Department of Paleontology at the University of California, Berkeley, got news in a letter dated 9 May

1946, from Dr. H. H. Hu regarding the living *Metasequoia* in China (letter at the Archives of the University of Oregon, AUO), he immediately realized that this was a very important discovery for paleobotany and botany alike. He helped spread this exciting news in the spring of 1947 (Anonymous 1947; Chaney 1947). This was not only the first report in the United States, it was the only one outside China at that time (Ma 2003a, b). In the spring of 1948, having received H. H. Hu's first reprint (Hu 1946), a fragment of a specimen from E. D. Merrill (who, in turn, had received it from China), and seeds from both E. D. Merrill and from China, R. W. Chaney traveled to China and visited *Metasequoia* Valley in person. Certainly he was the first western scientist to see this living tree (Silverman 1990). He was accompanied by Dr. Milton Silverman, then a science writer for the *San Francisco Chronicle*. They left the West Coast of the United States on 13 February 1948, and returned from China around the end of March and beginning of April, respectively, bringing back seedlings and some seeds, a point long denied by E. D. Merrill (Fulling 1976) and a misconception persisting to this day (Wagner 2003). The fact that Chaney really did bring back seeds is clear from a letter by W. C. Cheng to E. D. Merrill, informing him of the seeds and specimen that R. W. Chaney was bringing back with him. However, E. D. Merrill never mentioned the letter that W. C. Cheng sent to him in this regard (BLHU, Ma 2003a, b).

After H. H. Hu's first publication (Hu 1946) and R. W. Chaney's report (Chaney 1947), the whole story of discovery was made known to the greater scientific community by E. D. Merrill's two papers 'A living *Metasequoia* in China' in *Science* on 6 February 1948 (Merrill 1948a) and '*Metasequoia*, another "living fossil"' in *Arnoldia* on 5 March 1948 (Merrill 1948b). Later, in 1948, a more complete account of the discovery of *Metasequoia* by H. H. Hu was published in English (Hu 1948). All these literature sources have been cited again and again worldwide. Unfortunately, not all of the information in these papers is accurate (Ma 2003a, b).

In the summer of 1948, two additional expedition teams arrived at *Metasequoia* Valley, Lichuan. The team led by W. C. Cheng from the National Central University studied mainly the ecology and vegetation (Cheng and Chu 1949; Chu and Cooper 1950). The other team, organized jointly by the California Academy of Sciences and Lingnan University Dawn Redwood Expedition, focused on insects as well as other animals but also brought back *Metasequoia* seeds that were sent to the West Coast of the United States (Gressitt 1953; Silverman 1990). This was the last expedition to *Metasequoia* Valley from outside China after the new People's Republic of China was founded in 1949 because no permission was given to foreigners

to visit there until 30 years later (Bartholomew et al. 1983).

CONFUSION

After the news spread regarding the discovery of *Metasequoia*, Professor Toh Kan of the National Central University told W. C. Cheng that he had seen the tree in the winter of 1941 and collected a specimen but never conserved or identified it (Keng and Hsueh 1948; Y. Zhang 1981—the original copy is in the archives of *Plants*, Beijing; Chinese). Wan-Chun Cheng cited T. Kan's role in his first manuscript on the discovery of *Metasequoia*. However, W. C. Cheng's manuscript was not published until after his death in 1984 in a popular magazine (Cheng 1984). In his later years, W. C. Cheng did not fully accept T. Kan's role, though he had been the first to mention Kan's contribution in his manuscript. From 1949 to 1979, there had been no arguments about the discovery of *Metasequoia* in the botanical history of China for political reasons. However, after 1979 when China opened her doors to the world, W. C. Cheng began to doubt T. Kan's role in the discovery because L. H. Yang denied T. Kan's claim of having collected for him. This doubt was recorded in the letters to C. J. Hsueh and C. Wang (Ma 2003a, b). Because there was no specimen left by T. Kan, W. C. Cheng wrote a letter to T. Kan's widow, PeiZhen Zuo, regarding T. Kan's true role (G. Q. Wang 1999). At the same time, W. C. Cheng became involved in the production of the first Chinese documentary film about *Metasequoia*. As consultant of the film, absolute authority on Chinese conifers at that time, and co-author of the description of living *Metasequoia*, W. C. Cheng did not put T. Kan's picture in the film since his role could not be resolved (C. Wang 1981; Zhang 1981). Only C. Wang's first collection in 1943 was mentioned in the film (C. Wang 1981). Unfortunately, W. C. Cheng's change of heart in the 1980s was too late because the original publications (Hu 1948; Cheng 1984) had been continuously cited for several decades, not only in the Chinese literature but worldwide in many different languages (Fulling 1976; C. K. Wang 1981; G. Q. Wang 1999).

At the time when the living species of *Metasequoia* was found in China, W. C. Cheng was in Chongqing (before June 1946) and then in Nanjing (after June 1946); but H. H. Hu was in Nanchang, Jiangxi Province (before October 1946, except for a short time in Beijing from the middle of April to the end of May 1946) and then in Beijing (after October 1946). Most of the persons who were involved in the discovery of *Metasequoia* lived in Chongqing and Nanjing, including C. J. Hsueh and C. T. Hwa, the type and seed collectors. Since H. H. Hu lived neither in Nanjing nor Chongqing, and received the information from W. C.

Cheng through letters only, much of his account of 1948 (Hu 1948) had errors because W. C. Cheng's original information was inaccurate (Ma 2003a, b). For example, the seed collector, C. T. Hwa, was wrongly recorded as C. J. Hsueh, and T. Kan's role was introduced by H. H. Hu after W. C. Cheng's primary account (Cheng 1984; Hu 1948).

Even before W. C. Cheng died in 1983, L. H. Yang, C. J. Hsueh and C. Wang communicated many times regarding the true story. More than ten personal letters between them have been collected by the author but were never published in the Chinese botanical literature, although some of them are cited in Ma (2003a). The debate on who was involved in the discovery of *Metasequoia* continues to this day (C. K. Wang 1981; G. Q. Wang 1999; Shao et al. 2000).

SEARCHING FOR THE ORIGINAL SPECIMEN

After the People's Republic of China was founded in 1949, the story of the discovery and collection of *Metasequoia* was ignored in the botanical history of China until 1979. In particular, between 1943 and 2003, no clear mention is made of the first collection of *Metasequoia* made by C. Wang in 1943. Yet it was this key collection that had sparked W. C. Cheng's curiosity about an unusual new conifer. Moreover, no photographs of the original specimen were known to exist anywhere in the world.

Reports on *Metasequoia* indicate that the first specimen was located at Jiangsu Forestry Academy (JFA; the former National Bureau of Forest Research) at Nanjing, Jiangsu, China. Why did it take so long to gain access to the first specimen? First, nearly all botanists and forest scientists there were unaware of this important collection, and basic research on botanical history lacks primary support in China. Second, many research materials and/or documents, including original field collection records, diaries, expedition and research reports, old manuscripts and scientific communications, including letters regarding this tree, were destroyed or went missing during the Cultural Revolution between 1966 and 1976. Third, major persons who were part of the discovery had all passed away by 2000 when I began my search. Finally, long distance communication between the U.S.A. and China was inefficient compared to personal interviews.

The most encouraging information I finally received was that the specimen had been locked in the office of the former director of JFA. During the summer of 2002, I attended the First International *Metasequoia* Symposium in Wuhan, Hubei. After the symposium and a field trip to *Metasequoia* Valley, I visited several herbaria in Chongqing to search for the original specimen but to no avail. I then went to Nanjing. Thanks to the help of several colleagues, I finally was able to

enter the herbarium at JFA. A staff member told me that the first specimen had been taken away by the former director about 20 years ago due to nationwide debates in the early 1980s. Still, no one knew exactly where the specimen was. With permission, my colleagues and I nonetheless thoroughly searched for the specimen, cabinet by cabinet and folder by folder. All the specimens, estimated to be about 8000–10,000 sheets, were stored without any order. Finally, at the bottom of an old cabinet, I saw a dusty pile of specimens with C. Wang's collection #118 at the top without a cover folder! The first specimen of *Metasequoia* was found! This sheet was supposed to be among less than ten sheets collected by C. Wang with this number (C. Wang 1948; Lu 1986). It could not be the one given to W. C. Cheng, nor the one reportedly taken away by the JFA director about 20 years ago. The location of the remaining sheets bearing this number is still unknown. Sadly, the condition of this invaluable specimen was poor but the notes were typed and legible: Chinese Name: Shui Song (i.e., water pine), Scientific Name: *Glyptostrobus pensilis* Koch, Collector: C. Wang, no. 118, Date: 7-21-'43 (i.e., 21 July 1943), Location: Modaoxi, Wan Xian, Sichuan. Among these details, the Chinese name of this specimen and the collection locality were handwritten by C. Wang six decades ago (Ma and Shao 2003).

THE DISTRIBUTION OF THE SEEDS

Around Christmas of 1947, W. C. Cheng from Nanjing sent out his first consignment of seeds to the Arnold Arboretum. However, these were not the only seeds sent out from China. Even before the Arnold Arboretum received its first batch, W. C. Cheng had also sent seeds to other provinces in China, elsewhere in Asia, Europe, as well as other parts of North America. Recipients included the Missouri Botanical Garden (Andrews 1948), Forest Research Institute at Dehra Dun of India (Raizada 1948), botanical gardens in Denmark and the Netherlands (Hendricks and Sondergaard 1998; Satoh 1998/1999), and Kew Royal Botanic Gardens, U.K., arriving around late 1947 or early 1948. However, for various reasons, not all of the original letters and documents could be found in China (Ma 2003a, b), and so far little information is available on how the seeds were introduced throughout the rest of the world (Andrews 1948; Raizada 1948; Florin 1952; Wyman 1953; Dupouy 1955; Evinger 1957; Gorrie 1965; Fulling 1976; Saito 1995; Hendricks and Sondergaard 1998; Satoh 1998/1999; Zhang 2000). Additionally, H. H. Hu from Beijing sent seeds not only to E. D. Merrill at the Arnold Arboretum, but also to Dr. T. H. Goodspeed (according to H. H. Hu and R. W. Chaney's communication, Dr. Goodspeed had asked R. W. Chaney to write to H. H. Hu for

seeds) at the University of California Botanical Garden, Berkeley (Cronquist 1977), and to the Earl of Rosse at Birr Castle, Ireland (Nelson 1998).

Merrill always denied that Chaney had returned from China with seeds of *Metasequoia* (Fulling 1976; Wagner 2003), even though several lines of evidence suggest otherwise (Ma 2003a, b). First, according to my personal interview with C. T. Hwa at Beijing in the summer of 2002, W. C. Cheng still had some *Metasequoia* seeds in his possession that were collected by C. T. Hwa in the autumn preceding R. W. Chaney's visit to China (spring of 1948). It is these seeds that R. W. Chaney brought back (Silverman 1990). Merrill's refusal to credit Chaney with collecting seeds may stem from the fact that Chaney's seeds were not a new batch but part of the same consignment collected previously with funding procured by Merrill. In traveling to China, Chaney was given credit for introducing the seeds, even though the seeds were already widely distributed by Chinese botanists.

Second, as is evident from a letter W. C. Cheng sent to E. D. Merrill, W. C. Cheng asked R. W. Chaney to bring back seeds for E. D. Merrill (Ma 2003a; W. C. Cheng's letter to E. D. Merrill on 20 April 1948 at BLHU). This request, however, was never recorded in the botanical history of *Metasequoia* until March 2003 when I found their correspondence in the Harvard University Herbaria (Ma 2003a, b).

From the sources available to me, it is clear that the species has been successfully cultivated (reaching tree height) in much of the USDA Plant Hardiness Zones 5–8 in North America, from Hamilton (Ontario), Syracuse (New York), and Boston (Massachusetts), to Atlanta (Georgia), Baton Rouge (Louisiana), and Huntsville (Alabama) on the East Coast, and from Vancouver (British Columbia, Canada) to Los Angeles (California) on the West Coast (Kuser 1998, 1999), and even to Mexico (Martinez 1957), as well as much of Europe in the same hardiness zones. In China, this native species has been successfully cultivated in most parts of north, central and eastern China (25–42°N and 125–103°E; Zhang 2000), from Shenyang of Liaoning Province in the northeast to Kunming of Yunnan Province in the southwest, and from Xian of Shaanxi Province and Chengdu of Sichuan Province in the west to the eastern and southeastern coast of China, and from Liaoning in the north to Hong Kong in the south. It has also shown excellent growth in the middle and lower Yangtze River areas in central and eastern China.

CONCLUSION

Not a single individual but collaboration among several Chinese scientists led to the discovery of *Metasequoia glyptostroboides*. It was C. Wang who first

learned of a strange tree and changed his itinerary to see it. He collected the first specimen, identified it, and provided a specimen for further identification. It was W. C. Cheng who first realized that C. Wang's identification of the tree as *Glyptostrobus pensilis* was wrong. Wan-Chun Cheng then sent C. J. Hsueh to make additional collections. After making sure it was new, W. C. Cheng did not rush to publish the new taxon, but asked H. H. Hu for further comments. Finally, W. C. Cheng sent C. T. Hwa on another expedition, not only to collect the seeds, but also to find the original native distribution center. It is H. H. Hu who must be credited for matching the living specimen with the fossil described by S. Miki in 1941, whereby H. H. Hu's reputation and that of his institution made it possible for them to have S. Miki's paper on hand. Finally, Shu-Hsia Fu's contribution was to make Hu aware of Miki's paper, leading to the correct identification.

Smaller, but nonetheless significant roles were played by the local residents and others who were aware of the "unknown tree"; Lung-Hsing Yang, who informed C. Wang that the tree existed; Chung-Lun Wu, who took Wang's specimen to W. C. Cheng; Chi-Ju Hsueh and C. T. Hwa, the type collectors (male and female strobili); and C. T. Hwa, who made the first seed collections and located the original *Metasequoia* Valley in 1947.

Who introduced the seeds of *Metasequoia* into the United States and the world? The introduction of *Metasequoia* seeds was facilitated by the work of Chinese and American scientists. Chinese participants included W. C. Cheng of the National Central University at Nanjing, and H. H. Hu of the Fan Memorial Institute of Biology at Beijing, as well as W. C. Cheng's assistant and the seed collector, C. T. Hwa. Elmer Drew Merrill and the Arnold Arboretum of Harvard University played a leading role in the introduction of seeds outside China. The Arnold Arboretum supported seed collecting activities and later redistributed seeds around the world. Several Chinese scientists sent seeds to other institutions in North America, Europe as well as in Asia. Ralph Works Chaney of the University of California, Berkeley, also participated, not only by traveling to the *Metasequoia* Valley in the early spring of 1948, but also through his contribution to research and redistribution of the seeds on the west coast of the United States. Chaney brought back seeds with him when he returned from China in the early spring of 1948 (Silverman 1990). From the correspondence between scientists in China and in the United States, we now know that E. D. Merrill at the Arnold Arboretum received seeds at least four times directly from W. C. Cheng at Nanjing and at least once from R. W. Chaney at Berkeley upon his return from China. Merrill also received seeds from H. H. Hu at Beijing (letters at

BLHU and AUO). Thus, the introduction of seeds outside China and the United States was implemented in large part by Chinese scientists (Ma 2003a, b) and E. D. Merrill.

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APPENDIX

This appendix provides brief biographical sketches and summaries of the major contributions by the key people who were involved in the discovery of *Metasequoia*. Chinese personal names follow the Wade-Giles system, the method of transliteration used at the time when *Metasequoia* was discovered, with the Pin Yin alternative given in parentheses.

Ralph Works Chaney (1890–1971), Research Associate at the Carnegie Institution of Washington 1922–1956; Professor and Chair of the Department of Paleontology, and Curator of the Museum of Paleontology, University of California, Berkeley, 1931–1956; Emeritus 1957–1971; Save the Redwoods League President 1961–1971 (Anonymous 1972). He had collected and studied Asian fossils since 1925, and published his research on the Miocene flora of Shangdong Province, China, with H. H. Hu in 1940 (Chaney and Hu 1940; Hu and Chaney 1940). His last trip to China in the spring of 1948 was significant for the exploration of *Metasequoia* (Silverman 1990).

Wan-Chun Cheng (Wan-Jun Zheng 1904–1983), Professor and Chairman of the Department of Forestry at the National Central University, Chongqing, 1944–1946, Nanjing, 1946–1952; Professor and President of the Nanjing Forestry College (independent from the National Central University) 1952–1961; Professor and President of the Chinese Academy of Forestry 1962–1983. Dr. W. C. Cheng received his Ph.D. from Toulouse University, France, in 1939, becoming the authority on Chinese dendrology and an expert on Chi-

nese conifers (Cheng 1978). He was elected Academician of the Chinese Academy of Sciences (CAS) in 1955.

Shu-Hsia Fu (ShuXia Fu 1916–1986), assistant at the Fan Memorial Institute of Biology at Peiping [Beijing], 1946–1949, then Curator of the Institute of Botany, CAS, at Beijing, 1950–1959; Curator at Wuhan Institute of Botany, CAS, in Wuhan, Hubei Province, 1959–1986. He published several books on Chinese ferns in the 1950s (Fu 1954, 1957), was chief editor of the *Flora of Hubei* (Fu 2001, 2002), and was also an expert on Chinese Crassulaceae.

Chi-Ju Hsueh (Ji-Ru Xue 1921–1999), Graduate Student of W. C. Cheng at the National Central University 1945–1948; Assistant Teacher at the Institute of Zoology and Botany, Fujian Academy of Sciences, 1948–1949; Assistant Professor at the Department of Forestry, Yunnan University, 1950–1952; Professor at the Yunnan Forestry College (independent from Yunnan University) 1952–1991; and Emeritus from 1992. He was the authority on Chinese bamboos as well as the trees of Yunnan. He visited the Arnold Arboretum of Harvard University, the Arboretum of the University of California Santa Cruz, and other arboreta in 1996.

Hsen-Hsu Hu (Xian-Su Hu 1894–1968), Founder and Director of the Fan Memorial Institute of Biology at Peiking [Beijing] 1929–1949; Academician of Academia Sinica 1948–1949; and Curator of the Institute of Botany, CAS, 1950–1968. Hsen-Hsu Hu was the first Chinese student of plant taxonomy to receive a Ph.D. from Harvard University in 1925. He had been accepted as the leading authority on Chinese plants worldwide at the time, and is regarded as the founder of modern plant taxonomy in China (Shi 1993, 1994; Yu 1979).

Ching-Tsan Hwa (Jing-Can Hua, born 1921), Assistant Teacher to W. C. Cheng at the National Central University 1947–1950; Russian translator at the Chinese Administration of Forestry 1950–1952; Editor and Senior Editor of China Forestry Press 1953–1988; retired in 1988 and currently residing in Beijing. Ching-Tsan Hwa is the only person involved in this story who is still alive today. He visited his daughter in Houston, Texas, during 1995–1996.

Toh Kan (Duo Gan 1903–1961), Professor of Forest Management in the Department of Forestry, National Central University 1944–1952; and Professor and Vice President of Nanjing Forestry College 1952–1961. He died in Huang Shan, Anhui Province, China.

Elmer Drew Merrill (1876–1956), Director of the Bureau of Sciences, Manila 1919–1923; Professor of Agriculture and Dean of the College of Agriculture at the University of California, and Director of the Agriculture Experiment Station 1924–1929; Director of the New York Botanical Garden 1930–1935; Arnold Professorship of Botany, Director of the Arnold Arboretum, and Administrator of Botanical Collections, Harvard University 1935–1945; Arnold Professor of the Arnold Arboretum of Harvard University 1946–1948; Emeritus from 1948. He was a famous authority on the Asian floras in his time (Howard 1956; Schultes 1957; Robbins 1958).

Shigero Miki (1901–1974), plant ecologist and paleobotanist, started his research on fossil plant remains in 1932, received his Ph.D. from Kyoto University in 1939, and published his results in 1941 while a lecturer at Kyoto University, Japan, during 1939–1945; researcher at the Institute of Developing Asian Folk and Life Science in 1939, visiting eastern, northern and northeastern China many times for collection and research during 1939–1943; he also served in the Japanese Navy from 1944–1946 in southeast Asia. He was a teacher at Osaka Second Teachers School after the war, and then Professor at Osaka City University from 1947 until retiring in 1964 (Saito 1995).

Milton Silverman (1910–1997), science reporter of the *San Francisco Chronicle* during the 1940s; later a drug researcher at the University of California, San Francisco (Anonymous 1997). He visited *Metasequoia* Valley in the spring of 1948 with R. W. Chaney and wrote several vivid reports for the *San Francisco Chronicle* during 25 to 30 March and 5 April 1948 (Fulling 1976).

Chan Wang (Zhan Wang 1910–2000), Lecturer of Dendrology at the Department of Forestry, National Northwest University 1938–1943; Forest Engineer with the National Bureau of Forest Research 1943–1945; Officer of the Administration of Agriculture and Forestry 1945–1946; Associate Professor in the Department of Forestry, Northeast Agriculture College 1946–1947; Senior Engineer of the National Bureau of Forest Research 1947–1949; Associate Professor in the Department of Forestry, Northeast Agriculture College 1949–1952; Chairman of the Department of Forestry and Vice Director of the Institute of Forestry and Pedology (now the Institute of Applied Ecology), CAS, 1953–1999 in Shenyang, Liaoning Province. He was also the founder and the first director of the Changbaishan Forestry Ecological System Station 1980–1999, one of three Chinese research stations participating in the Man And Biosphere project of UNESCO. He was a famous forest ecologist and an authority on Chinese Salicaceae (Shao et al. 2000).

Chung-Lung Wu (Zhong-Lun Wu 1913–1995), Assistant Teacher to W. C. Cheng at the National Central University in 1945; he pursued further study on forestry at Yale University in 1946 and Duke University in 1947–1950, returned to China in 1951 with a Ph.D. to become Engineer of the Administration of Agriculture and Forestry 1951–1955; Researcher at the Chinese Forestry Academy (CFA) 1956–1988 and Vice President of CFA from 1978–1988; Emeritus from 1988. He was elected Academician of CAS in 1980 and was a famous Chinese forestry expert and forest ecologist (Jiang 1985).

Lung-Hsing Yang (Long-Xing Yang 1913–1999), teacher and principal of Wan Xian Agriculture High School 1941–1943; Local Technical Officer at Kaiyuan, Yunnan from 1943–1951; Officer of Yunnan Agriculture Bureau and Yuxi Administrative Region, Yunnan, from 1951–1954; Researcher and Director of Yuxi Agriculture Institute and the Tobacco Research Institute, Yunnan, from 1955–1980; retired in 1980.