

Scratching the Dirt, Digging the Rocks

The Economy and Technology of Late Imperial Era Pingxiang County

In order to understand the impact of mechanized mining in Pingxiang County beginning in the late nineteenth century, I begin with a study of the decades just prior to modernization, when coalmining was integrated with family farming and local trade. While peasants' production in this region was not unique, their strategies for using the local natural resources and environment influenced their lives and the history of this county. As the mountainous soils and bitter winters altered the possible farming strategies for peasant families, so too the natural paths of the navigable rivers that flow east and west and dangerous and cumbersome peaks to the north facilitate trade with some towns and cities while hindering communications with others. In this manner, production of crops and coal allowed for local trade in family necessities within the county. However, because of China's lack of investment capital and the peasants' desire to maintain a subsistence-based economy as well as the high costs of transportation of bulk goods, the "take-off" spark that brought about an economic and technological transformation in Europe did not happen in China. Rather, the Chinese chose to maintain strategies that both assured them of subsistence and occupations even at the cost of expanded production.

In this chapter I first describe the world of peasants in this county in the nineteenth century and place that world into a context of both agriculture and mining, family and labor, local consumption and regional markets. After a brief description of agricultural practices, I focus on the place of coalmining in the lives of these people. Then, I examine the markets and strategies they provided for local producers and subsistence needs. Finally,

I examine regional trade and empire-wide interaction where just beyond the confines of Pingxiang County an explosive market in coal was emerging that was whetting the appetites of some Chinese merchants and foreign consumers but not the producers of the Jiangxi provincial highlands.

The Setting: Life in “Duckweed Township” and “Peaceful Spring”

The county of Pingxiang, which can literally be translated as “Duckweed Township,” is located in Central China south of the Yangzi River valley and the Wuhan Cities. It is nestled in the Jiangxi provincial highlands, straddling the Luoxiao Mountains, which delineate the border between Hunan and Jiangxi provinces, the two bowl-shaped regions to the east and west. This macroregion, which is an upside-down-shaped “U,” features three major rivers: the Xiang River of Hunan to the west; the Gan River of Jiangxi to the east; and to the north, the Yangzi River joins the two together as it collects the runoff of each of those rivers and continues on its eastward trek toward the Pacific Ocean.¹

The county’s topography is mostly rolling hills along the east-west horizontal. Though most of the county stands at an elevation of from 1,500 to 2,000 meters, the highest peaks along the northernmost and southernmost reaches of the county rise to more than 2,000 meters above sea level.² Travelers in search of an easy path from Nanchang, the capital of Jiangxi Province, to Changsha, the Hunanese provincial capital—that is, from one side of the upside-down “U” to the other—cut across the less-developed highlands by going through the corridor of Pingxiang County. This trek would include bypassing the county seat of Pingxiang City, among other towns and villages. As was standard for Chinese county seats during the late imperial era, Pingxiang City was enclosed by a brick wall that delineated the city limits. The city’s design did not follow standard Chinese practice in that the walls were not properly squared off, as there was some rounding of the southern edges and the entire city was not strictly aligned with the cardinal directions as was deemed proper for a bureaucratic center. It was surrounded on the east, south, and west by the navigable Ping River, which flowed from east to west. To the north stood a large mountain that gently spread into the city walls and provided a backdrop for the magistrate’s yamen, partially fulfilling the geomancy requirements of the city’s location. Pingxiang City was also a major economic center and was well linked to all the other important markets within the county and beyond. The city contained several market areas,

including one located outside the “Minor Western Gate” near an intersection between the Ping River and a bridge that joined the city to several overland routes. From this market a traveler could walk inside the gate and find themselves in the gentry’s district, where the most illustrious people in the county lived or spent their time. Many merchants, however, may have traveled from the Pingxiang City market to other markets in Pingxiang County and neighboring counties. Because the many rivers in Pingxiang County all descended from the Luoxiao Mountains into the lowlands on either side, virtually all the rivers and therefore the major trading routes, traveled in east-west orientations.³

As travelers left the Pingxiang City market, they could go eastward toward the Jiangxi provincial lowlands. East of the county seat the traveler would quickly run into the town of Anyuan, referred to as “Peaceful Spring” by the American minister Walworth Tyng using the direct translation of the name. Throughout most of the eighteenth and nineteenth century, if not before, Anyuan was a small village with several mining huts and opened mines dotting along the hills. Tyng described the walk between these two locations as a “beautiful one in October or November. The road winds among the hills, which in November are covered with blossoming tea-trees.”⁴ Not far from there, one could take a boat down the Yuan River to the major market at Luxi and into the Gan River valley of Jiangxi Province. The early twentieth-century county gazetteer, which includes a wealth of entries of stories and lists of facts both small and important, indicates that Luxi allowed for overland and river traffic and that for traveling merchants it was a center of market traffic, “like the spokes on a hub.” This market town, which reportedly held several tens of thousands of people in the late Qing dynasty, was an important location for administrative business as well as marketing needs.⁵ The traveling guests, particularly those of high rank, could stay at the Luxi Guest House, which was constructed in the late sixteenth century at the end of the Ming dynasty. Other shrines and official buildings described in the gazetteer indicate that Luxi may have existed in the Southern Song dynasty in the thirteenth century and functioned for hundreds of years as a stopping point for officials who traveled from Jiangxi Province into Hunan Province or for those descending from the county into the provincial lowlands.⁶

If travelers left the market in Pingxiang City and proceeded westward, on the other hand, they would descend the Luoxiao Mountains along the Lu River into Hunan Province. When Tyng took this trek from the city of Pingxiang to the Hunanese lowlands in the early twentieth century, he described the route in majestic tones:

The trip back to Changsha was a glorious one after the October frosts. There is a sort of tree that spots the landscape with vivid red, warm as the send-off of our friends who came to see us off. Between the great hills are terraced fields of golden grain, uncut here and there reduced to stubble. . . . Ping-hsiang is most picturesque of all with river, bridge and wall—from city wall a stretch of plain to the greater ramparts of the hills. The oranges are golden in the autumn, as in the Tuscan orchards, and the pumeloes, show like small yellow moons against dark leaves.⁷

The most important city of Pingxiang County along this route was Xiangdong, a small market town that reportedly contained “more than 400 merchant and commoner families.”⁸ Like Luxi, Xiangdong contained a Guest House built during the Wanli reign period in the late Ming dynasty. From Xiangdong the traveler would rather quickly enter into Liling County in Hunan Province. The Lu River passes by Liling City, a major marketing and administrative center, and then proceeds in a southwestward direction to Lukou, the city that, as the name implies, is located at the mouth of the Lu River. Here, the river empties into the Xiang River that in turn flows past the major regional rice market city of Xiangtan and then the Hunanese provincial capital city of Changsha. From Changsha, large and small boats followed the river into the Dongting Lake and then from there to the Wuhan Cities and into the Yangzi River to Shanghai and the Pacific Ocean.

Finally, travelers could also leave Pingxiang City and walk along the northern overland footpaths to the important merchant and mining town of Shangli. While the east-west corridor of Pingxiang County was largely sloping toward their respective river valleys, the trek north is much more dramatic. Mountains emerge from the lowlands in sharp and grandiose manner, making the trip northward a difficult one. Once travelers arrived in the northernmost region of the county, they entered Anle Township and the northern market town of Shangli. The Pingxiang County gazetteer lists the population of the city at “300 to 400 merchant and commoner families.” Also, the gazetteer does not list a Guest House in Shangli or any buildings as old as those found in Luxi. This indicates that Shangli was a newer city, likely developed after the Ming-Qing transition, and was primarily a market town containing more mining merchants rather than a center dominated by gentry elites.⁹ In fact, the area around Shangli was a small mining community that continued to function and prosper at least

into the early twentieth century.¹⁰ Since Shangli was difficult to reach from Pingxiang City, it developed much closer cultural and economic ties with the Hunanese counties to its west and provided goods such as coal and tea to the markets immediately outside of the county boundaries more than to those within Pingxiang County.¹¹

Family Farming Strategies: Subsistence through Self-Exploitation

In this isolated highland, the mountains provided both minerals for heating and cooking as well as flowing streams that watered the soil needed for farming staples and cash crops. Summer rice agriculture depended on the labor of men, women, and children, who each did their part while fall crops and labor strategies varied from region to region and family to family. Then in the winter months mining was almost certainly the most productive form of labor among peasant men in the county. Hundreds of small mines were opened throughout the county that exposed mineral deposits, including lead and iron ore as well as coal.

Mineral extraction, like handicraft work and farming, relied on the availability of laborers to complete the tasks. The county's production schemes followed the broad outlines theorized by the nineteenth-century peasant scholar Alexander V. Chayanov, who surmised that families sought out family labor strategies that balanced production output with the subsistence demands of their members. Put simply, rice farming strategies required each family member to perform duties following culturally defined gendered divisions of labor and relative skill levels. Subsequently, during the off seasons and off-peak hours of the day, men, women, and children performed tasks that in some way augmented their farming output and added to the overall output of the family's total labor. Chayanov explains that such small tasks were viewed by the family members as "drudgery" and that the payoff was so small as to constitute "self-exploitation," but the members continued to perform these tasks to assure their survival.¹² As each family moved through its natal cycle, it altered the tasks members were able to perform. That is, it developed a production "portfolio" that suited its members' needs.¹³ In this manner, peasants within the community, as well as those located in different locations or even those who lived in different times, emerged not as a monolithic class but as various strata of "peasantries" that included some who focused nearly all their laboring energies on farming and others who devoted greater efforts to mining or other nonfarming pursuits.

In Pingxiang County, the people enjoyed a prosperous agricultural economy throughout much of the Qing dynastic era in the eighteenth and nineteenth centuries. In the summer months, rice was the focus of most farming strategies among peasant families, as about 80 percent of all cultivated lands in the Pingxiang County area were irrigated and used for wet rice agriculture.¹⁴ The rice was watered by a combination of the heavy spring and summer rains and hydraulic systems that used water from the rivers that flowed down the mountain slopes. Western travelers who trekked across the Hunanese highlands in the late nineteenth and early twentieth centuries wrote of the ingenious and labor-intensive methods of irrigation that stretched across the fields.¹⁵ Similarly, one Chinese official noted that the systems of dams and wooden derricks and pipes used for agricultural hydraulics in Pingxiang County and the neighboring fields descending into Hunan Province were more complex than any he had ever seen.¹⁶ With the beginning of the fall, some peasants in Pingxiang County farmed a second rice crop. Much more commonly, families harvested winter wheat and hardier crops.

One very colorful section of the 1935 gazetteer written by an unnamed author provides a description of the planting schedule based upon the Chinese calendar and farming proverbs. It explained that the farming schedule begins at the end of the period known as “Excited Insects,” or March 5th to 18th. “After the Excited Insects,” wrote the author, “you must have cold. This is called ‘Freezing Worms.’” Furthermore, the proverb explains,

“On Qing Ming the frost ends and there is no snow on the land.” During the “Grain Rains” (April 20th to May 4th) it should rain. If there is no rain, then it will be difficult for hoeing and plowing. As the proverb says: “If there is no rain during the ‘Grain Rains,’ then give the land as repayment back to the landlord.”¹⁷

Some of the rice was of the early-ripening variety that could be harvested as early as July, allowing for another crop to be planted and harvested in October. In about half of all lands, a second crop was interplanted with the first, allowing the peasants to use the ample water supplies while avoiding the problems of the growing season that was too short for two complete successive rice crops. The remainder of the rice was allowed to mature throughout the entire summer and harvested in autumn in the month of October.¹⁸

The late summer months bring the hot temperatures that dry the wet croplands and supply the rice crops with needed sunlight. The gazetteer author wrote that “as the proverb says: ‘if it is not hot during the 6th month, then the five grains will not bear fruit.’” This is followed by rains in August during the period known as “The Beginning of Autumn” (August 7th to August 23rd). During this time the peasants believed that if the rains failed to arrive, then the harvest would suffer.¹⁹

Finally, in the late autumn months the climate becomes cooler and the rains continue to provide for late-ripening crops. The author of the gazetteer entry recounts one proverb that explains, “In the spring if the land is without rain, do not plow the fields, in the fall if there is no rain, do not sow the gardens.”²⁰ Beginning in November, between 20 and 40 percent of the northern half of Pingxiang County was used to harvest winter wheat. Similarly, barley was commonly found in the region in the winter months. Summer and fall crops of corn, sesame, tea, beans, cotton, and other supplemental crops were also noted by Buck in his research.²¹ Along with the extensive fir tree forests, which grew both naturally and with active planning by the lumber workers, could be found chestnut trees, from which the town of Shangli takes its name.²² Animal husbandry and hunting and fishing provided such supplemental proteins as poultry, pork, and fish to augment family farming output.

Not all farming in Pingxiang County was centered on rice agriculture. In the less densely populated southern townships of Pingxiang County where the soils were poor and access to markets was particularly difficult, some peasants gradually turned to sweet potatoes for staple food production.²³ Beginning in the nineteenth century and continuing into the early twentieth century, the American crop spread throughout China and altered the strategies of many peasant communities, including southern Pingxiang County, where nearly 20 percent of the land was used for the farming of the new crop. In some farms in southern Pingxiang County, in fact, rice was not grown at all, but instead peasants farmed sweet potatoes in both the spring and the fall and then harvested in the fall and early winter, respectively. Once harvested, the poorer families who could not afford to secure rice for their diet consumed this new crop as a staple.²⁴

The labor required to farm two crops of food and provide fuel for the household involved an elaborate set of strategies for family labor. At the simplest level, Chinese often stated that “men plow, women weave,” meaning that men were in charge of most of the physically intensive labor required by farming, while the women tended to do the supplemental tasks of producing textiles and other home-based tasks.²⁵ However, even

this is too simplistic, as women and children performed many tasks in the fields to support men's more muscle-intensive labor. Where rice was grown, for example, women and children pulled up weeds and husks at the end of the season.²⁶ Sweet potatoes, too, required extensive labor of the women and children as well as the men for a successful harvest. Taken out over decades and centuries, following Chayanov's theories, it is obvious that as young families aged and their members became older, the relative labor and input strategies utilized by each family changed to meet both the available labor inputs and the consumption requirements.²⁷ The degree to which a given family farmed beyond their own small plot of land, worked in factories or mines, or sought out occupations as maids or servants to the elites in the community changed from one family to the other and from year to year.

So, to supplement agricultural output provided by family labor, peasants turned to a variety of by-employments or nonagricultural labor. Little data exist telling us what sideline industries were found in the county, though many forms of artisanal work and even firecracker production were common. Most likely, many peasants engaged in farming-related activities. For instance, one entry in the gazetteer explained that during the late autumn and winter months some peasants sold cloth to supplement their incomes. Supporting evidence for this contention can be found elsewhere in the gazetteer. In one particular case found in the section on venerable women, a *née* Peng was said to have arranged for her two sons to marry and trained the daughters-in-law to spin thread for the market while her sons sold some of the grain they harvested. Though *née* Peng and her family were poor, they engaged in several farming strategies that collectively supplied them with their subsistence. Not only did *née* Peng's sons provide labor for their own needs, but their marriages also provided added labor power that augmented the family's production as well.²⁸ Some peasants also engaged in livestock fowl husbandry for sale in the local markets. Among the most significant types of land and waterfowl raised were the ducks peasants tended to, keeping as many as twenty birds at a time, a large number for the region.²⁹ As will be seen in the next chapter, some members of the county emerged as landholding elites who no doubt turned to some of their poorer brethren to do any number of tasks, including construction, child rearing, and even maid and butler services. In this way, men, women, and children worked for the landlord families in a number of capacities based on their ages, genders, and personal skills.

In all, peasant families turned whatever labor combinations suited them to provide for their subsistence. The variations of staple crop farm-

ing, sidelines, and even service jobs allowed them to provide for the subsistence of the family. Moreover, as each family in the community moved through their natal cycles, sought out jobs of various forms, and utilized and altered the environment, jobs that were selected for subsistence by one family for several years might eventually fail to satisfy that family's needs. Those jobs might be, instead, picked up by another family that could not be satisfied by the task at hand previously but would presently find it suitable. Over generations, such a community came to assume that the workable options for production and consumption were available when they needed them. A sense of a bond between the natural environment and the human-made community developed that each individual and each individual family counted on for survival throughout their lifetimes.

Mining Strategies and Technology

In the early twentieth-century gazetteer, a Pingxiang County member proudly proclaimed that the county had "minerals in store (that are as numerous as) the hairs of a pony's tail."³⁰ In fact, the county holds some of the province's largest fields of gold dust, lead, copper, sulfur, antimony, lime, manganese, and iron as well as porcelain clay.³¹ Even still, the deposits of high-grade bituminous coal were by far the most significant and abundant source of family-required resources and dependable by-employment in the county. Geological studies show that beginning in the Paleozoic era, the county's mountains were covered with ocean greenery and dense forests that solidified and transformed into various grades of coal over the millennia.³²

Over the last two thousand years local inhabitants of the area utilized whatever tools and skills they had at the time to extract coal from the mountains to heat their homes and fuel their kitchens.³³ At least as early as the Han dynasty some inhabitants extracted coal for their daily needs.³⁴ Moreover, several hundred years later, during the Tang era, local inhabitants of Pingxiang County reportedly opened small mines for extraction and personal use.³⁵ By the early thirteenth century a local gazetteer and another publication indicated that the county's output was quite exceptional, boasting one of the two best coalfields in Jiangxi Province, in fact.³⁶

By the height of the Qing dynastic era in the eighteenth and nineteenth centuries, Pingxiang County peasants developed and employed strategies to utilize the coal for personal needs and to incorporate

coalmining into their labor portfolios. Mining was used as another by-employment strategy that was to supplement their farming and was done almost exclusively in the winter months after the last harvest was completed. Beginning in December, the cool and dry winter season begins and lasts for about four months, at which time the temperatures average about 6 to 8 degrees Celsius. These near-freezing temperatures are supplemented by frosts almost every day, and some snow and freezing rains do fall. The precipitation quickly comes and goes and melts, leaving the ground soft and wet. Local proverbs stated:

One inch (*cun*) of snow turns into one foot (*chi*) of mud
One foot (*chi*) of snow turns into ten feet (*zhang*) of mud

The gazetteer further explained that during the height of winter the frost takes over and some sleet and freezing rain fall heavily on the houses and make icicles off the eaves. In fact, one proverb exclaims, “The winter is a cold and miserable time.”³⁷

Even as the winter cold was seen by many peasants as “miserable,” the local winter conditions made for good mining weather. Since the winters were not excessively cold, the temperature difference between the wells and the land above was not especially dramatic. More importantly, the dry winters protected the miners from the dangers of water damage that can destroy the mines and even kill the miners working below. In those winters when the rains fell harder and longer than usual, the damage to the mines—not to mention the homes and fields—was devastating. The excessively wet winters damaged or destroyed the mines and slowed the transportation of the mineral to the homes and markets in the valleys below.

During these brutal winter months, the women and small children of the family turned to indoor activities like cotton spinning or handicrafts and the men and older boys grabbed whatever tools and supplies they could carry and they left the family farms for the mines in the mountains. When they arrived in the mountains, they sought out the best locations for coal they could find. That is, they searched for the best coal located as close to the surface as possible. In many cases the men turned to pits they had used the previous year and simply began yet again. However, due to the changing seasons and weather patterns and general neglect, these shafts were usually destroyed and the walls of the shaft crumbled in, making them too dangerous to work. So instead, they simply planted a flag in a new location nearby claiming the land for themselves and started

excavating a new mine. In this manner, flags and dilapidated mines were strewn throughout the highlands providing the next generation of miners tangible evidence of past successes and failures.³⁸

Even as the abandoned mines were potentially dangerous traps that many unsuspecting people fell upon, the new mines were equally dangerous and often crudely constructed. Men and boys who worked them did so knowing that the chance of injury, if not death, was high. To enter the mine, the worker walked down a crude bamboo ladder until he reached the mineral seam. In many cases, the miner continued downward to a second and even third seam in the mountain. Most of the coalfields contained two seams located close to the surface that produced poor-grade bituminous coal that was lumpy and therefore easy to transport and use in family furnaces. Moreover, the coal was low in ash and so would produce little smoke when fired.³⁹ Nearly all the small pits in the Anyuan area were dug down to retrieve the coal from these two seams. Then, when the mineral deposits near the mine shaft were depleted, miners usually started a new mine to extract elsewhere. However, some of the mines were dug deeper to extract the higher-grade bituminous coal. This coal was softer and lower in phosphorous and sulfur and, though it was high in ash, it was still a better-quality coal than the top-layer deposits. In any case, the deeper the miners descended, the more dangerous the task. And once they arrived at the spot they intended to work, the seams were often narrow and undulating, forcing the worker to move about under the rock following the natural contours of the deposit. For example, one Western observer in Pingxiang County explained that as the miner burrows into the ground, he

avoids rock so far as is possible. . . . The diggings are largely in the seams and consequently have many torturous and narrow passages. The shaft of the native mine follows the vein from the surface, usually at an inclination of from 20 to 60 degrees. After a varying distance the shaft or drift becomes horizontal and then rises still following the vein.⁴⁰

Miners were required in this manner to descend into the rock and then crawl along the seams picking and digging their way to find the minerals they needed. Most mines were reportedly dug no more than 100 to 150 feet deep.⁴¹ And even at that depth, the German engineer Baron von Richthofen explained, “[I]t proved to be very unsafe,” though some wells reached even greater depths. These shafts were only fully excavated at great danger to the workers.⁴²

Most of the mines were completed using simple farming tools the peasants brought from home. Being too poor to invest in specialized devices for mining, peasants from the most ancient periods until the early twentieth century employed whatever gear they could bring from home. Since mining obviously began with the simple digging into the ground, one would assume that shovels would be among the most important tools needed. However, even though irrigation agriculture itself required constant attention to dredging silted canals, the Chinese did not develop a shovel as Europeans did.⁴³ Instead the tools peasants brought to the mines were primarily digging sticks or sharp metal objects like harrows or sickles used to maintain their family's rice fields; the hammers, mallets, and other woodworking tools needed for home or farming construction; some stone quarrying tools for building dams and bridges; and whatever candles and baskets they used at home.⁴⁴ Among the only specialized tools most miners used was an iron gad, a wedgelike tool that may have a wooden handle. The method of mining with a gad and mallet is hundreds if not thousands of years old, and the tool designs have changed very little in that time. While many hammers they owned had long handles for leverage, the ones used in the mines were often quite short so that the miner could fit inside the cramped space without disturbing the fragile walls. Unfortunately, this need to utilize short-handled equipment meant that the force they could bear on the rock was diminished, but in many cases the shaft sizes dictated the tool selection. Pick axes and other tools used in the 1920s in local Jiangxi provincial mines had handles as long as two feet. Other long-handled equipment was said to be too long for work inside the shafts but was incorporated into above-ground activities. The local museum in Pingxiang County holds several tools that were used in the premodern mines. Simple axes with medium-length wooden handles predominate the collection and provide a picture of the daily tasks and methods of extraction.⁴⁵

Once the older, more skilled workers extracted the mineral from mine walls, young men or boys brought the coal to the surface by climbing up the bamboo ladder with heavy baskets or carrying poles balanced on their shoulders. This labor—both the transporting of heavy loads upwards of 100 feet to the surface and the work at the surface—was in fact so arduous that it often constituted upwards of 60 percent or more of the total labor power and number of laborers in the mine team.⁴⁶ The relative strength of the young boys and the size of the shaft that provided the opening for both carrier and basket constrained the size and weight of the baskets and their contents. For the larger mines, windlasses were

constructed over the opening that sent baskets up and down the shaft to the mine bottom. The handheld crank could require eight to ten men to operate in order to bring the heavy mineral to the surface. In some cases, in fact, the windlass was also used as a crude elevator for workers who stood in the basket on their way into the mine. The hundred or more pounds of either a miner or a load of rock placed a strain on the muscle power of the mine crew and in this manner altered the extraction and purification strategies from one mine to another.⁴⁷ For instance, in places where vertical shafts had to be excavated so deep as to hinder output, some miners excavated horizontal adits instead. These mines cut into the mountain from the face and directly exposed a single seam. Not only did this method at times improve the chances of extracting lower and more lucrative seams, but it allowed the workers to walk in and out of the adit without the use of ladders or windlasses. This strategy was rarely if ever used in Pingxiang County prior to mechanization.⁴⁸

To prop up the mine shafts, miners used timber along the ceilings and walls. Incorporation of timbers into the mine shaft had to be done properly in order to maintain structural integrity inside the artificial cave. Miners quickly found that timbers should be placed at slight angles when they prop up their shafts. In many cases, miners constructed box-like structures within the shaft to increase the strength and security of the support beams. They also found that in damp shafts timbers became damp and weak. In locations where only poor timbers were abundant, miners had to replace the structures regularly or gamble with their lives as the wood lost its rigidity. In some mines, workers left strategic areas of the rock in place to prop up the ceiling above. This method, referred to as a “room and pillar” technique, was used extensively in some areas of China and little if at all in others.⁴⁹

As has been suggested earlier, excavating wells of one hundred feet or more, especially when they are exposed to the seasonal rains, meant that the wells filled up with water and threatened the efficacy of the mines as well as the health of the men who worked in the deep shafts and tunnels. When there were problems with water seepage, the miners used methods of extraction that were crude but sufficient for the needs of the miners. Throughout China miners who experienced this problem simply opened a new shaft and began yet again. More often, as the rains or groundwater seeped into the shafts, boys and other surplus laborers hauled baskets lined with oiled cloth or leather to bring water out of the deep shafts.⁵⁰ Chinese miners are somewhat unique in employing this strategy in that they did not invent the water pump as the miners in Europe did. Even

though it seems perverse that the Chinese did not develop this technology given the threat of water damage and injury due to seepage, some Western scholars suggest that Chinese miners did not develop a pump in part because they chose not to. In his study for the *Science and Civilization in China* series, Peter J. Golas informs us that the pump that was used by Europeans as early as the Roman era could have been a useful device had the Chinese developed it sometime during the two millennia prior to the late nineteenth-century Western technological invasion. In fact, he tells us, when Chinese miners did see diagrams of European pumps, they chose not to incorporate them into their production schemes even though the pump designs required little capital investment and fell within the technological levels of the society.⁵¹ Even more likely, Chinese miners chose not to develop or, failing that, incorporate the pump because it did not fit the perceived needs of the mine culture. Given the cheap labor costs of mining in China, technology that Westerners deemed as useful was often viewed by the Chinese as unnecessary. Even more importantly, the Chinese viewed technology that cut labor out of a production scheme as harmful because the same families that consumed the coal also produced the coal. In this manner, petty producers sought to keep their employees working rather than searching for strategies that could eliminate them from the labor force.

It is also true that the Chinese did not simply allow water to ruin their mines. Instead, miners used a number of alternative approaches to alleviate this problem. Following the demands of the miners to keep their labor force intact, these strategies tended to be labor-intensive rather than labor-saving schemes. One method of extracting water that actually does follow the general principles of the pump was the incorporation of bamboo as a natural tube, as described by one Westerner who observed mining in Pingxiang County and elsewhere in the early twentieth century:

Pumping is effected by manpower, as machinery is never used. A long section of a large bamboo, 6 to 8 inches in diameter, is cleaned out, making a circular smooth pipe. Into one end of this a crude valve is fitted and into the opposite end is introduced a piston with a valve. This pump is laid along the slanting floor of the shaft and operated by a coolie who sits at its upper extremity. The water is caught in a small pool lined with clay from which it is pumped by a second similar apparatus at a higher level. A sufficient number of these relay bamboo pumps are provided to reach the surface.⁵²

Similarly, some miners incorporated the commonly used water wheels that farmers designed centuries ago to bring water from one rice field to another. The oblong wheels contained a series of leather buckets or other clothlike baskets to fill with water at the bottom of the wheel's run and then deposit the water when it reached the top. These devices, too, were pedaled by one or more laborers often for hours at a time.

Chinese coalmines not only suffered from too much water but also contained dangerous gasses that came off from the newly struck coal rock and in some cases were so deep that workers nearly suffocated. In fact, in one study of Chinese mineral economy, the global historian Kenneth Pomeranz argues in part that Chinese miners rarely had problems with water seepage but instead had greater problems with ventilation of gasses.⁵³ His argument is an important one in that it also points to the need by many miners to seek solutions to ventilation. It is true that miners nearly suffocated where the deepest shafts were nearly devoid of breathable oxygen and the gasses that came from some of the coal in Pingxiang County's mines was particularly heavy and dangerous. To alleviate these problems these men sought strategies such as opening a second ventilation well, and at times some miners kept a fire lit in the bottom of the well that moved oxygen through the shafts. More importantly, however, Pomeranz's depiction of Chinese mines being exceptionally dry is quite odd and counter to the findings of most scholars who have studied mining in China. These scholars are nearly uniform in stressing the point that water seepage was a constant and real danger.⁵⁴ It is true that both ventilation and water seepage were serious problems for miners. It is also true that water seepage was especially troublesome and dangerous and was handled by local miners in manners that suited their needs and the tools and capital available to them. That is, Chinese miners did not invent the water pump because they did not perceive a need for one. They did, however, find ways of alleviating the dangers of both poisonous air and flooding waters but did so in ways quite different from those employed in Europe.

After coal was extracted from the mines and brought to the surface beyond the dangers of the pits, a number of boys purified the coal. To this end first the boys separated the high-grade coal from poor-quality mineral and shale. Once the best coal was separated from the rest, men coked the coal to produce the high-grade fuel source. To coke coal—a process similar to turning wood into charcoal—one needed to cook the extracted mineral in a controlled furnace until the impurities were burned out of the rock. Miners completed this task by making crude coking

ovens. After making long, shallow trenches in the ground, the men filled the ditches with coal and placed brick and clay over the mineral. They then lit the coal and allowed it to burn at a low temperature for two to three days. This coking process separated the pure carbon from most of the volatile constituents and impurities in the raw mineral and made it more effective when smelting iron ores or other minerals.⁵⁵ Coked coal's burning temperature was lower than the much harder and purer anthracite. However, when it was fired it put out a constant heat with little smoke that allowed for controlled smelting. This, in turn, improved the quality of the iron produced.⁵⁶ Moreover, volatility of the coal was greatly reduced and therefore it could be left unburned longer. And, because the coked coal was pure, it could be transported more cheaply than if the coal was sent with shale and other heavy impurities.

Peasant men completed these tasks in many parts of the county, searching for the locations close to home that held sufficient sources of mineral that could assure them of success in their efforts. For the most part, the coalmines within the county limits predominated in three locations of the Luoxiao Mountains that formed the Jiangxi-Hunan provincial border. To the far north, small mines around Shangli merged into Liuyang County, Hunan. To the northeast, the mine fields referred to as Gaokeng stood near the border with Yichun County. And the center of the county, near the county seat, contained the rich fields around the village of Anyuan.⁵⁷ As the county grew into communities centered around one particular market or another or with one lineage or another, the mining topography developed accordingly. Similarly, as certain locations were proven to be more lucrative than others, families altered their labor portfolios accordingly, and in this way their agency altered the history of the county.

I have argued up to this point that the climate, topography, and mineral deposits in and around Pingxiang County were integrated into the annual production and consumption patterns of the local population. The warm, rainy growing seasons and mountain-fed streams provided the conditions for extensive wet rice production throughout much of the county. Conversely, I have shown that the families that settled in Pingxiang County were influenced by their internal gendered composition and natal cycles and were further integrated into a community whose actions were focused around the seasonal clock. In order for families to survive in the isolated highlands, they had to spend most of their year working in irrigated fields of rice while supplementing their incomes with by-employments including coalmining accomplished by the men and boys in each family.

While some families simply gained sufficient benefits through much of their labor, others turned to the marketplace to gain cash and trade value. For them, family strategies that included production of surplus foods and extracted coal could not sustain the family if the surpluses could not be sold in an active marketplace. To this end, local and regional markets established along river routes and natural crossings purchased many of the goods produced by Pingxiang County residents, as traveling merchants supplied them with other goods and services.

Local Markets and the Furtherance of Subsistence

All families needed to engage in some trade to secure certain goods and services they could not provide for themselves. To this end, they produced surpluses in goods they could trade in the marketplace. Marketing strategies were influenced by the relative demand for the product and the cost of transporting that product from the site of production to the markets. Since most staples are both heavy and relatively abundant throughout both Hunan and Jiangxi provinces, trade in these goods was almost certainly contained geographically within local markets. Tea, on the other hand, was light and in higher demand for markets farther from the source. To reach regional markets, consumers and producers alike trekked over narrow footpaths or seasonal river flows to reach the markets. Since many paths into town were slow if not treacherous, they hindered transport methods and schedules and therefore altered marketing schemes further. From this, nested markets of various sizes and specialties arose both within the county and in the regions beyond the county's borders.

Among the goods most prevalent in the Jiangxi provincial highlands was good-quality bituminous coal. Though most peasants did not mine coal primarily to sell, certainly some of the mineral was traded to other peasant families and migrant peddlers who attended the market days. For many part-time miners, the price they received for the coal was miniscule as the transportation cost alone likely priced the mineral beyond the budgets most could afford. Even the cost of transporting coal more than a day's walk from the mine pit was prohibitive for most consumers.⁵⁸ For example, the cost of anthracite coal at the mine pit in Leiyang, Hunan Province, was about 2 *yuan* per ton.⁵⁹ However, the economist Thomas Rawski determines that the cost of a single ton transported just one kilometer on the backs of workers from the mine shaft to the dock would cost an additional .2 to .35 *yuan* or an additional 10 percent haulage cost.⁶⁰ In

this manner, miners simply brought as much coal back from the mines as they could and sold it for whatever they could get and considered it an additional revenue for their families. It is possible that isolated markets and high transportation costs were beneficial to miners as it tended to cut off investors who might wish to undercut them with coal from outside the immediate marketing area.⁶¹ However, at the same time, the lack of access to markets meant lower profits or potential profits for small investors. These two realities assured the markets of small amounts of coal demanded for daily use but very little profit required to bring about expansive or sustained output for the county's inhabitants.

These calculations also suggest that at least some Chinese sought to create a year-round mining firm that could provide fuel to the richer families if not to peasants located closest to the mine shafts. To the degree that coalmining was an occupation that paid a wage it is likely workers who agreed to mine for pay earned a fraction more than a farmer, but even this supposition is difficult if not impossible to prove. Figures for Pingxiang County miners' wages are not available, and deciphering an exact conversion rate may be difficult as the values of Chinese coinage varied over time and from locality to locality. Many studies have shown the wages of one occupation or another in a specific location or time though these figures are more suggestive than conclusive. Yet based on these admittedly incomplete numbers, it is safe to assume that the poorest professional miners were making little more than minimum subsistence wages. These wages could not entice men to leave their homes and families to work as professional miners. Those who did attempt to take mining as an occupation were primarily landless laborers who had no family or lineage ties they could turn to for alternative subsistence. More importantly, the poor financial gains promised these men curbed the chance of a possible breakthrough in the Chinese mining sector.⁶²

While mining in the late Ming and early to mid-Qing eras was primarily meant for subsistence, there is some evidence to suggest that as the population of the county increased by the mid to late nineteenth century this sparked more trade in the mineral. To this end, individual families joined into larger cooperatives and worked together to excavate deeper shafts.⁶³ By the height of the Qing dynastic era, new markets were formed and expanded transportation routes and merchants' schedules were established to supply the developing local economy.⁶⁴ The concomitant increase in total demand sparked expansion of mining among the seasonal workers. In some mines, the shafts became increasingly deep and the labor extreme. One observer of Chinese mines wrote that he had descended

into shafts that were 600 to 800 feet deep. He indicated both amazement and anxiety at the effort of these miners when he wrote, "In most cases the wonder is not that the miners have stopped where they did but that they were able to penetrate so far and won so little from their efforts."⁶⁵ From this we can see that workers were indeed willing to engage in difficult and dangerous work for the addition of miniscule added wealth to the family. The local markets provided these men with locations to trade their goods and take home cash or exchange items needed for their family's survival. In this manner, the marketplace was an essential feature of their lives and was well integrated with their farming and mining labor. However, because the costs of transporting the coal in any great distance dramatically increased the cost of the good, the low capital demand for cash crops and commodities failed to spark the evolution of subsistence mining and sales into the kind of capitalist markets that were developing in Europe at the same time. Thus, the "take-off" phase did not materialize.

Local Coal Production and Regional and International Markets

Because the Chinese economy was labor rich and capital poor this affected the farming and mining strategies the people employed, and it had a significant impact on the nature of the markets. Local trading centers and market towns were designed to provide for the subsistence of the people, and in this they succeeded. At the same time, in the mid to late nineteenth century, regional markets and international trade lagged in China compared to contemporary markets in Europe. Chinese populations sought production strategies that promised jobs and the greatest chance of subsistence for their members and viewed the promise of more efficient production schemes or more elaborate marketing strategies as potentially dangerous to those goals and therefore counter to these plans.

In Pingxiang County, coalmining as well as rice farming and cash cropping provided in theory a chance to engage in transformative regional trade, though that opportunity never arrived. Larger markets located along the greater waterways outside the county might seem to a modern capitalist as an opportunity for economic advancement. However, trade in high-grade bituminous coal did not take off as a regional commodity. Indigenous development of coal sellers and buyers did not lead to new strategies for trade or transportation or to avenues of investment or mass marketing. Rather, even in the nearby lucrative markets of Hunan Province and in the international market city of Shanghai, the demand for

coal did not reach the mines of Pingxiang County. Rather, both markets remained content with less costly items that employed labor-intensive rather than capital-intensive production. And in this way, the indigenous economy did not entice greater investment or the search for new forms of marketing of their coal into the larger markets.

The most likely destination of extended trade from Pingxiang County was the Hunanese provincial lowland cities to the west of the county. Local producers who could find a viable strategy for transporting their goods nearly 100 miles down the county's rivers to Hunan Province's market towns or more than 200 miles further down the Xiang River to the Wuhan Cities in Hubei Province could have access to hundreds of thousands if not more than one million potential buyers in each marketing city.⁶⁶ And to this end, tea merchants frequently used this route to sell their product in the Xiang River valley markets. These men who were part of the Liling-Pingxiang Boat Guild transported some goods, presumably tea, to the Wuhan Cities, porting their boats at a special pier built by the guild.⁶⁷

While tea farmers had some success selling their product in Hunan and Hubei provinces, coal miners did not. Even local porcelain producers in such important sites as Liling County and Changsha turned away from regional coal for fueling their kilns.⁶⁸ Many potters in China consumed coal rather than wood to fuel their kilns because the heat provided was as high as and attained more quickly than wood. For this reason, the availability of Pingxiang County's bituminous provided a potential alternative to felling the forests for porcelain manufacture. However, even the demand for coal by these potters remained low throughout China as the use of coal had several pitfalls as well. In particular, they complained that coal was too high in ash for making good-quality porcelain, and coal tended to burn for less time than timber. More importantly, to use coal they had to retool their kilns, thus forcing them to rely heavily on this inferior product.⁶⁹ Under these circumstances, even in some of the most prosperous factories of the nineteenth century, the demand for coal was insufficient to alter Pingxiang County miner merchants' marketing strategies.

The county's coal also suffered from high transportation costs due to inadequate and seasonal river passages. In particular, the Lu River was so low as to be unusable for several months during the dry winter period. Moreover, the wet months were a time when peasants diverted river water in order to provide for their irrigation systems that watered their fields. Lastly, the Lu River was ill-suited to trade with the most lucrative markets