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**Title**

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**Journal**

Cross-Currents: East Asian History and Culture Review, 1(13)

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**Publication Date**

2014-12-01

# CROSS-CURRENTS



## EAST ASIAN HISTORY AND CULTURE REVIEW

### **The Tangdan Copper Mines and the 1733 Earthquake: A Mining Community before the Boom in the Far Southwest of Qing China**

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#### **Abstract**

In the official records, copper mines in the southwest of the Qing empire seem to suddenly appear in the late 1730s. In part, this impression is an effect of government attention. Copper, which was the most important metal for casting cash coins, became a pressing concern when imports of Japanese copper dwindled. The government responded by developing domestic resources. Seemingly overnight, Yunnan mines reached impressive levels of productivity and replaced imports. For several decades, the Tangdan mines in northeastern Yunnan supplied most of the copper consumed by the centrally important metropolitan mints. The sudden boom is remarkable and not entirely plausible. This article reassesses the history of Qing-period mining by examining a particular case study. It explores an essay about the Dongchuan earthquake of 1733 that provides a glimpse at the empire's leading copper mines on the eve of the recorded boom. A close analysis of figures, mining technology, and organizational structures reveals that the mines had been developed by mining entrepreneurs and migrant workers for a considerable period of time outside government attention, operating in a gray zone of unlicensed exploitation. The studied case permits a new assessment of the role of the state and of nonstate players in the industry. Moreover, it throws a new light on the image of Qing society and economy created by the official emphasis on agriculture and the actual role of the nonagrarian sector.

Keywords: China, Yunnan, Qing period, mining, social history, economic history, nonagrarian economy

#### **Introduction**

Dongchuan Prefecture in northeastern Yunnan was famous for its copper mines in Qing China. The gazetteer of 1761 proudly states that “the richness of the copper mountains ranks first throughout Yunnan” (*Dongchuan fuzhi* [1761] 2006, 335). The Tangdan mines in the south of

the prefecture were the oldest and by far the most productive areas of copper exploitation. The first mention of the Tangdan mines in extant records dates to 1697, when mining was declared legal, provided that taxes were paid. The mines were officially opened in 1726, when the area was added to Yunnan Province. In the same period, copper mining became a state issue because the imperial mints encountered supply difficulties. In the early Qing, the casting of cash coins relied on Ming-period coins, Japanese copper, and domestic zinc, tin, and lead for raw materials. But by the 1720s, restrictions on copper exports by the Tokugawa shogunate made themselves felt. The Qing government eventually shifted to procuring copper from Yunnan Province; thus, starting in 1739, the Tangdan mines became the main supplier of copper for the mints in Beijing. Exploitation occurred on a massive scale. The mines shipped some 2,000 tons of copper annually to the imperial mints through the eighteenth century, and probably about 1,000 tons annually through the first half of the nineteenth century. Mining in the southwest came to an end in the early 1850s, when the Taiping Rebellion cut off the transport route to the capital and Yunnan was engulfed a regional civil war commonly known as the Panthay Rebellion.<sup>1</sup>

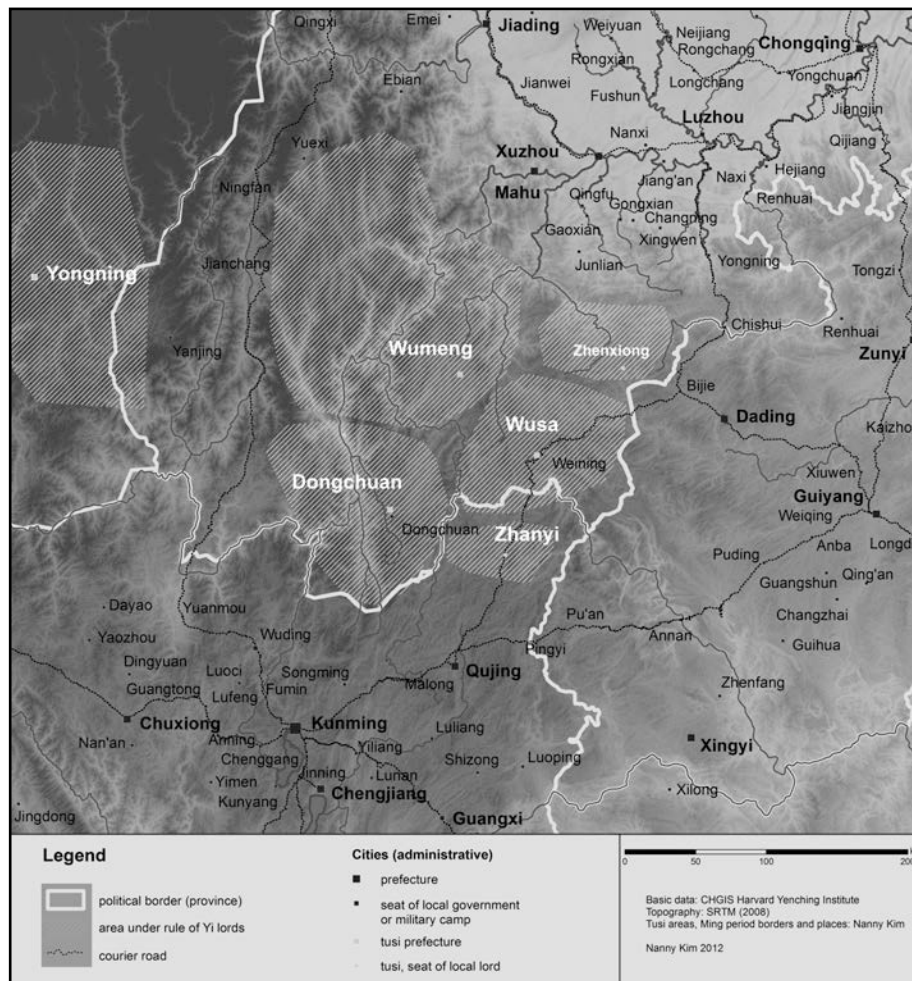
Copper exploitation in the Tangdan area is ancient. The archaeological record goes back to prehistoric times, and ancient Chinese bronzes are thought to contain copper mined there.<sup>2</sup> The scope of mining, however, is uncertain. As late as 1730, the mines apparently were hardly noticeable. In a detailed report that year by Governor-General E'ertai (Manchu: Ortai, 1677–1745), who led his troops along the Xiaojiang Valley, passing under the slopes of the Tangdan mines, he makes no mention of the mines or of the presence of a Chinese community (*E'ertai zougao* 2002, 347–355). Another account of the same war campaign, however, mentions an attack on the Tangdan mines late that same year that dispersed “tens of thousands of miners.”<sup>3</sup> Only six years later, the same mines had eclipsed all other copper mines in the empire (Vogel 1989, 263, 278; *Dongchuan fuzhi* [1761] 2006, 235). The records are confusing: either a mine that achieved an output of thousands of tons materialized within a matter of a few years, or the expansion began earlier but remained mostly unremarked. The former appears technically and organizationally impossible; the latter demands an exploration of the reasons for the silence.

This article investigates the history of the Tangdan mines before the recorded boom starting in the late 1730s. To this aim, it focuses on a source that is not apparently relevant to the issue: an account of the great earthquake that struck Dongchuan in 1733. Because of its careful analysis of miners and mining in the local society and economy, the text in fact reveals important information about the history of mines in the period when the area was supposedly off-limits to Han Chinese. The seemingly sudden appearance and disappearance of mines, and the scarce and conflicting information about them, is a common issue in the history of mines. By examining a comparatively well-documented case, therefore, we can gain a better understanding of historical developments, of the scale of exploitation, and of the social and economic structures of borderland societies.

### **The Conquest of Northeastern Yunnan**

At the beginning of the eighteenth century, the area that we know as northeastern Yunnan and adjacent northwestern Guizhou was out-of-bounds for Chinese. On the map, the area had been part of the empire since the Yuan period and had been placed under the administration of Sichuan Province in the early Ming. In fact, these were lands of people who referred to themselves as Nuosuo and were renamed Yi 彝 in the early 1950s. Traditional Chinese writings refer to them as “barbarians” (*yi* 夷), as Luoluo 倮倮 or Luoren 倮人, or as *wuman* 烏蠻 (black barbarians). The mention of Yiren or Luoluo was enough to warn off travelers, as Yi society was ruled by aristocratic warriors. Raiding for goods and people was part of life; hence, an outsider who came within reach without the protection of a noble lord traveled at the risk of being robbed, enslaved, or killed. With the exception of a few intrepid monks and merchants, people kept away.

Actual power was shared among the four Yi statelets: Wumeng, centered on the Zhaotong Plateau; Mangbu, in the valleys north of modern-day Zhenxiong; Dongchuan, on the Huize Plateau, and Wusa on the Weining Plateau. The Yi lords recognized the emperor’s suzerainty and received investiture as *tusi* (local chieftains), but imperial presence was limited.<sup>4</sup> Map 1 shows the *tusi* lands of the Ming to early Qing.



Map 1. The Sichuan-Yunnan-Guizhou border area, Ming to early Qing. Cartography by the author.

In the early eighteenth century, the chieftains of Wusa and the already relatively insignificant Zhanyi to the south of Dongchuan and Wusa were formally abolished, although the lords were left alone. At the same time, the ruling houses of Dongchuan and Wumeng were headed by minors. In a feudal order in which the lesser lords (regarded as “headmen” by the Chinese authorities) maintained their independent power bases, such events constituted a temporary weakening but no fundamental challenge. Nothing indicated that the rule of the Yi lords was about to end. In early 1726, the Yongzheng emperor (r. 1723–1735) dispatched a

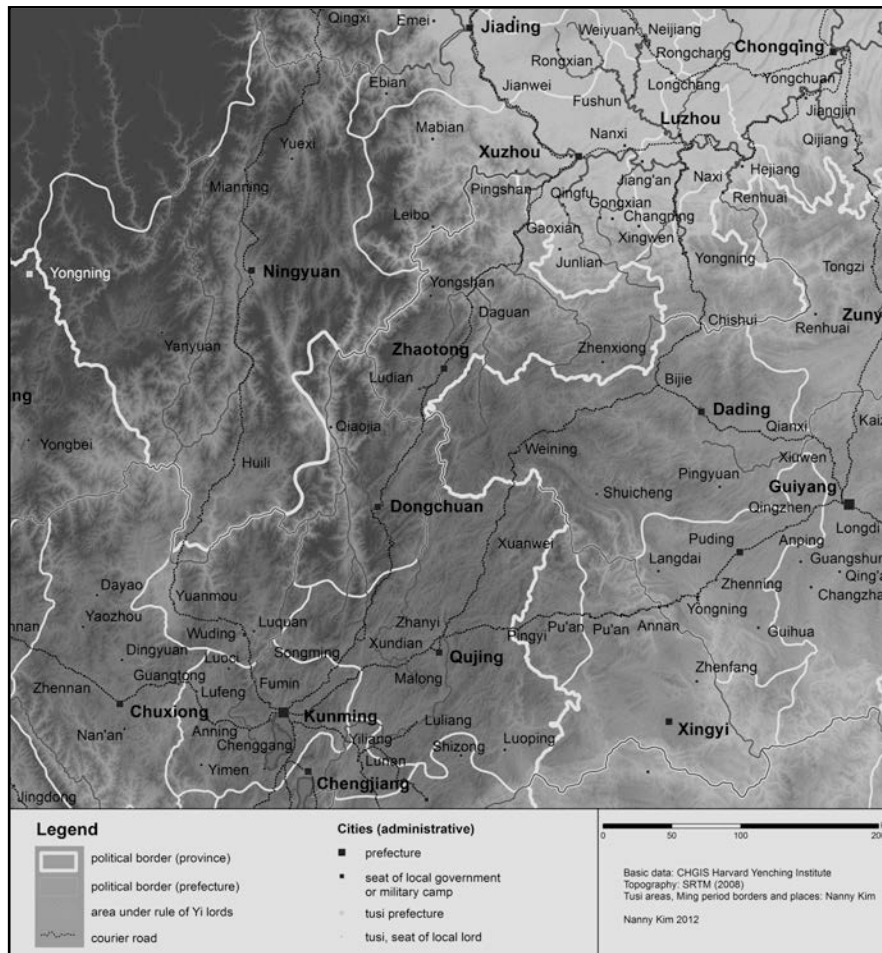
young official named E'ertai to the southwest. The emperor placed his full trust in E'ertai and supported him, even when his activist policy became costly and open to criticism. Until 1732, E'ertai served as governor of Yunnan, and soon also Guizhou, and was finally put in charge of Guangxi Province as well. Upon his arrival in Kunming, he began reporting on rampant abuses by native chiefs. Singling out the Dongchuan chieftain as particularly malicious, E'ertai supported the opinion of the Xundian magistrate Cui Naiyong (dates unknown), who had pointed out that raiding terrorized the population in neighboring Xundian and that the area was beyond effective control by Chengdu.<sup>5</sup>

In 1727 E'ertai abolished the chieftains of Dongchuan, Wumeng, and Mangbu in a show of force so swift that it met little resistance. However, when the Yi lords realized that the Qing troops had come to rule, they fought back. After four years and three war campaigns on an increasing scale, most strongholds of Yi power in Dongchuan and all locations of any importance in Wumeng were destroyed. E'ertai had promised his emperor that he would direct military action against insurgents only and spare the indigenous local population, yet in the repeated campaigns the Qing troops came to wage a war of annihilation. According to E'ertai's reports, the last campaign against Wumeng left ten thousand dead on the battlefield, while another ten thousand died in flight or by their own hands. The fighting, punitive and preemptive slaughters, and burning of villages and forests destroyed Yi society, leaving only remote mountain communities relatively unscathed, while survivors who remained on the plateaus became a fearful minority, and most survivors of the noble clans fled across the Jinshajiang River to the Liangshan region.<sup>6</sup> Map 2 shows the administrative boundaries established in 1726.

The war campaigns of the years 1726 to 1731 seemingly left a blank slate in northeastern Yunnan. Chinese history writings inscribed the landscape with new meanings and traditions. Dynamic development began, driven by Han and Muslim Chinese in-migrants. Population increase, intensive agriculture, and mining transformed the area. Reliable population figures are not available prior to the twentieth century. The most convincing estimate has been advanced by James Lee based on a figure of salt consumption that converts to some three hundred thousand inhabitants in Dongchuan and Zhaotong Prefectures in the 1760s (Lee 1982, 730, table

7, footnote b).<sup>7</sup> Lee's figure agrees with available figures of registered inhabitants.<sup>8</sup> This estimate is likely conservative because the population registers of the Qianlong period in the southwest were the product of systematic underreporting and because most inhabitants in the mining settlements were unregistered.

A short descriptive Chinese source dating to 1733, merely two years after the conquest, permits us to make a relatively detailed reconstruction of the sizes of specific sites, including the prefectural city of Huize and the Tangdan mines in the south of the prefecture, correcting the impression that mines sprang up overnight in empty lands.



Map 2. The Sichuan-Yunnan-Guizhou border area, 1726. Cartography by the author.

## The Earthquake

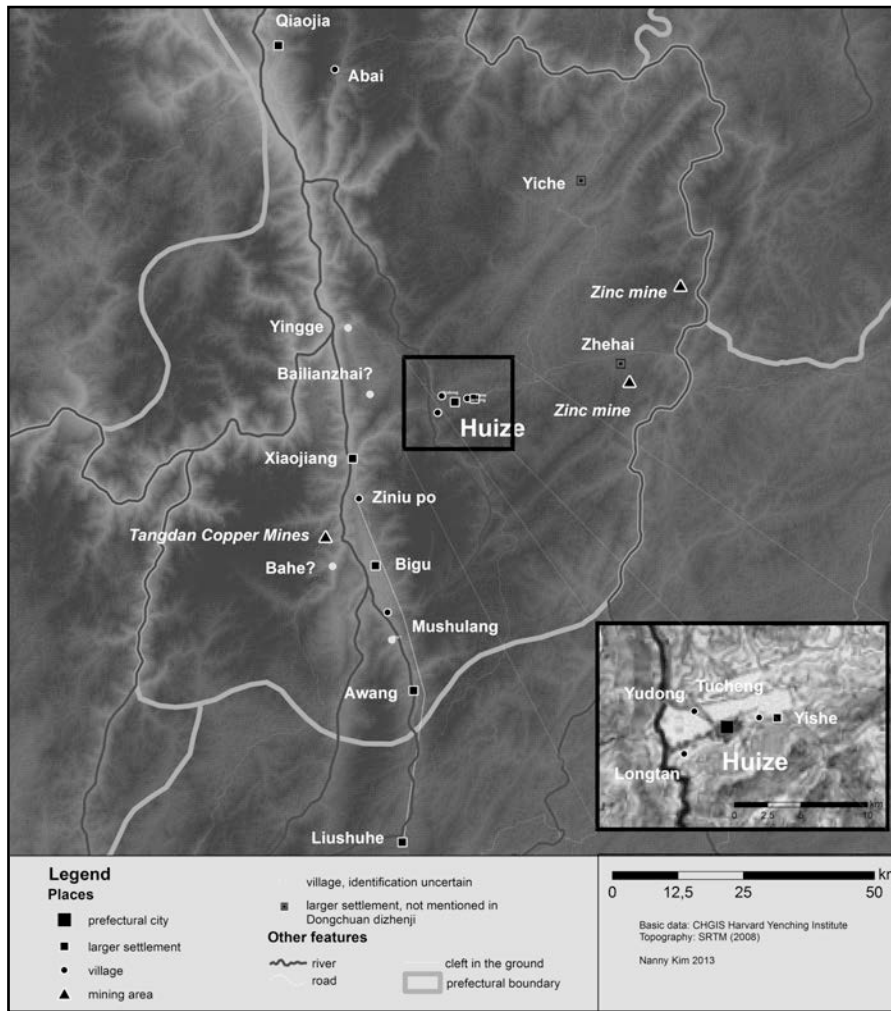
At about noon on August 2, 1733, an earthquake on the Xiaojiang fault that modern scientists have rated as a 7.8 on the Richter scale struck Dongchuan (Shen, Wang, and Song 2003). Cui Naiyong, the prefect of Dongchuan, had just sat down for lunch when the walls started to shake and tiles fell from the roof. He escaped unscathed, and no one in his entourage was hurt. In a short account entitled *Dongchuan dizhen jishi* (Factual record of the Dongchuan earthquake),<sup>9</sup> Cui described the events of that day on the basis of his own experience and information obtained from other parts of the prefecture. In the tradition of the historical record, he assembled facts concerning casualties and other damage, adding only the briefest commentary.

Cui's account begins with Huize and radiates out. The first section covers the Huize Plateau, the Qiaojia area, and several locations in the Xiaojiang Valley. There were no deaths in the city itself and only one casualty, a boy of about eleven years who was injured near the city. Damage to buildings was, however, severe; most houses in the city collapsed, and only three out of twenty-four in Yishe, the village to the north of Huize, were left standing.

In Qiaojia, on the Jinshajiang Plateau, all buildings were destroyed. Fifty soldiers stationed on that plateau happened to be on the exercise ground and escaped unharmed, while in another camp one soldier was killed by a falling beam. There were sixteen civilian casualties in the area, all of whom were Yi who died as a result of rockfall.<sup>10</sup> The destruction was worst in the Xiaojiang Valley: Cui records a total death toll of some forty people for Bigu, Awang, and Xiaojiang, the main settlements in the valley, pointing out that most Yi houses were wooden structures that rarely became lethal traps, even if they collapsed. The qualification and the number of larger settlements indicate a relatively dense population in the Xiaojiang Valley. The author further describes ruptures that occurred as results of the earthquake, including steps appearing in the fields, the destruction of irrigation systems, interrupted trails, and landslides that shifted fields and parts of villages and even blocked valleys. The largest of the ruptures was a cleft that opened along a length of 200 *li* (1 *li* = 1,640 feet) from Ziniupo near Bigu to Liushuhe in Xundian.



Cui records no damage for the northern parts of the prefecture. This may be simply because he received no news from the remote villages of this sparsely inhabited area. However, the Zhehai Plateau was home to sizable settlements and was closer to Huize than Qiaojia. Hence, it is safe to assume that this area was probably relatively unaffected. Modern seismologists have placed the earthquake’s epicenter near Bigu, where Cui records surface ruptures that created steps cutting across fields and paths. Map 3 shows the locations mentioned in Cui Naiyong’s account.



Map 3. Places mentioned in Cui Naiyong’s *Dongchuan dizhen jishi*. Source: Basic data from China Historical GIS (2001–2010, Harvard University and Fudan University); cartography by the author.

Cui Naiyong's account reflects a very small population. The prefectural city consisted of only a few hundred houses, while Yishe, one of the largest villages on the plateau, had, as previously mentioned, only twenty-four houses. The military outpost at Qiaojia apparently had few inhabitants beyond the stationed garrison of one hundred men, most of whom presumably had families. Cui's main sources of information were presumably reports sent in by military and other posts and therefore did not extend to places off the main roads or inhabited by people unable or unwilling to report, such as more distant Yi and Miao villages. Since the Huize Plateau was the most productive agricultural area and the center of the prefecture, the smallness of its population suggests that the prefecture as a whole was thinly inhabited, with perhaps about ten thousand total inhabitants. The local gazetteer, compiled in 1735, lists 485 villages. If Yishe, which was considered a large village, had 24 houses and perhaps 150 inhabitants, a rough calculation based on the number of villages corroborates this figure.<sup>11</sup>

While Cui Naiyong recorded limited damage for most of the prefecture, he reports a staggering death toll for the Tangdan mines. His description of the situation at the mines is second in length only to his eyewitness account about the prefectural city:

The Tangdan mines are next to Bigu, and the trembling was similar. People in the mines number in the tens of thousands; there are markets, streets, and lanes, where people could escape when the quake hit, so that only four or five persons died there. But as for those who had entered the mountain to dig for ore, the mines are several *li* deep, and with the first trembling, rocks and gravel came down, inevitably causing death and injury. There are several hundred mines, each with thousands or hundreds of miners; a mine has seventy-three branch adits, each of which is a path from which a merchant extracts ore, and each is worked by no less than fourteen or fifteen miners. Only a few were lucky enough to escape from each mine, but the mine headmen covered this up, claiming, "None of the brethren in my mine was harmed." For the most part, the mines attract men from Hubei and Hunan, Jiangsu and Jiangxi, Sichuan, Shaanxi, Yunnan, and Guizhou; people of the five directions mix here. Who would know anyone personally? We will never know how many lost limb and life out of greed for profit. Alas, how mournful! Moreover, if we commiserate with them and wish to offer support, how can we reach them? Alas, what extremely cruel fate! On top of this, mining areas are numerous, for Tangdan is not the only location where the fate of the common people is pitiable; since their death is alike to that of ants, how would we expect the merchants to pay any attention to the misery of their life even in ordinary times? (*Dongchuan fuzhi* [1761] 2006, 395)

In contrast to the small prefectural city, the mining town appears to have had urban dimensions, with markets and a grid of streets. Cui mentions that many stone walls tumbled down in Huize, while even rickety wooden constructions survived. On the basis of this observation, the low death toll in the mining town may reflect the prevalence of relatively makeshift wooden buildings.

Cui includes a description of the mines to give substance to the frightfully high death toll of miners who were working underground when the earthquake struck. According to his account, the mountain flank was riddled with several hundred mines (*dong* 洞, more commonly written 洞). Each mine branched out into seventy-three adits (*jian* 尖, literally “spikes”). Each mine was run by a mine headman (*dongke* 洞客) and each adit was worked by fourteen or fifteen miners (*shading* 沙丁, literally “gravel strongmen”). Cui adds that Tangdan was not the only mining area in southern Dongchuan, suggesting further calamitous events in more distant mines.

The figures appear impossibly high. Cui’s initial figure of several tens of thousands living in the mining town does not, however, match the far larger number of miners that would result from his stated several hundred mines containing seventy-three adits worked by fourteen or fifteen men each. Some figures, such as the “several hundred” mines and the depth of “several *li*” appear to be general indicators of large numbers and great depth, rather than accurately measured values. The precise number of seventy-three branch adits presumably records conditions at a particular mine, possibly the largest of which Cui had knowledge.<sup>12</sup>

Even applying a reading that understands all figures to mean “many,” there is no doubt that the mines were extensive. Numerous visible mine entrances on the mountain’s flank, at least some of which were reported to be of great depth and branching out into many adits, had to be the product of long years of exploitation. Besides, these figures and the information concerning organizational arrangements are confirmed by other sources.<sup>13</sup> The main groups identified by Cui and substantiated in numerous materials were “merchants” (*shang*), who included mine owners, capital investors, and metal merchants; “masters” (*changke* or *kezhang*, literally “mine guests” or “guest masters”), who were in charge of both mining technology and the workforce; and “brothers” (*xiongdì*), who were full miners organized into teams that received a share of the

income derived from selling ore instead of wages. The “brotherhood” system was the general practice in productive silver and copper mines until the end of the dynasty. Miners received food, lodging, and tools, but no wages. Their cash income depended on the mine’s output, 60 percent of which went to the entrepreneur who provided all materials and consumables, while the “brothers” shared the other 40 percent.<sup>14</sup> Miners commonly worked in teams of three, taking turns holding the chisel, wielding the hammer, and resting. In addition, two or three ore carriers worked with a mining team, the number depending on the depth of the mine. This would suggest that Cui Naiyong’s teams of fourteen or fifteen men either represent an inflated number or comprise two teams working the same seam. Given that twelve-hour shifts were recorded as common practice, the second interpretation appears probable, as the basic unit that worked an adit and shared the income derived from the seam (Yang Y. 2013, 108–109).<sup>15</sup> If, for a quick estimate, there were in fact one hundred adits worked in 1733, the total number of miners and carriers working underground may have been as high as fifteen hundred men, almost half of whom would have been in the mines around noon on August 2, 1733. A close analysis therefore shows Cui’s rounded figures to be hyperbolic. Conservatively reduced by a factor of ten, however, the account still suggests operations on a massive scale that employed several thousand men below and above ground. Moreover, Cui’s socioeconomic observations are acute and show an understanding of those operations.

### **A Community Apart**

Cui Naiyong was a conscientious official who felt responsible for the people under his rule, including the miners. At the same time, he admitted that he had no means of reaching the families of dead and injured miners and inferred that the local government had no figures on the population of the mining town or the number of mines in operation. The Tangdan mines were some 80 kilometers from Huize, reckoned as requiring two-and-a-half days on the road. The journey involved a descent of over 1,000 meters into the Xiaojiang Valley and a similar ascent onto the lower ridges of the Hongwangshan Massif. Yet, in terms of communications in the area,

the mines were within relatively easy reach. We can conclude that factors other than physical distance kept the local administration from paying more attention to the mining community.

Administrative structures installed a measure of control but also maintained considerable distance from mining operations. The official status of a mine only partially reflected the situation on the ground. The Tangdan mines, for example, had been officially opened in 1726, when the area was added to Yunnan Province (*Dongchuan fuzhi* [1761] 2006, 235). As the level of development of deep mining by 1733 could not have been realized in a few years, operations evidently reached back further into the past. In fact, indirect evidence of the exploitation of copper deposits by Chinese in southern Dongchuan is available some eighty years before the mines were official opened. The famous traveler Xu Xiake (original name Xu Hongzu, 1587–1641), who passed by the southern borders of Dongchuan in 1639, mentioned that the roads frequented by transporters who carried “Dongchuan copper” to Kunming were wider than the courier road (Xu 1980, 736–737). His observations indicate the production of considerable output as well as the status of Kunming as the main market for Dongchuan copper. The official “opening” was in fact equivalent to a full legalization of the operations and the setting of a tax quota by which the provincial government included the mine in a monopoly system and the state increased the mine’s output, paying at a fixed rate and in advance. The implementation of this system required a relatively advanced stage of development at which sizable and sustained productivity was expected. The scope and reliability of production implied that several mines were worked. In fact, the term *chang* 廠 (usually translated as “mines” in the plural) designates a generally open area employed for a production process. It varied in size, ranging from a dyeing workshop (*ranchang* 染廠) to a timbering plot (*muchang* 木廠). A mining area (*kuangchang* 礦廠, literally “ore plot”) referred to the entire area in which the ore was extracted and processed, and the provincial monopoly dealt with mining areas rather than individual mines. The provincial intendant responsible for the tax income charged local officials with the actual collection and physical management of tax payments and procured copper. With a couple of exceptions, no formal staff was provided for the task.<sup>16</sup> The local official dispatched a member of his private staff, a relative, or a servant of the family to reside at the mines to collect taxes and the output

quota as well as to maintain law and order. This informal representative went almost entirely unmentioned in the sources. From the remains of buildings and oral history we know that he resided in his own *yamen* (the working and living quarters of an official) near the mines. Although the state ultimately backed up his authority, as a subofficial functionary he depended on the cooperation of the leading mining entrepreneurs and the community's self-organization. The mining administration created a system of control that apparently worked well enough but did not involve much formal, documented official activity.

In addition to the layered structure of the mining administration, the registration process rendered mining communities largely invisible in the official records of local administrations. Local government was primarily responsible for the “good commoners” (*liangmin* 良民), members of the registered, sedentary, and tax-paying population. Miners, as people who came to the area without the intention of becoming peasant settlers, rarely obtained a registration. The system that made the payment of the land and head tax a precondition of registration in fact excluded a considerable portion of the population from full citizenship. Those who lost their registration or stayed outside the locality where their family held a registration were counted among the “floating people” (*liumin* 流民), as unregistered drifters. The loss of registration was caused by mobility, yet “floating people” could live sedentary lives, as did the majority of “shed people” (*pengmin* 棚民), peasants who cultivated marginal, unregistered land (see Leong 1998, 97–108). Many others, including miners, transporters, loggers, and itinerant craftspeople, spent their working lives as “floating people” but held a registration back home. New arrivals to an area who started families and settled in the community might eventually register and rejoin the ranks of “good commoners.” Registration was, however, a lengthy process and not necessarily in the best interest of either new residents or the local administration. For simple commoners, the right to take the state examinations and the hope of receiving famine relief in case of natural calamities was probably an insufficient inducement for facing the costs of registration and the burden of taxation. For administrators, an upward adjustment of the taxpaying population was hardly welcome, because it meant higher payments to be transferred to the provincial and central governments. The proportion of “floating people” is estimated at between 10 and 20 percent of

the total population in the late imperial period (Chi 1996; Liu T. 1992). In mining areas, the proportion of the population that was unregistered was far larger.

The land survey in the Dongchuan gazetteer reflects this bias. The prefecture was subdivided into sixteen village compounds (*xiangli* 鄉里). The gazetteer's section on population and taxation lists the villages for each village compound. The Xianghua village compound covered the area south of the Xiaohe River, including the Hongwangshan Massif. The gazetteer of 1735 recorded only eight villages, none of which was associated with a mine. The updated 1761 edition lists forty-nine villages, again omitting the mining towns. The later edition adds a brief evaluation of the productivity of each compound, noting that Xianghua possessed only dry fields and was unproductive (*Dongchuan fuzhi* [1761] 2006, 185–186).<sup>17</sup> The regular administration focused on agricultural productivity and the taxation of the registered peasant population. Mining communities were nonexistent in terms of registration.

Cui Naiyong quite possibly never visited Tangdan and almost certainly never entered a mine. His responsibility with regard to copper mining was to deliver the annual copper and tax quota and to maintain peace and order. However, he almost certainly had a personal interest in the private income that he derived from the mines, since other income from customary fees and surtaxes would have been minimal due to the small registered population and the postwar situation. As mines were self-organized communities and entrepreneurs had an interest in cultivating contacts with local administrators while running their own affairs, the local official usually did best if he abstained from direct involvement. There was, moreover, a taboo against officials entering mines. An official visit to a mine was even worse than the firing of cannons, the beating of gongs, or the building of roads, all activities that were thought to cause ore to become exhausted or to suddenly deteriorate.<sup>18</sup>

An analysis of Cui's text shows that the experienced administrator was well aware of social and economic structures, whereas technologies escaped him. Cui presents mines as holes in the mountainside, mentioning great depth but no timbering, ventilation, or drainage systems, which were necessary in mines deeper than 150 meters.<sup>19</sup> In his account, operations appear to consist exclusively of excavating the ore, while he omits any mention of aboveground work,

which involved a large labor force in ore dressing, transporting materials within the mining area, and smelting. Adjusting the information in Cui's account to reflect research on mining technologies and organizational structures leads to a downsized estimate of the Tangdan mining community and of the disaster, but confirms a frightening death toll and the existence of mines on a very significant scale.

### **Mining Communities in Dongchuan Society**

Cui Naiyong's account paints a picture of largely uninhabited landscapes, with small settlements on the plateaus and in the high, wider valleys. The population of the prefectural city would not have surpassed two thousand individuals. The population of the Tangdan mining town probably did not amount to several "ten-thousands," but it certainly was several times larger than that of Huize. Since another source also records "several ten-thousand" miners in the Tangdan mines in late 1730,<sup>20</sup> the size of the town appears to have been impressive enough for the writers to consider a figure in the thousands as insufficient to describe it. A population approaching ten thousand therefore appears probable. This figure would include all permanent and semipermanent inhabitants of the town, miners as well as the aboveground workforce in ore dressing, transportation, and at the smelters, as well as other inhabitants, such as transporters, craftspeople, traders, monks, entertainers, and prostitutes. In the same period, the total registered population of the prefecture was 5,400 households, which translates to around 25,000 individuals. Even if we assume massive underregistration, especially of Yi and Miao in the more remote areas, "good subjects" probably did not number many more than 30,000.

Moreover, the Tangdan mines were not the only mining area in the prefecture. Cui Naiyong explicitly mentions the existence of other mines. The 1761 gazetteer includes a short list of mines that presumably were important: two iron mines in the southeast part of the prefecture, followed by the zinc mines of Zhehai and lead mines that presumably were less important (*Dongchuan fuzhi* [1761] 2006, 343).<sup>21</sup> One indication of the size of the Zhehai mines is a reported tax income of 345,227 *jin* (207 tons) for 1752, suggesting a total output above 2,000 tons at a tax rate between 10 and 15 percent (*Qingdai de kuangye* 1983, 2:345).<sup>22</sup> No information



beyond names is available for the other mines. Nevertheless, the iron mines probably were important, because they head the list and because the mining industry itself created a massive demand for iron tools. By a conservative estimate, the mining population of the prefecture likely exceeded ten thousand and quite possibly twenty thousand persons. The relative weight of the mining communities in local society is evident. The ratio of registered inhabitants to the mostly unregistered nonfarming population in the mining areas probably ranged between 3:1 and 3:2. This ratio shows that mining was the motor that drove the population and economic development of the area. Mining communities were almost insatiable markets for local producers, in addition to attracting much long-distance trade and promoting both the commercialization of the local economy and the economic integration of the area with Chinese trade networks. At the same time, the demand for basic goods, including charcoal, timber, grain, oil, and salt, may well have constituted a burden on local producers and on the local ecology.

Through the subsequent decades of swift development, some aspects of the composition of local society become clearer. The population growth reflected in official figures was impressive: By 1761, the prefecture had 15,200 registered households, suggesting a registered population approaching 80,000. In addition, 2,404 mining households were recorded (*Dongchuan fuzhi* [1761] 2006, 172). The number of individuals belonging to mining households is uncertain, as these probably were not ordinary families. There are several possibilities: The mining households may have been miners and their families who took the trouble to obtain permanent registration. As most miners were recent in-migrants to the area, we would expect relatively small families, and hence at most 10,000 individuals. Equally possibly, however, mining households were not families but economic units that were headed by a registered mining master and comprised entire mining teams. If this were the case, we would expect at least thirty-five thousand individuals. The third possibility is that these were the specialized professionals who almost certainly would obtain permanent registration, such as furnace masters and mining entrepreneurs, implying a highly variable number of “dependents.” Although pinpointing the exact size of “mining households” proves impossible, their administrative existence testifies that

a proportion of the inhabitants of mining towns in time registered, possibly with a special category set up for registration without land ownership.

To reach an estimate of the number of persons in mining, other materials have to be used. A 1756 document reports an enormously large figure: “Now there are over twenty silver, copper, zinc, and tin mines in the area, and as for all those who work at the furnaces and in the mines, as laborers and traders, their numbers are no less than several hundred thousand men” (*Dongchuan fuzhi* [1761] 2006, 275). This statement appears in an argument in favor of increasing the amount of cash minted at Dongchuan. It states that the Dongchuan mint cast 224,134 strings of cash per year, over half of which was put into circulation as advance payments for the copper procured from the Tangdan, Lulu (also Luoxue), and Dashuigou mines (*Dongchuan fuzhi* [1761] 2006, 379). In the context of his proposal, the author had an interest in making the mining sector look important. He claims that the cash was used for paying the wages of the miners and hence secured the livelihood of several hundred thousand workers.

As the miners of Tangdan were hired through the brotherhood system in 1733, the direct payment of wages appears unlikely. The statement was primarily an argument and reflected accounting concerns rather than implemented practice. In the final analysis, however, independently of how the newly minted cash entered circulation, the operation of large mines evidently required the circulation of large amounts of money. If skilled and unskilled men earned between one and two strings per month, the cash output of 1756 would hire between five and ten thousand men year-round. A workforce on this order in the copper mines of southern Dongchuan seems probable. The order of magnitude is corroborated by records of some twenty to thirty thousand inhabitants in the mining communities of Tangdan and Dalu (also Luoxue) and one hundred furnace masters in the years between 1765 and 1772, with numbers then falling to ten thousand inhabitants and twenty-eight furnace heads for Tangdan in 1772.<sup>23</sup> The fact that the same ratio of about 1:300 for furnace masters and the mining workforce applies to the figures before and after 1772 suggests that the information is relatively credible.

On the basis of this investigation, by a conservative estimate, the population of the mining communities across the prefecture reached roughly fifty thousand at a time when the total

number of people not directly involved in mining was around one hundred thousand. This estimate is a rough order of magnitude that nevertheless sharpens the picture of local society. We can confirm that about one out of three persons directly depended on the mines for their livelihood. Moreover, many occupations were indirectly linked to the industry in the areas surrounding the mines. Smelting ore and refining metals required massive amounts of charcoal, which far exceeded the amount of ore that went into the process. Charburning therefore was conceivably the main occupation of large groups of people who lived more or less in the woods and kept no registered fields. In addition, the volume of local, regional, and long-distance transport needed to supply the mining communities and to ship metals out of the area required organized, professional caravan trade. Transporters may have been registered subjects but certainly were at best part-time peasants. The high proportion of the nonagricultural population demonstrates that mining was profitable through much of the period, because the system could work only as long as mining generated sufficient gains to pay decent rates for goods and services and for their carriage so as to maintain reliable supplies and trade relations. At the same time, the dependence of the local economy on mining involved a dependence on government and market prices for copper, zinc, and other metals and on the commercial and transport networks that shipped the metal out of the area.

## Conclusion

This investigation has shown considerable divergence between the picture provided by official records and that obtained by the analysis of an account of the Dongchuan earthquake in conjunction with a reconstruction of historical mining. According to the official records, the Tangdan mines were insignificant until they experienced a tremendous boom in the 1730s. The rise of the mines is presented as the result of masses of homeless drifters who “dug unlicensed pits everywhere, which attracted smelters and miners like ants” (*Dongchuan fuzhi* [1761] 2006, 197).<sup>24</sup>

This article has shown instead that substantial and well-organized development predated official attention. When the Dongchuan earthquake struck in 1733, the existence of deeply driven

mines attests to long-standing, technically and organizationally advanced exploitation, while the presence of the “brotherhood” system of profit participation demonstrates well-established professional structures and labor division. The scale as well as the technological and organizational input of the enterprises appears massively underrepresented in the official records.

This discrepancy has its basis in the ruling mentality. Mining was an occupation of dubious repute in the Confucian order. It was necessary to obtain metals and minerals, yet in the dichotomy of “roots” and “branches” of economic activities (*benmo* 本末), it was evidently secondary as well as detrimental to what was seen as the fundamental human occupation of tilling the land. On a more applied level of statecraft, mines were both morally and environmentally destructive: the lure of quick monetary gains induced peasants to abandon their fields, while mines occupied and polluted ground and diverted water resources that were no longer available for agriculture. Moreover, mining communities were in fact hard to control and therefore troublesome in the eyes of administrators.

The image of swarms of poverty-driven “floating” single men was thus a product of the worries of Confucian administrators rather than an accurate description of mining communities. Local administrators understandably had no interest in attracting attention to mines in their jurisdiction, which might cast a bad light on the area as well as greedy looks. At the same time, they were undoubtedly aware of the importance of mining in the local, regional, and imperial economy, and they effectively steered development through a combination of relatively remote supervision and economic control that worked through the incentive of advance payments and the threat of illegality for direct marketing.

Official records suggest that over forty copper mines, half a dozen silver mines, and four large zinc mines are known to have been in operation during the high Qing in Yunnan Province and adjoining areas of Sichuan and Guizhou. Dongchuan was the prefecture in which mining was most dominant, in terms of both the size and number of mines, yet the industry clearly was important throughout the region. The case of the Tangdan mines before the boom therefore bears implications for the history of mining in southwest Qing China more broadly. Much of the seemingly factual information needs careful interpretation. For example, records regarding the

opening and closure of mines mark the beginning and end of formalized government attention, not of the exploitation itself. Although the official opening of a mine probably indicates the development of stable outputs on a significant scale, both the scale and the duration of the “unofficial” exploitation may be considerable. Perhaps most importantly, the administrative structures of population registration, as well as the morally problematic status of mining, resulted in a systematic underrepresentation of mining populations and of the economic weight of the industry during periods of smooth operation that could give way to sudden overstatement in the context of emergencies.

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### Notes

- 1 For the figures for copper procurement from the Tangdan mines, see Vogel (1989, 277–278).
- 2 See Yang Guangkun (1992) regarding excavated objects in Dongchuan and Li Xiaocen (2002) for an analysis of ancient bronzes.
- 3 “Ping Dongchuan ji” (The pacification of Dongchuan), dated 1730, in *Dongchuan fuzhi* ([1761] 2006, 60–61).
- 4 For information about the *tusi* system in Yunnan, see Gong (1985).
- 5 Cui Naiyong was a native of Tongguan in central Shaanxi and obtained his *jinshi* degree [the qualifying “doctorate” for entering state service] in 1721. His first field appointment was the magistracy of Xundian, where he attracted attention by proposing drastic measures against Dongchuan and the incorporation of the area into Yunnan Province. He became magistrate of the newly established department of Zhenxiong in 1727 and was promoted to the position of prefect of Dongchuan in 1730, where he served for two terms. Having distinguished himself in the reconstruction of Dongchuan, he was promoted to the position of provincial treasurer of Hubei in 1738. For biographical information, see *Qing shilu; Zhenxiong zhoushi* ([1784] 2006, 1016); and *Dongchuan fuzhi* ([1761] 2006, 292, 321f).
- 6 For Yi history and the conquest of the Yi lands in northeastern Yunnan, see Fang (1984, esp. 490–551); on E’ertai and the expansion of imperial rule in the southwest, see Smith (1970).
- 7 No further reliable population figures are available for northeastern Yunnan, but general trends can be inferred. According to Lee, population increase throughout the southwest

- was rapid during the century and a half of the high Qing. He states that by 1700 the region had recovered its sixteenth-century population of four to five million. This figure at least doubled by 1775 and reached approximately twenty million by 1850 (Lee 1982, 720, 732, 736). The authoritative population history of the Qing period gives a far more conservative estimate, with a peak population of merely one hundred thousand for the two prefectures by about 1820 (Cao Shuji (2000, 238–240).
- 8 Census figures recorded in local gazetteers of the 1760s give a combined total of 38,776 households for Dongchuan Prefecture, En'an district, the core area of Zhaotong Prefecture, and Zhenxiong department (*Dongchuan fuzhi* [1761] 2006, 172; *Zhenxiong zhouzhi* [1784] 2006, 1103; *En'an xianzhi gao* [1909–1911] 2006, 55). The En'an gazetteer of 1765 records 9,937 households and specifies that these included 29,459 men and 19,818 women, suggesting a ratio of approximately five persons per household. On the basis of this ratio, we can infer a total of some 200,000 persons as the registered population of northeastern Yunnan, exclusive of the subprefectures Dagan and Ludian and the districts of Yanjin and Yongshan.
- 9 See Cui Naiyong's *Dongchuan dizhen jishi* in *Dongchuan fuzhi* ([1761] 2006, 393–396). The text was added to the gazetteer by Liang Xiaoqiang, who produced a copiously annotated and carefully collated edition of the gazetteers of 1735 and 1764. The editor provides no source. The fact that it was not part of the 1764 edition suggests that the text was of a relatively private nature, which neither the author nor the editors considered sufficiently important to be included.
- 10 For the Qiaojia area, the gazetteer entry provides some additional information, namely that a great landslide blocked the Jinshajiang River for several days and that Qiaojia experienced several lesser quakes over the following two years (*Dongchuan fuzhi* [1761] 2006, 351).
- 11 The number is exclusive of the area west of the Jinshajiang, which was added to the prefecture in the early Qianlong period in the context of a project aimed at opening up the river for water transport of copper. The area was described as consisting of twenty-one villages in Ming records, and the same number was recorded in the eighteenth century. Since this was, in fact, Yi land under only the remotest control, the village count may be expected to have little basis in fact (see *Dongchuan fuzhi* [1761] 2006, 131–132).
- 12 A qualification such as “up to” may have been lost in the editing or printing process.
- 13 See, especially, Wu Qijun's *Diannan kuangchang tulüe* (An illustrated account of mining in Yunnan).
- 14 For a concise discussion of labor relations and subdivisions, see Yang Yuda (2008; 2013). Rocher still found the system in operation in the early 1870s (1879, 2:221–223).
- 15 Variation in the size of a mining team was due to the depth of the seam. A seam near the mine entrance could be worked with a single carrier, while more men were needed in deep seams. The hierarchy of underground work differentiated between full miners and carriers. Rocher records the figure of ten to fifteen men for a mining team (Rocher 1879, 2:221).

- 16 Two subprefects of central Yunnan were relocated to the most important copper mines to serve as specialized mining officials. In 1765, Cheng Zhizhang, the subprefect of Chengjiang Prefecture, was transferred to the Tangdan mines. Three years later, he was prosecuted for continuously falling output. Following this unsuccessful measure, the position was apparently left open and abolished in 1770 (see Vogel 1989, 294, and archival documents QL 29/12/21, excerpted in *Qingdai de kuangye* 1983, 1:144, and QL 29/11/24, QL 29/12, QL33/7, QL35/4/24, held at Taipei). In the 1770s, the Ningtai mines in western Yunnan expanded to rival the Dongchuan mines. In this period, a mine official was installed at Ningtai and the position was apparently maintained (Vogel 1989, 293).
- 17 The identification of historical place names is based on the work of Liao Xiaoqiang, who provided an extensively annotated and analysed edited edition of the gazetteer.
- 18 The earliest record of the taboo appears in Wu Daxun's 1782 *Diannan wenjianlu* (Yunnan stories), reprinted in Fang Guoyu's 1984 *Yunnan shiliao conkan*, vols. 12 and 22.
- 19 Timbering, ventilation, and drainage systems are recorded in sources of the later eighteenth century (especially Wu Qijun 1844). Beyond a depth of about 150 meters, oxygen supply became the main limiting factor. Another 100 to 150 meters could be gained by deploying ventilation systems that pumped in fresh air using hand-powered fanning machines. More efficient, but also far more costly, was the opening of parallel galleries for air circulation (Rocher 1879, 1:242–243, 2:196). Water drainage by pumps and drainage galleries was an issue in deep and low-lying mines.
- 20 See “Ping Dongchuan ji” (Account of the pacification of Dongchuan), in *Dongchuan fuzhi* ([1761] 2006, 60), which is based on military records of the 1730 campaigns.
- 21 In addition, presumably lesser silver, copper, and iron mines are recorded in the mountain massif bordering the Huili district west of the Jinshajiang (*Dongchuan fuzhi* [1761] 2006, 84).
- 22 The first mention of the Zhehai mines dates to 1741 (*Qingdai de kuangye* 1983, 2:344), but the exploitation probably dates back much further.
- 23 The document of 1765 is excerpted in *Qingdai de kuangye* (1983, 1:141), that of 1772 is from Lee (1982, 4, 16, 23).
- 24 The 2006 edition has 冶坑 (“smelting pits”); the 1965 facsimile edition of *Dongchuan fuzhi* has 野坑 (“pits in the wild”), which makes more sense in the context of the sentence, which goes on to state that many mines had to be given up, and that the miners intermarried with Yi.

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