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# Noah Drake and the Coal Mining Industry in China, 1898-1911

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Coal had been mined in China for hundreds of years and came into use as early as the Fourth Century A.D. in northern China. By the seventeenth century, when westerners became interested in China's vast coal deposits, the nation's output of coal probably amounted to several hundred thousand tons per year, and the pits were as large as those in Europe. However, mining by native methods improved very slowly, and when the westerners arrived, many were surprised, and later frustrated, at the methods used to extract the coal from the mines. The growth of the coal industry was constrained both by the limitations of traditional technology and, more importantly, because of its high cost due to the isolation of the coal deposits. Regardless of the limited demand, coal miners supplied fuel to a wide variety of industrial and household users even before the mid-nineteenth century.<sup>1</sup>

In late 1877, a modern large-scale coal mining enterprise in the Kaiping area of China was established and began to produce coal in 1881.<sup>2</sup> This initial introduction of modern mining machinery and methods enticed a growing number of European and American geologists and mining engineers to China. Like other westerners who participated in the New Imperialism of the period, mining experts hoped to develop China's natural resources through the introduction of new technology and western training. Among this group was Noah Drake, who spent 13 years (1898-1911) in China training native students in geology and in surveying the rich coal deposits.<sup>3</sup>

The examination of Noah Drake's experience in

China is significant for a number of reasons. His story, for example, offers an attractive case study of some important questions in the economic history of China during the late Ch'ing period. Second, his experience brings to light western industrial technology and business methods. Third, Drake's unique story represents the larger western efforts to modernize China with new technology and new industrial techniques. In essence, Drake's story provides a microcosmic look into a macrocosmic phenomenon in world history during the late nineteenth and early twentieth centuries.

## A Teacher of Mining

From the late 1870s Chinese entrepreneurs and officials began to use western technology in their fledgling coal-mining industry when western methods were becoming more common.<sup>4</sup> A group of progressive Chinese hoped to accelerate the transformation, but they encountered various obstacles such as strong opposition from the conservatives, lack of skilled managers, and poor transportation facilities. The political instability of the nation further hampered modernization efforts.<sup>5</sup> Several Chinese officials, however, refused to give up, and through their perseverance, western methods and technology were employed. Li Hung-chang, an influential diplomat, general, and court official, was one of them.

In order to introduce the new technology to China, Li Hung-chang advocated the funding of a western-style university in Tientsin in 1887.<sup>6</sup> His suggestion came to fruition when Dr. Charles Tenney, a former tutor to Li Hung-chang's family, was commissioned to establish the Imperial Peiyang University.<sup>7</sup> Tenney created four departments--Mining and Geology, Civil Engineering, Mechanical Engineering, and Law.<sup>8</sup>

As president of the new university, Tenney was responsible for recruiting new faculty members. With this in mind, he went to the United States in 1897,

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and listened to the professor. The students then were expected to spend evenings studying what had been learned each day, while also preparing for the next day's class. On the other hand, students were tested in a more traditional Chinese fashion. Drake and his fellow professors, in fact, did not give the examinations. Instead they were administered semiannually by a special examination board composed of university officials and professors, much the same as testing had been done under the traditional system. Because the Peiyang University, and in fact the entire educational system, was new, changes were often made in an effort to coordinate all phases of the new training methods.

Political unrest in northern China in 1900, however, soon curtailed all educational endeavors. With the outbreak of the Boxer Rebellion, classes at the Imperial Peiyang University ceased. The university was in ruins, and the professors and students were unable to return to school because the buildings remained occupied by German soldiers after the western military forces seized the Chinese government and did not return it to the Asian power until 1902.

Drake was able to return to the university in 1905 after the political turmoil subsided. By this time, the university had been reorganized and preparatory work had been completed to begin advanced classes. The

students and teachers still faced some of the same problems with textbook acquisition and the language barrier. To combat this problem, the professors discovered that it was easier to teach the students English than to translate the textbooks into Chinese.

In good progressive-era style and efficiency, the university had been reorganized for orderly maintenance of the emerging educational system. In the Mining Department, the first one to two semesters for students were devoted to prerequisite studies needed to begin advanced work. These were intensive classes that absorbed from twenty to thirty-two hours per week of class time. The remaining four to five semesters in the program were spent in advanced studies within chosen fields as well as in the Chinese classics and history. These classes took from twenty to thirty-seven hours per week. Courses were offered in mining and metallurgical engineering, mine surveying, and iron mine engineering and metallurgy.<sup>11</sup> Included in this regiment were experiments in the laboratory along with field work. Drake and his students, for example, took investigative trips that lasted anywhere from a few days to several weeks.

Drake wrote an instruction manual "Instructions and Outline of Work for Summer Class in Metallurgy, Mining, and Geology" for students to use as a guide on their field trips. Because Chinese students had



Chinese coal mine workers hoisting coal. Photographed by Noah Drake, ca. 1898-1911. (Courtesy Special Collection University of Arkansas.)

never been educated in this manner, they needed a comprehensive guidebook. Drake then wrote a workbook that included everything--from what type of clothing to take to how to sketch a roasting furnace.<sup>12</sup>

Field work of this nature was a totally new concept to the Chinese students. In the traditional educational system, students learned from experts in their occupational setting, not through public education--a process whereby apprentices learned directly from their masters. Consequently, practical work such as Drake's was excellent for the students, teaching them to sharpen their skills of observation, to ask questions, and to make their own deductions. This method also helped to teach the students to think on their own, rather than to limit themselves to reiterating verbatim what the instructors had told them. Students were now introduced to a "thorough schooling in exact and independent thinking," in contrast to the classical Confucian teachings which stressed conformity, not individual expression.<sup>13</sup>

After several years working in Honan, Drake went to Manchuria to conduct another summer excursion of research with his students from the university in Tientsin. During this particular adventure, Drake introduced the students to the principal techniques and concepts for mining coal: analysis of the coal, mining methods, core sample sketching, output estimations, transportation facilities, ventilation and drainage of the mines, and market possibilities, among other things. He and his students maintained a rigid schedule and traveled extensively in a short amount of time.

This trip, however, was not without problems. In his field notebook, Drake recorded the difficulties encountered in trying to cross swollen rivers and how, on the return trip, a small boat with six hired laborers and the group's luggage turned over in the middle of the river. Everyone's baggage was lost. In spite of this accident, the group continued on its way and camped for the night at a local village. Drake noted that "We slept in a little room with about a dozen other people."<sup>14</sup>

Drake's field trips proved to be an essential part of the learning experience for the Chinese students of Peiyang University. Yet as is common with academics, the professor of geology left Peiyang University for a position at Stanford University in February of 1911. His legacy, however, did not go unnoticed. The Chinese government, in fact, gave Drake an award in September of that year honoring his service to China. As a professor of geology and mining, Drake had introduced western teaching methods and modern mining techniques to China's future leaders in the

coal mining industry, a story of success in which students applied what they had learned to real life experiences.<sup>15</sup>

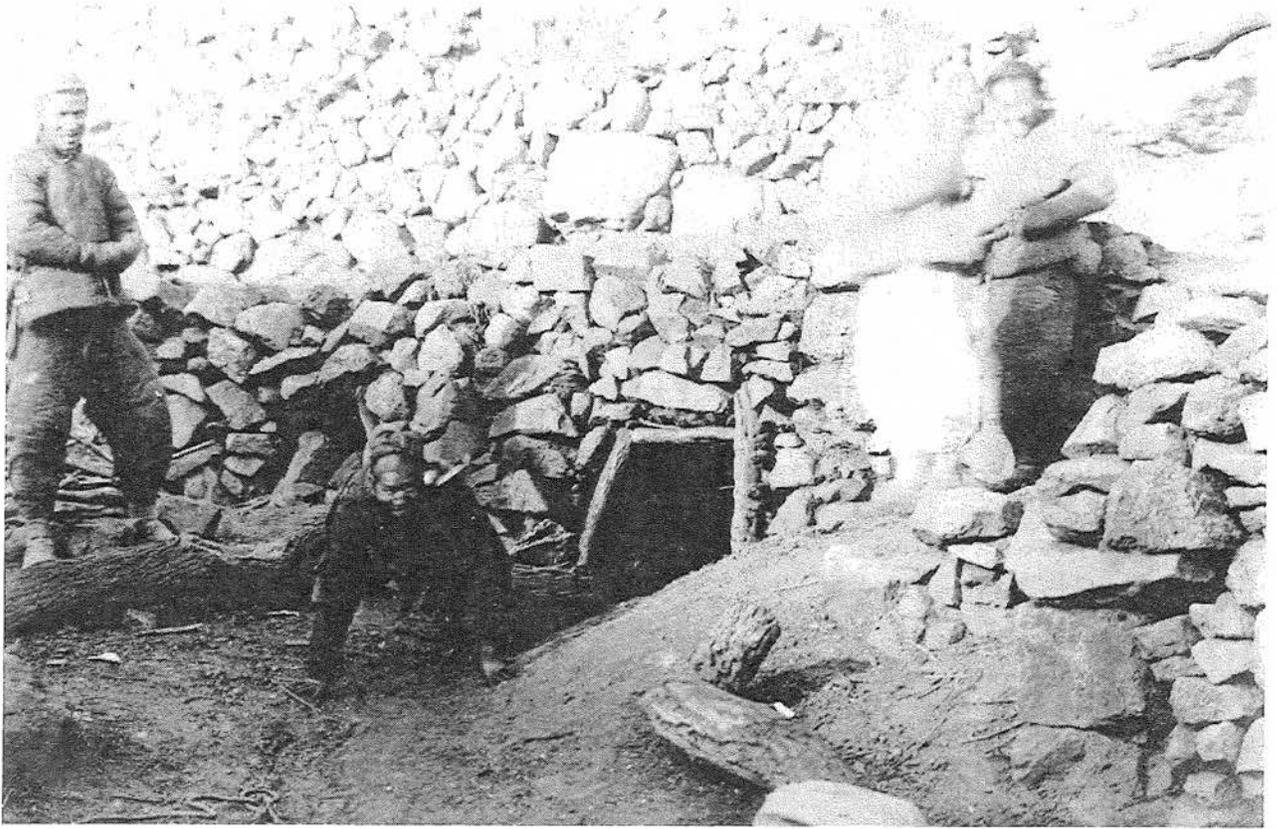
### Surveying the Coal Deposits

Drake's influence on the Chinese coal industry transcended the classroom in other ways. When the Imperial Peiyang University was closed from 1900 to 1905, in fact, he devoted his free time while unemployed to publish several reports on the coal mines of China. In February, 1900, in cooperation with the American Institute of Mining Engineers, Drake published his first report, "The Coal-Field Around Tse Chou, Shansi, China." He investigated and analyzed the surroundings at the coal mines in Shansi Province and described their characteristics such as volatile hydrocarbons, fixed carbon, ash, sulphur, and color of ash. He reported on the availability of water and the current state of mining technology. Drake concluded that "No steam is used for hoisting, nor are explosives employed in mining. The latter is done simply with pick and gad. The coal is hoisted by a windlass which is run by men. . . . About 300 pounds of coal are hoisted at a time in baskets. . . . The present style of working the mines and transporting the coal presents a striking contrast to what might be done were modern methods used."<sup>16</sup> In the final analysis, Drake suggested that implementation of western methods in the coal mining industry in Shansi Province would increase production.

In February, 1901, the American geologist finished another report, "The Coal-Fields of Northeastern China." This study was devoted chiefly to the coal fields of the western part of Chili Province and the eastern part of Shansi Province; the outline of this belt gave some idea of the extension of the coal fields of northeastern China.<sup>17</sup>

Later, through correspondence with Willis E. Gray, general manager and engineer-in-chief of the American China Development Company,<sup>18</sup> Drake procured a position in this company as a consulting geologist. Drake was to conduct mining surveys along the proposed route of the railroad near the borders of Hunan and Kwangtung Provinces from February 1903 to March 1904, "outlining the geology and locating and studying the occurrence of coal and metalliferous deposits."<sup>19</sup>

He arrived in Shanghai in January, 1903, and then proceeded to Kwangtung Province to begin investigating mining possibilities in the areas of Shao-chow and Lo-chan.<sup>20</sup> Before Drake and his party left Canton in late February, 1903, Peiyang University



Chinese coal mine workers hauling coal. Photographed by Noah Drake, ca. 1898-1911. (Courtesy Special Collection University of Arkansas.)

President Charles Tenney wrote to Drake about his forthcoming trip: "I am rather sorry to see you starting off for the south of China, because I think there is going to be a great deal of trouble down there, and I think that we who have been through the war in the north [the Boxer Rebellion] are entitled to a rest from any more amusements of that sort."<sup>21</sup>

Despite his friend's warning, Drake headed for the interior of Kwangtung Province, arriving at Shao-chow on March 13. Drake wrote to Willis Gray that the progress was slow because of "showers of rain every day."<sup>22</sup> Yet despite this and other encumbrances, Drake did most of his work on foot, claiming he was better able to study the geology of the area by walking. He wrote that the area was more complicated than he had expected, but that "the coal is better than I had anticipated and decidedly worth extensive mining operations."<sup>23</sup>

The weather, however, was not the only difficulty Drake and his party encountered along the way. There were river boat pirates as well as robbers and bandits. During that trip Drake's mail messenger was robbed in early May. As a result, Gray did not hear from Drake for several weeks, and decided to send out telegraph inquiries to Canton as to the geologist's whereabouts.<sup>24</sup>

Drake himself was fine, but after this incident, he wrote to Gray that he thought it "advisable to reserve details of important mining properties to be described in a later report,"<sup>25</sup> fearing that the results of his work might fall into the hands of "other parties."<sup>26</sup> In his work for the American China Development Company, Drake made pioneering studies of coal and other mineral resources for the Canton-Hankow Railway.

Afterwards, while still in the employ of the same company, he worked on the Chekiang Mining Concession under the direction of Montague Ede. In mid-April, 1904, Drake sailed from Shanghai to the area of central Chekiang Province that he was to survey. He spent two months examining coal possibilities. Drake concluded his surveys in mid-May and returned to Tientsin to write the reports for Ede, who had asked him to make the reports "as favorable as he[Drake] conscientiously can."<sup>27</sup> Drake wrote and submitted his reports to Ede late that summer, completing his employment with the company by the end of the year.

After concluding his work for the Chekiang Concession and Ede, Drake left China for a visit to the United States in late August 1904. He and his wife stayed several months and returned to China in early November of the same year.



Open coal field in China. Photographed by Noah Drake, ca. 1898-1911. (Courtesy Vera Wade.)

Drake returned to his teaching position in April 1905 but still continued to do survey work for private companies during summer vacations and breaks from teaching at the university. Throughout his stay in China, he conducted field work, and periodically worked for private mining and railroad companies such as the Imperial Railways of north China. He often financed his own research projects, most of which were devoted to surveying China's coal reserves; Peiyang University also made financial contributions to his studies.

Summer vacation 1906, for instance, was partially spent doing work for a Chinese mining company in Honan Province. The Six River Channel Mines were located fifteen miles north of the city of Chang-te in the district of An-yang. The Chinese mining company needed a geologist to do some survey work in this area and asked Gustav Detring to recommend a candidate. Detring was from Germany but spent much of his life in China and was involved with the Kaiping mines. He was also an advisor to Li Hung-chang and held the post of Commissioner of Chinese Customs for twenty-five years. He chose Drake for the job.<sup>28</sup>

The demands for this particular job were not as rigorous as some of Drake's earlier surveying ventures. The job consisted of a preliminary survey of a coal mine, a colliery, and a railroad. Drake was also to estimate the extent of the coal field, the quality of the coal, and its marketability. Drake had easy rail access to the mine, and completed his work in only a week. He then wrote to Detring, who had earlier written Drake concerning his duties, that he had been favorably impressed by what he had seen at the mine. In his return correspondence, Detring requested that Drake write the report in a form that could easily be translated. The American subsequently wrote a detailed report that was later translated and printed into both Chinese and English.

On November 15, 1906, after examining the coal field in Honan Province, Drake finished the report, "The Chang Ho Coal-Field and the Liu Ho Kao Coal Mines." Drake concluded that "Such an immense quantity of coal, more than average in quality, with transportation facilities and good markets awaiting its development, justifies rapid exploitation by the best modern means."<sup>29</sup> Drake's suggestion was adopted by the Chinese in the following years. The Liu Ho Kao Coal Mines, for example, became one of the major modern coal mines in China with an annual output of 600,000 tons from 1912 to 1927.<sup>30</sup> Later in 1906 Drake published "The Hsuan Hua Coal Fields."<sup>31</sup>

Over the next seven years, Drake published a series of reports on the Chinese coal reserves. In 1909 he wrote "The Coal Mining Industry in China in 1908," concluding that "about one-fourth of the total output of coal is influenced by foreign methods and this influence is rapidly growing." He predicted that "The



Chinese Miners stacking different grades of coal. Note their coal carts. Photographed by Noah Drake, ca. 1898-1911. (Courtesy Vera Wade.)

development of China's coal mines will add a great source of revenue to the country and be one of the best means of increasing the purchasing capacity of the country and enlarging the commerce of the world."<sup>32</sup> Drake's prediction came true. The following table suggests that with the adoption of the western methods the annual output of large coal mines in China grew rapidly, about 60 times within a forty-year span:

**China's Coal Output, 1896-1936** <sup>33</sup>

Year	Output (tons)
1896	486,000
1901	521,000
1905	954,000
1910	1,026,000
1915	8,371,000
1920	13,536,000
1925	16,732,000
1930	18,680,000
1936	29,368,000

The following table demonstrates that the exportation of Chinese coal increased dramatically in

the early 1910s and throughout the 1920s. Clearly, from 1905 on, Chinese coal production steadily increased, exportation accelerating simultaneous with this rapid growth.

**Exports of Chinese Coal, 1901-1930** <sup>34</sup>

Period	Exports (tons)	Value(¥)
1901-5	33,000	335,000
1906-10	110,000	941,000
1911-15	1,164,000	8,385,000
1916-20	1,609,000	12,350,000
1921-25	2,715,000	27,180,000
1926-30	3,722,000	44,202,000

Drake's most comprehensive paper, "The Coal Resources of China" (1913), appeared in the first volume of *The Coal Resources of the World*. He described the geology and the types of coals and estimated China's coal reserves at just under a trillion metric tons, a figure that proved to be quite accurate.<sup>35</sup>

To complete his extensive minerals studies, Drake had to visit and survey eleven provinces, making him a top authority on the Chinese coal deposits. Without

a doubt, Drake's surveys provided a framework for the next several decades of exploration and development of the coal mines of China.

### Facing Problems

Forty years before Noah Drake had gone to China, foreign investors had been trying to get mining concessions from the Chinese government. The first efforts were by the British in 1850. They asked for coal mining rights in Chilung, Taiwan, but the Chinese government rejected them. One of the reasons for those rejections was that the Chinese people were very superstitious. They feared that if the foreigners were allowed to dig tunnels underground, the "Feng-shui" would be disturbed, which would bring bad luck to the people living in the vicinity of the mines.

"Feng-shui" means "wind" and "water" in Chinese and is derived from ancient Chinese geomagnetism. Geomagnetism prescribed that a balance should be maintained in the earth. Because of this cultural belief, many Chinese were afraid that this balance would be disturbed if the foreign nationals started digging coal mines all over the country. As Drake wrote: "When it comes to opening mines caution will be necessary to keep the 'Feng-shui' in proper control."<sup>36</sup> In addition

to "Feng-shui," the Chinese also feared that mining endeavors would violate the tombs located near the mines.<sup>37</sup> Ancient superstitions were difficult to overcome, and although the westerners vied for mining concessions in coal (as well as gold and lead), little progress was made until 1894.<sup>38</sup> As a result, when Drake surveyed the coal mines, he and his crew faced cultural opposition to the implementation of new technology.

In 1904, Drake was conducting mining surveys along the proposed rail route for the Hankow-Canton railway, one-half of which ran through Hunan, an interior province located in south-central China. The Hunanese people were "considered by many authorities to represent the best native types," but they were also known for their "ultraconservative and anti-foreign" attitudes.<sup>39</sup> While along the border between Kwangtung and Hunan Provinces, Drake wrote that "so far the people where I have been have been very civil and I have seen nothing to indicate danger."<sup>40</sup>

In January 1904, however, Drake encountered local opposition to his work to the south in Kwangtung Province. He wrote a long letter to Gray, telling him that he had to abandon the "prospecting work for the present on account of the hostile attitude of the Chinese to such work."<sup>41</sup>



Chinese workers carrying coal. Photographed by Noah Drake, ca. 1898-1911. (Courtesy Vera Wade.)

Even though he had received permission from the magistrates in Canton to prospect near Wan-sha, he encountered stiff opposition from locals. About an hour after he began to work, in fact, the elders and other people from the area gathered and declared that they would not allow anymore prospecting. It was too near their graves and their village. Drake deemed it best to stop work and he returned to Canton with his party to consult the magistrates. Several days later, a deputy from the magistrate's office returned to the site with Drake to meet with the elders of the village and to see if an agreement could be reached. However, the elders, just as they had done before, would not agree to allow prospecting. Drake, "in order to get at the real ideas of the people," asked the elders some questions: Why did they object to the prospecting? What would be an agreeable distance from the graves for prospecting to avoid injuring the hallowed ground?<sup>42</sup>

The villagers claimed that prospecting would "injure the graves and rupture the veins of the dragon that lay in the hill and thus destroy the good 'Feng-shui.'" They also suggested that Drake could prospect three to seven miles away from the graves and still not injure them. In response to the questions, Drake wrote that he "could get no definitive answer. . . but finally six or seven of the elders said if it were a well it would not injure the graves. But a coal prospecting pit would. I asked them the difference between the coal pit and a well. They answered that if I dug a pit to prospect for coal and found the coal good. Sooner or later coal mines would be opened and that they objected to it."<sup>43</sup> Drake concluded that it would "take strong pressure to keep the people from raising a disturbance should I begin work there again." He closed the letter by saying that he would wait until Gray came down in a few weeks when they could discuss the problem and find possible solutions at that time.<sup>44</sup>

Although Drake did not record how the problem was solved, this episode reveals insight and patience on Drake's part not often exhibited by foreign businessmen. Most westerners in China at this time were woefully ignorant of Chinese customs, and instead of trying to understand these traditions, they imposed their ways—regardless of the impact. Drake, on the other hand, by dealing with the magistrates, demonstrated that he was willing to go through the proper Chinese channels to legitimize his prospecting activities and to complete them as quickly as possible, while causing a minimum of difficulties with the local Chinese. His questioning of the elders of the village showed a genuine interest on his part in wanting to

know why the villagers protested his presence there instead of merely attributing their opposition to ignorance or "heathenism." Although he did not agree with the village elders, he did not force his will on them and instead respected their wishes, opting to wait for Gray to arrive in order to find a solution advantageous to all parties involved.

On another occasion, Drake sailed from Shanghai to the area of central Chekiang Province to survey in mid-April 1904. He spent two months examining coal possibilities. In trying to observe the coal outcrops at Huang-pu-chia, Drake faced some difficulties. The greatest difficulty was getting the native people to agree to such work. When Drake and his party first examined the coal deposit, a mob gathered around his crew and then brutally beat a villager who had led the outsiders to the spot. The recalcitrant natives then threw stones at Drake and his party, forcing them to hastily depart the scene. The angry crowd also threatened to burn down the house where Drake's group was staying. As a result, Drake had to leave. Several days later, however, Drake returned with the county magistrate who convinced the people to allow the American to examine the open cut of coal. Drake asked the magistrate to request permission to open up the bed. After consultation with some of the locals, however, the official advised against further development of the coal deposit. The people claimed that their cemetery was too close to the cut to open a mine. So Drake left again.<sup>45</sup>

The hostility of the villagers in the area was unfortunate because Drake, after a preliminary survey, believed the coal reserves in the Huang-pu-chia basin deserved further investigation. Chances were good, he believed, that a workable coal mine could be started there. Drake wanted to impress upon the Chinese the importance of accurate information regarding these mines, and he believed that because the mines were located so near Shanghai, it would be a waste not to follow up on the mining possibilities there.

Drake must have been profoundly frustrated to see his efforts going up in flames because of Chinese conservatism. He knew probably better than most outsiders, however, the difficulties faced in modernizing the coal industry in China. Unlike many outsiders who lived exclusively in the treaty ports, Drake had resided and explored the interior of the country, experiencing firsthand the cultural opposition to change.

In conclusion, the development of the modern Chinese coal industry required the importation of western technology. Like other Americans and Europeans in China during that time, Drake played an

important role in this process of modernization. As a geologist and as a professor, he trained the Chinese students to become technical and managerial personnel and conducted the extensive surveys of the coal fields of various provinces.

His perseverance also paid off in the long run. Drake's attempt to facilitate the modernization of the Chinese coal-mining industry, for example, had a limited impact at first because of Chinese conservatism and traditions; the language barrier also made sharing of knowledge difficult. In the end, however, Drake's efforts, the first step in a very gradual process, helped to develop a modern coal industry in China. During this process, Drake had respected the unique native customs during his entire thirteen years of residence in China. The American had both taught the Chinese and learned their language, at the same time admiring their integrity and respecting their philosophy of life. The result was a transfer of technical knowledge from the West to the East as well as a cultural exchange from East to West.

#### NOTES

1. Tim Wright, *Coal Mining in China's Economy and Society, 1895-1937* (Cambridge: Cambridge University Press, 1984), 1-7.
2. The Kaiping mines, located in northeastern China, served as an excellent example of China's efforts to modernize the coal mining industry. Begun in 1875 by Li Hung-chang, the mines were the first successful effort to employ western technology in a Chinese mining endeavor, and in the next decade, the Kaiping mines were an important source of coal for the domestic Chinese market. Ellsworth Carlson, *Kaiping Mines, 1877-1912* (Cambridge, MA: Harvard University Press), 1-11.
3. For a discussion of American mining engineers' efforts throughout the world during Drake's lifetime, see Clark C. Spence, *Mining Engineers & the American West* (New Haven: Yale University, 1970), 8, 278-317. Drake was born in 1864 in the small trading town of Cincinnati, Washington County, Arkansas. He went on to the state university in Fayetteville to study civil engineering and geology, and then to Stanford University where he received his Ph.D. He spent 13 years in China from 1898 to 1911 as professor of geology and mining at Peiyang University and consulting geologist for the American China Development Company. See Noah Fields Drake Papers, Special Collections Department, University of Arkansas Libraries, Fayetteville (hereafter cited as Drake Papers).
4. For Chinese coal mining before 1895, see Shannon Brown and Tim Wright, "Technology, Economics and Politics in the Modernization of China's Coal Mining Industry: The First Phase, 1850-1895," *Explorations in Economic History* 18:1 (January 1981): 61-83.
5. G. Allen, *Western Enterprise in Far Eastern Economic Development* (New York: August M. Kelley Publishers, 1962), 151.
6. The city of Tientsin was located on the Grand Canal and had been a treaty port city since 1858. Most of the western countries had concessions there. Located in Chili Province seventy miles southwest of Peking, Tientsin was in a more progressive part of the country. It was also one of the leading areas in the new educational endeavors. However, programs were not developed for the establishment of this new western-style university until 1895 after the Sino-Japanese War. At that time funds for the university were available from the imperial telegraph system, the China Merchants Steamship Navigation Company, and the Office of the Superintendent of Customs. See Ping Wen Kuo, *The Chinese System of Public Education* (New York: Teachers College, Columbia University, 1915), 65-66, 70.
7. Thomas Read, "University Education in China," *The Popular Science Monthly* (May 1912): 442, Drake Papers.
8. "History of the Organization of the Tientsin University," Catalog of the Imperial Pei-Yang University, 1905, Drake Papers.
9. Noah Drake to Wang Shoh-lien, President of the Imperial Peiyang University, January 10, 1912, Drake Papers.
10. *Peiyang ta-hsueh nien-chien* [Annual of Peiyang University], Kuang-hsu 21st year (1897), Drake Papers.
11. *Courses of Study: Catalogue of the Imperial Pei-Yang University* (1908), Drake Papers.
12. Noah Drake, "Summer Field Work in Metallurgy, Mining, Geology, Outline of Study," (1908), Drake Papers.
13. Warren A. Seavey, "The Imperial Pei-Yang University," *Pei-Yang University Bulletin* (1909), Drake Papers.
14. Noah Drake, *Field Notebook*, July 24-26, 1910, Drake Papers.
15. By 1926, the Peiyang University had become chiefly an engineering college. The buildings of this university still exist today, which is a part of Nankai University.
16. Noah Drake, "The Coal Field Around Tse Chou, Shansi, China," *Transactions of American Institute of Mining Engineers*, 30 (1900): 261-277.
17. Noah Drake, "The Coal Fields of Northeastern China," *Transactions of American Institute of Mining Engineers*, 31 (1901): 492-512.
18. The railroad had been unknown in China until introduced by westerners in the last half of the 19th century. With the endeavors in coal mining, foreign-owned railroad concessions became part of the concession scramble from 1895 to 1906. The American China Development Company obtained the railroad concession to construct the Canton-Hankow Railway and received extensive mining rights with the concession during that time, see Chi-ming, *Foreign Investment and Economic Development in China, 1840-1937* (Cambridge, MA.: Harvard University Press, 1965), 67.
19. Noah Drake to Willis Gray, General Manager and Chief Engineer, Hank-Canton Railroad, American China Development Company, 1904, Drake Papers.
20. Willis Gray to Noah Drake, December 20, 1902, Drake Papers.
21. Charles Tenney to Noah Drake, January 1903, Drake Papers.
22. Noah Drake to Willis Gray, May 25, 1903, Drake Papers.
23. Noah Drake, letter-press copy to Willis Gray, March 13, 1903, Drake Papers.
24. Noah Drake to Willis Gray, May 25, 1903, Drake Papers.
25. Noah Drake to Willis Gray, May 13, 1903, Drake Papers.
26. Noah Drake to Willis Gray, June 8, 1903, Drake Papers.
27. R. B. Moorhead to Noah Drake, May 17, 1905, Drake Papers.
28. Gustav Detry to Noah Drake, May 2, 1906; July 22, 1906; August 17, 1906, Drake Papers.
29. Noah Drake, "Report on the Chang Ho Coal Field and the Liu Ho Kao Coal Mines", November 15, 1906, Drake Papers.
30. Tim Wright, "Entrepreneurs, Politicians and the Chinese Coal Industry, 1895-1937," *Modern Asian Studies* 14:4 (October 1980): 588-89.
31. *Mining Magazine* 13 (1906): 295-302.
32. *Mining World* 30 (1909): 170-172.
33. Chungping Yang, *Chungkuo Chintai Chingchishih Tungchi Tsuliao hsaunchi* [The statistics of economic history of modern china] (Peking, 1955), 102-3.
34. Liang-lin Hsiao, *China's Foreign Trade Statistics, 1864-1949* (Cambridge, MA., 1974), 93.
35. China is one of the world's coal-rich countries, ranking behind only Russia at 6 million, million tons and those of the United States at 4 million, million tons. No accurate figures of total reserves are available. Most estimates during the 1930s put total reserves at around 250,000 million tons, see Kung-ping Wang, *Controlling Factors in the Future Development of the Chinese Coal Industry* (New York, 1947). Drake estimated that China's coal reserves were 996,612,700,000 metric tons, Drake Papers.
36. Noah Drake to Lyman, August 3, 1903, Drake Papers.
37. The Kaiping mines were located about sixty miles from the Eastern Tombs of the ruling Manchu Dynasty. When the mines were developed, a high official from Peking feared "that the deep shaft dug at the mines, acting through the veins of the earth, will have a deleterious effect on the tombs." Li Hung-chang, the man originally in charge of Kaiping, was ordered to investigate later. See Carlson *Kaiping Mines*, 16.
38. Hou Chi-ming, *Foreign Investment and Economic Development in China, 1840-1937* (Cambridge, MA.: Harvard University Press, 1965), 66.
39. Lynwood F. Garrison, "The Mining and Industrial Development of China," *Mining and Metallurgy* 6 (January 1, 1901).
40. Noah Drake to Justice Burns, May 14, 1903, Drake Papers.
41. Noah Drake to Willis Gray, January 4, 1904, Drake Papers.
42. *Ibid.*
43. *Ibid.*
44. *Ibid.*
45. Montague Ede to Noah Drake, June 18, 1904, Drake Papers.