Mint Metal Mining and Minting in Sichuan, 1700-1900:

Effects on the Regional Economy and Society

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To my daughter

Zumin

who was born during the writing of this thesis

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Tübingen, June 2012.

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ABBREVIATIONS

For complete bibliographic information, see the works cited in the Bibliography.

DNKCTL: *Diannan kuangchang tulüe* 滇南礦廠圖略 (Illustrated account of the mines and smelters in Yunnan)

GZDQL: *Gongzhong dang Qianlong chao zouzhe* 宮中檔乾隆朝奏摺 (Palace memorials of the Qianlong reign-period)

GZZL: *Qinding Hubu guzhu zeli* 欽定戶部鼓鑄則例 (Imperially endorsed regulations and precedents for minting of the Ministry of Revenue)

JJCLF: *Junjichu lufu zouzhe* 軍機處錄副奏摺 (Copies of palace memorials in the State Council)

JQ-SCTZ: *Sichuan tongzhi* 四川通志 (Gazetteer of Sichuan Province), 1816.

MNYZ: *Qingdai Mianning xian yizu dang'an ziliao xuanbian* 清代冕寧縣彝族檔案資料選編 (A selection of the archive materials of the Yi in Mianning District in the Qing period)

MQDA: *Ming Qing dang'an* 明清檔案 (Ming and Qing archives)

NGDK: *Neige daku* 內閣大庫 (Archives of the Grand Secretariat)

NQSBSC: *Niqing shiban Sichuan kuangwu beilan* 擬請試辦四川礦務備覽 (A comprehensive handbook for the proposal of experimental mining in Sichuan)

NYFS: *Ningyuan fushu tongkuang qingxing qingce* 寧遠府屬銅礦情形清冊 (Comprehensive handbook of copper mining in Ningyuan Prefecture)

QCWXTK: *Qingchao wenxian tongkao* 清朝文獻通考 (Encyclopedia of the historical records of Qing Dynasty)

QDDKY: *Qingdai de kuangye* 清代的礦業 (The mining industry of the Qing Period)

QL-SCTZ: *Sichuan tongzhi* 四川通志 (Gazetteer of Sichuan Province), 1736

RM: *Neige Huke tiben, huobi lei* 內閣戶科題本•貨幣類 (Routine memorials of the Grand Secretariat; material on monetary matters)

SCBZL: *Sichuan buzheng lu* 四川布政錄 (Notes of [the affairs of the] Provincial Treasurer of Sichuan)

TZBL: *Tongzheng bianlan* 銅政便覽 (A manual on copper administration), collected by National Science Library, Chinese Academy of Sciences, hand written copy of Yunnan Provincial Administration Commission.

ZPZZ-CZ: *Gongzhong dang zhupi zouzhe, caizhenglei* 宮中檔硃批奏摺財政類 (Palace memorials with vermilion rescripts, category financial administration)

ZPZZ-GY: *Gongzhong dang zhupi zouzhe*, *gongyelei* 宮中檔硃批奏摺工業類 (Palace memorials with vermilion rescripts, category industry)

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WEIGHTS AND MEASURES

Qing (1644-1911)[1]

Weights

1 *dan* 石 (picul) = 100 *jin* = 59.7 kg

1 *jin* 斤 (catty) = 16 *liang* = 597 g = 0.597 kg

1 *liang* 兩 (ounce) = 10 *qian* = 37.3 g

1 *qian* 錢 (mace) = 10 *fen* = 3.7 g

1 *fen* 分 (candareen) = 10 *li* 厘 = 0.37 g

Length measures

1 *li* 里 (chin. mile) = 180 *zhang* = 576 m

1 *zhang* 丈 = 2 *bu* 步 = 3.2 m

1 *zhang* = 10 *chi* = 3.2m

1 *chi* 尺 = 10 *cun* = 0.32 m

1 *cun* 寸 = 10 *fen* 分 = 0.032 m

Volume measures

1 *shi* 石 = 2 *hu* = 103.5 litres

2 *hu* 斛 = 10 *dou* = 103.5 litres

1 *dou* 斗 = 10 *sheng* = 10.35 litres

1 *sheng* 升 = 10 *ge* = 1.035 litres

1 *ge* 合 = 10 *shao* 勺 = 0.1035 litres

[1] Qiu Guangming (2001).

Republic (1912-1949)[2]

1 *jin* = 0.5 kg

1 *chi* = 1/3 m

Table 1: The particular system of weights and measure at the Tong'an mines[3], 1939

Name of the weighing device		**Relation with the measure of balance**	**Usage**
"double scale"	*shuangcheng* 雙秤	100 *jin* = 200 *jin* (balance)	purchasing fuel
"feet scale"	*jiaocheng* 腳秤	100 *jin* = 220 *jin* (balance)	transporting ore
"ore scale"	*kuangcheng* 礦秤	100 *jin* = 308 *jin* (balance)	purchasing, roasting and smelting ore
balance	*tianping* 天平	standard	selling copper

2 Ibid.

3 Chang Longqing (1939).

MAP OF RELEVANT JURISDICTIONS IN SICHUAN, 1820

Levels of jurisdictions:

Prefecture (*fu* 府)
Independent Subprefecture (*zhili ting* 直隸廳)
Independent Department (*zhili zhou* 直隸州)
Subprefecture (*ting* 廳)
Department (*zhou* 州)
District (*xian* 縣)

Chengdu Prefecture 成都府 (provincial capital)

Peng District 彭縣

Jiading Prefecture 嘉定府

Leshan District 樂山縣
Hongya District 洪雅縣
Ebian Subprefecture 峨邊廳

Ningyuan Prefecture 寧遠府

Xichang District 西昌縣
Mianning District 冕寧縣
Yanyuan District 鹽源縣
Huili Department 會理州
Yuexi Subprefecture 越嶲廳

Xuzhou Prefecture 敘州府

Pingshan District 屏山縣
Mabian Subprefecture 馬邊廳
Leibo Subprefecture 雷波廳

Yazhou Prefecture 雅州府

Ya'an District 雅安縣
Yingjing District 滎經縣
Tianquan Department 天全州

Chongqing Prefecture 重慶府

Ba District 巴縣

Kuizhou Prefecture 夔州府

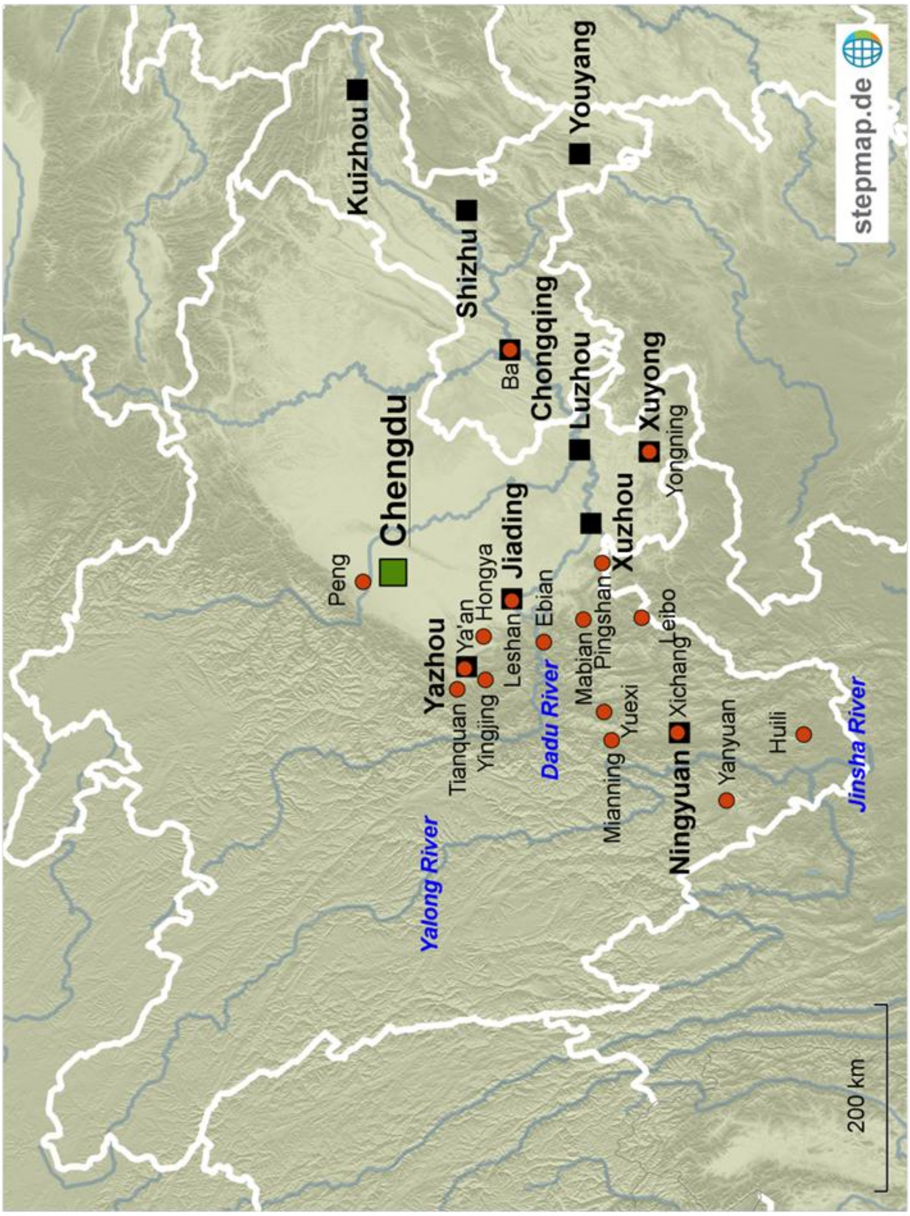
Shizhu Independent Subprefecture 石砫直隸廳

Xuyong Independent Subprefecture 敘永直隸廳

Yongning District 永寧縣

Youyang Independent Department 酉陽直隸州

Luzhou Independent Department 瀘州直隸州



Map 1: Relevant jurisdictions of Sichuan, 1820

1 INTRODUCTION

The 18th century in China stands for a time of consolidation and expansion under many aspects such as population, economy and political power. If this is true for the empire as a whole, then even more for its southwestern part, namely the provinces of Sichuan, Yunnan and Guizhou, where large scale immigration and agricultural development lead to a population explosion alongside with urbanization and commercialization[4]. A persistently expanding Chinese economy needed to be based on a sufficient money supply and an according monetary policy at any time[5]. The mint metal deposits – i.e. copper, zinc, lead and tin – necessary to carry out such a monetary policy were found especially in the fast growing provinces of the Southwest.

Although large-scale copper mining in Sichuan began considerably later than in Yunnan, the province soon came to rank second in copper production and the Baochuanju 寶川局, the Chengdu mint, was the most productive of all the provincial mints[6]. In addition to supplying its own mint, Sichuan copper was procured for the mints of Beijing, Shaanxi, Hubei, Guizhou and even Yunnan, and coins cast in Chengdu circulated beyond the province in Shaanxi and Gansu. From the late Jiaqing reign-period (1795-1821), when Yunnan's copper production began to decline, Sichuan copper became increasingly important for supplying the metropolitan mints. Lead and zinc were also produced in Sichuan under a similar administrative system and management, but the scale of their production was comparatively small, thus this dissertation treats copper as the main research subject and put lead and zinc into a secondary place.

Much of the research about the development of Sichuan's copper production numbers, the coin output and distribution of the Baochuanju as well as aspects of mint organization and administration is based on the evaluation of the mint reports in the *tiben* 題本 (Routine Memorials). This copious and complex source has until now only been

[4] Hsü and Wu (2000); Skinner (2001); Lee (1982a). Entenmann (1982)

[5] Vogel (1989), Glahn (1996).

[6] See chap. 4.1.2

used by studies in the field of monetary history to a relatively limited extent. It is thus an important intention of this thesis to provide an example for the chances, a thorough analysis of the Routine Memorials can offer not only for the case of the Baochuanju but also for all other Chinese mints. It would be desirable to promote this type of research to achieve a better understanding of the monetary development in Qing China at large.

The copper for the provision of the mint was mined in the region of southern Sichuan, including mainly four prefectures: Jiading 嘉定, Ningyuan 寧遠, Xuzhou 敘州, and Yazhou 雅州. It shares the same copper mining region with Yunnan, which is defined as "Chuan-Kang-Dian copper region" 川康滇銅礦區[7] in 20th century and which extends on a length of approximately 700 kilometres from north to south. Its northern part in Sichuan has also been separately described as the "Chuan-Kang Copper Region" 川康銅礦區[8].

Although exploiting the same geological strata as Yunnan, Sichuan displayed significant differences in the operation of mining and copper transportation. This paper focuses on Sichuan's special way of copper management. In Sichuan, the capital for mining was provided by private merchants, responsible officers were petty officials (*zuoza guan* 佐雜官), and transport brokers (*yahang* 牙行) were responsible for transportation. By contrast, government funding, supervision by seal-holding officials (*zhengyin guan* 正印官), and transport organization by local officials were the rule in Yunnan. Sichuan's copper administration was thus much more dependent on non-state structures and took place under a relatively loose government control.

Another specialty of Sichuan's copper mining was the role of Yi. The Yi are an ethnic minority which inhabits mainly in mountainous regions all over the southwest of China. For Sichuan, the area which was during the Qing period under a particularly intensive influence of the Yi reaching until a de facto independence inside the empire was what is nowadays Liangshan Yi Autonomous Prefecture (Liangshan yizu zizhizhou 涼

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[7] Feng Jinglan (1953), p. 61.

[8] Xia Xiangrong et al. (1980), p. 55.

山彝族自治州) and its immediate surroundings. This area almost exactly coincides with the core region of copper production in Sichuan during the time period concerned. The incomplete control of the Qing in the Liangshan region could not prevent mining from being repeatedly interrupted by recurring ethnic conflicts, which not only influenced the management measures, but also sometimes caused destruction.

After being mined in such remote mountain areas, that part of copper which was procured by the government would be transported mainly to the Chengdu mint, where it would be cast into coins. The Chengdu Mint (*Baochuanju* 寶川局) was of outstanding importance for the province of Sichuan and its capital city. It not only provided the state with great amounts of cash for various types of expenses but also subsidized and stimulated the regional economy of the entire Province.

This dissertation investigates the technological, social, geographic, economic and administrative circumstances during the processes of mining, smelting and transport of mint metals in Sichuan, the effects of these processes on society and economy of the mining regions, and the operation of the provincial mint in Chengdu. During all stages, particular attention is paid to the involved actors, their association with structures of state and market as well as to their patterns of cooperation.

1.1 *State of the Field*

Despite the considerable role of mining and minting in Sichuan, research on the topic is very limited.

Concerning mint metal mining, with the exception of the work of Wang Gang 王綱 (1991) [9], which is only based on the *Qing shilu* 清實錄 (Veritable records of the Qing Dynasty" and provides no more than an introduction into the policies of copper production, so far no special investigation exists on the economic, social, and

[9] Wang Gang 王綱 (1991): *Qingdai Sichuan shi* 清代四川史 (History of Sichuan in the Qing period), chap. 20, pp. 709-730. See also his article (1990): "Lun Qingdai Sichuan de tongqian shengchan guanli" 論清代四川的銅鉛生產管理 (An essay on the producing and management of mint metal in Sichuan in the Qing period).

administrative aspects of mining and mint metal transportation in Sichuan. In Hans Ulrich Vogel's hitherto unpublished doctoral dissertation, which focuses on the situation in Yunnan, Sichuan's mining is mentioned briefly and annual copper production data of several years are provided.[10].

As to minting, extent research on Sichuan is even less. The only existing article is from Wang Detai 王德泰 and Qiang Wenxue 強文學[11]. It is based on the *Neige Huke tiben, huobi lei* 内閣戶科題本·貨幣類 (Routine memorials of the Grand Secretariat; material on monetary matters) of the Qianlong period and shows how the Qing government made high profit by monopolizing copper mining and manufacturing currency at low costs. With its disregard of the wider circumstances and the difficulties of mint metal procurement, the view this article can offer is rather limited and at times distorted.

Besides, Vogel, Hartill (2003)[12] and Burger (2005)[13] also mention Sichuan's as a part of China's mints as a whole.

Beyond the immediate borders of the topic defined so far, valuable research has been carried out on related issues in other sectors of economy or society and forms the setting in which this dissertation is standing. Special mention is deserved for instance the works of William Skinner, Helen Dunstan, Richard von Glahn, Mark Elvin and Thomas Metzger within their respective fields. [14]

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[10] Vogel (1989): *Chinese Central Monetary Policy and the Yunnan Copper Mining Industry in the Early Qing (1644-1800)*, pp. 239-241.

[11] Wang Detai 王德泰; Qiang Wenxue 強文學 (2008), "Qingdai Sichuan tongkuang longduan lirun xiang zhuqian lirun zhuanyi de kaocha" 清代四川銅礦壟斷利潤向鑄錢利潤轉移的考察 (An investigation into profits transferring from copper monopoly to coinage in Sichuan during the Qing period).

[12] Hartill (2003): *Qing Cash*. Royal Numismatic Society.

[13] Burger (2005): "Minting during the Qianlong Period: Comparing the Actual Coins with the Mint Reports".

[14] Skinner (1977), Dunstan (2006), Glahn (1996), Elvin (1973), Metzger (1973).

1.2 *Research Questions, Methods and Aims.*

With its observation of all stages from the production to the consumption of mint metals, this dissertation closely follows a so-called commodity chain. Thus the method of commodity chain analysis forms a useful tool for this pursuit. The term

> *"refers to the factors, processes, Techniques, logistics, distribution and commercialization networks, consumption patterns and demand for one or more substances, materials, or products with particular physical characteristics which things or objects have been or can be made from, are of a value quality and are trade, bought or sold by society. While described as a chain, operationally it is more circular to strew-like in function as the commodity flows through place(s), space(s) and time(s). Temporally, it is a dynamic historical process that is subject to change, evolution, contraction, cessation, growth, and progression over time. Spatially, it is also an inclusive analytical tool, since it captures either a moment or large segments in time that encompasses all factors of production, commercialization, and consumption of a commodity over space. And it captures the actions of multiple agents and their agencies in this process. Since individual commodities and their chains share symbiotic production and marketing networks with other commodity chains, this analytical tool is even more dynamic, because it interfaces the relationships between one commodity chain and others."*[15]

By using the tool of commodity chain analysis, the following questions are answered: what was the value of copper, zinc, lead and tin as mint metals and thus as currency components in China and where did it originate from? How was mint metal production initiated and who provided the capital? How were mint metal production and minting organized under various different aspects like exploration, mining, smelting and minting Techniques, labour etc.? How was the transport of mint metal or coins carried out? How were the coins cast by the mint distributed? Who benefitted financially from the process of cash production? What were the consequences of developments in the operation of the commodity chain inside and outside the system? The approach of commodity chain

[15] George Bryan Souza , oral communication.

analysis hereby provides a perspective somewhat independent from the institutions and actors involved and is thus helpful for achieving comprehensive and substantive research results.

Secondly, the occasionally abstract and impersonal approach of commodity chain analysis is contrasted by an actor-based research model as employed by Thomas Metzger in his insightful studies on the administration of the Qing Dynasty. This encompasses the consideration and examination of individual motivations, actions and experiences, which are also observed by means of case studies offering close-up views of individual behaviour inside the larger contexts relevant to this study.

Thirdly, comparative research is employed to display particularities of Sichuan's largely privately organized copper production especially in contrast to China's other important copper producing region of Yunnan, where the related processes were carried out with a much closer involvement and control of the state.

Fourthly, the dissertation focuses on the most important end point of all the mint metal commodity chains, the provincial mint. The Sichuan mint's organization and management, its metal procurement, its casting Techniques, coin output and distribution as well as the appearing problems and abuses are shown and discussed. Quantitative analysis with the help of a database is carried out on the data provided by the Routine Memorials in order to gain an overview over the output of the mints in Sichuan and elsewhere and thus to reach conclusions about the social and economic impact of mint metal production.

Fifthly, the effects of mining and minting on the regional economy will be analysed with regard to Skinner's Macroregion theory: Skinner argues that the heartland of China can be divided along geographical borders into nine physiographic regions, each of them with a core-periphery structure. The internal as well as the mutual relations of these macroregions throughout the history follow certain patterns which thus can be used as a tool of historical analysis[16]. In the case of Sichuan's minting and mint metal production accordingly the core-periphery relation inside the Upper Yangzi macroregion is

[16] Skinner (1977).

concerned in particular because the situation of the mines in the peripheral Liangshan region effected on the operation of the Chengdu mint in the core and vice versa. A second aspect is added by the overlapping of Sichuan's mining area with the Yungui macroregion, which is reflected in various types of conflicts and cooperations between the two macroregions. At last, the mines and the mint in Sichuan were both integrated into structures largely transcending the purely macroregional economies, namely the system of metropolitan copper transport and the practice of mint metal procurement carried out by the provincial mints all over the empire.

The systematic investigation of this topic is not only aimed at offering new information on the historical facts concerning mining and minting in Sichuan, but also at shedding light on several correlations standing as examples for processes, structures and conflicts beyond the mining region itself, among them most importantly the relation between state and merchant and between Han settlers and indigenous population.

1.3 *Sources*

This research is based on both Chinese and western sources.

1.3.1 *Sources in Chinese*

1.3.1.1 Sources from Qing period

Firstly the dissertation uses Qing archival sources, which can be divided into archives preserved by central and by local governments. In central government archives, the reports written by provincial and local officials in the Palace Memorials[17] containing information and suggestions concerning mining and monetary policy are of special interest. Besides, the Routine Memorials of the Grand Secretariat about the Baochuanju

[17] Including: *Gongzhong dang Kangxi, Yongzheng, Qianlong and Guangxu chao zouzhe* 宮中檔康熙、雍正、乾隆、光緒 (Secret Palace Memorials of the K'ang-his, Yongcheng, Ch'ien-lung and Kuang-hsü Periods); *Gongzhong dang zhupi zouzhe, caizhenglei* 宮中檔朱批奏摺財政類 (Palace memorials with vermilion rescripts, category financial administration) ; *Junjichu lufu zhouzhe* 軍機處錄副奏摺 (Copies of palace memorials in the State Council), *Huobi* 貨幣 (Currency), *Caizheng* 財政 (Finance), *Kuangwu* 礦務 (Mining).

provide accounting books with data concerning mint metal procurement, coin output and distribution. The local archives of Ba District 巴縣[18] and Mianning District 冕寧縣[19] complement these information especially in the field of mining and offer detailed views for example through mine accounting books or law suits involving ethnic conflicts.

Secondly, gazetteers of Sichuan provide rich background information about the history of mining. Like the local archives, they also contain materials suitable for undertaking case studies concerning for example the development of singular mines or conflicts between miners and peasants.

Thirdly, Qing government records, regulations and precedents are indispensable for understanding the administrative side of the topic. For instance, the *Qingchao wenxian tongkao* 清朝文獻通考 (Encyclopedia of the historical records of the Qing Dynasty) and the *Qinding Da-Qing huidian shili* 欽定大清會典事例 (Imperially endorsed precedents of the collected statutes of the Great Qing Dynasty) provide us with general knowledge as well as with some detailed events. There is also plenty of information on the mining and minting events in the *Qing shilu* 清實錄 (The veritable records of the Qing Dynasty). The *Qinding Hubu guzhu zeli* 欽定戶部鼓鑄則例 (Imperially endorsed regulations and precedents for minting of the ministry of revenue) contain detailed regulations for the operation of mines in Sichuan and for mint management in the Baochuanju until Qianlong 31 (1767), while the *Tongzheng bianlan* 銅政便覽 (A manual on copper administration) collected by National Science Library of Chinese Academy of Sciences offers the information for the following years until the 1830s. The handbook for Sichuan's provincial treasurers, the *Sichuan buzhenglu* 四川布政錄 (Notes of [the affairs of the] Provincial Treasurer of Sichuan) adds further valuable details. Last but not least, the *Ningyuan fushu tongkuang qingxing qingce* 寧遠府屬銅

[18] *Qingdai Baxian dang'an huibian (qianlong juan)* 清代巴縣檔案彙編(乾隆卷) (Compilation of the archives of Ba District (volume of Qianlong [reign-period])); *Qingdai Qian Jia Dao Baxian dang'an xuanbian* 清代乾嘉道巴縣檔案選編 (A selection from the archives of Ba District during the reign-periods of Qianlong, Jiaqing and Daoguang).

[19] *Qingdai Mianning xian yizu dang'an ziliao xuanbian* 清代冕寧縣彝族檔案資料選編 (A selection of the archive materials of the Yi in the Mianning District in the Qing period).

礦情形清冊 (Comprehensive handbook of copper mining in Ningyuan Prefecture) consists in unique information about the abuses of clerks, inspectors and mining merchants, the situation of land-carriage and water way transport and many more.

As additional primary sources from the Qing period, literary texts such as local officials' anthologies and travel writings are consulted, too.

1.3.1.2 Sources from Republican period (1912- 1949)

During Republican period, Chinese geographical investigations were frequently carried out in Sichuan and plenty of research was undertaken and reports compiled. In those reports, by using methods of field research and chemical analysis, geologists undertook detailed investigations on the mines in this region, such as on their locations and environment, transport conditions, geological structures, deposits, reserves, circumstances of mining, methods of smelting and suggestions concerning the chances for a development of the mining industries in the future. At that time, the former splendour of Sichuan copper mining in middle Qing was long forgotten. Since 1914, Ding Wenjiang 丁文江[20] carried out his field research in Huili, which marked a starting point for further geological investigations in the region. Since the 1920s, the establishment of a new province named Xikang 西康 in the border region of Tibet, Sichuan and Yunnan stimulated geographical research and resource exploration. In 1929, Tan Xichou 譚錫疇 and Li Chunyu 李春昱 went on their geological field trips but only published the result much later[21].

However, it was not until 1934 that the first large scale governmental expedition reached the mining region and brought it back to the public eye again[22]. An institution

[20] Ding Wenjiang 丁文江 (2008): Ding Wenjiang wenji 丁文江文集 (A collection of works by V.K.Ting [1887-1936]).

[21] Tan Xichou 譚錫疇; Li Chunyu 李春昱 (1959): *Sichuan Xikang dizhi zhi* 四川西康地質志 (Geology in Sichuan and Xikang), written in 1939.

[22] The result of the investigation was published in 1939, see footnote Chang Longqing.

was established[23], which together with private scholars carried out geological, mineralogical and economical surveys. Among them were Chang Longqing 常隆慶[24], Feng Jinglan 馮景蘭[25], Yu Xiyou 于錫猷[26] and Zeng Zhaolun 曾昭掄[27] who all carried out remarkable research. However, due to their purely present-oriented interest, no research was undertaken on mining organization in late imperial China.

At the same time, ethnological and sociological survey had also become a popular topic in the same region. Zhuang Xueben 莊學本[28], Ren Naiqiang 任乃強[29] and others drew a picture of the ethnic minorities' lives, habits and customs in the region.

1.3.1.3 Sources from People's Republic (1949-)

Since 1949, many ethnological researches about the Yi have been carried out by government by the request of ethnic solidarity and under the influence of Marxism. Especially on the question of ethnic relations between Han and Yi, means of production and productivity, on commodity prices and on marketing, further enlightening answers can be found in several works of oral history recorded during the 1950s and 1960s[30].

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[23] The West China Academy of Sciences 中國西部科學院 was established in 1930 by Lu Zuofu 盧作孚 in Chongqing.

[24] Chang Longqing 常隆慶 et al. (1935): *Lei Ma E Ping diaocha ji* 雷馬峨屏調查記 (An investigation of Lei[bo], Ma[bian], E[bian] and Ping[shan]); (1939): *Ningshu diaocha baogao huibian* 寧屬調查報告彙編 (A compilation of the investigation reports about Ningyuan [Prefecture] and its subordinates).

[25] Feng Jinglan 馮景蘭 (1953): "Chuan Kang Dian tongkuang gaiyao" 川康滇銅礦概要 (The general situation of the copper mines in the border region of [Si]Chuan, [Xi]Kang and Dian [i.e. Yunnan]).

[26] Yu Xiyou 于錫猷 (1940): *Xikang zhi kuangye* 西康之礦業 (Mining industry in Xikang).

[27] Zeng Zhaolun 曾昭掄 (1947): *Daliangshan yiqu kaochaji* 大涼山夷區考察記 (A record of survey in the Yi territory in Daliangshan).

[28] Zhuang Xueben 莊學本 (1941): *Xikang yizu diaocha bangao* 西康夷族調查報告 (A report of the investigation of the Yi in Xikang).

[29] Ren Naiqiang 任乃強 (1933): *Xikang tujing* 西康圖經 (An illustrated record of Xikang).

[30] *Sichuan sheng Liangshan yizu shehui lishi diaocha ziliao xuanj*i 四川省涼山彝族社會歷史調查資料選輯 (A selection of survey materials of the history and society of Yi in Liangshan, Sichuan Province), survey in 1956-1957; *Sichuan sheng Liangshan yizu shehui lishi diaocha (zonghe baogao)* 四川省涼山彝族社會歷史調查(綜合報告) (A general report of the survey of the history and society of Yi in Liangshan, Sichuan Province); *Sichuan yizu lishi diaocha ziliao, dang'an ziliao xuanbian* 四川彝族歷史調查資料、檔案資料彙編 (A selection of survey materials and archives of Yi history in Sichuan); *Sichuan Guizhou yizu shehui lishi diaocha ziliao* 四川貴州彝族社會歷史調查 (A survey of the history and society of Yi in Sichuan and Guizhou Provinces), survey in 1960.

1.3.2 *Sources in western languages*

Besides sources in Chinese language, the reports and researches of western travellers, who explored the region from 1850-1950 contain vivid descriptions and provide us with a distant perspective on various points, for example on the role of the Yi minority, the condition of mint metal transportation and on the prices of commodities[31]. Of particular value are here the reports of Henri d'Ollone, Edward Colborne Baber, Heinrich von Handel-Mazzetti and Henry Rodolph Davies, the accounts of many others like for instance Louis de Carné, Alexandre François Legendre, Alexander Hosie or Earnest Henry Wilson contain useful information, too.[32]

[31] Richthofen, Henry Rodolph Davis, Baber, Herbert Way, Fergusson, Alexander Hosie.

[32] Rest of the names concerned see Bibliography, Western Language Sources.

2 MINING

In this chapter various aspects of mint metal production in Sichuan are discussed, such as its human and physical geography, its administration, its workers and applied techniques of prospection, mining, smelting and transportation so forth.

2.1 *Natural and social conditions*

Before discussing the actual establishment and operation of Sichuan's copper mines at the time of their highest output during the middle Qing period, certain factors forming the framework for this need to be taken into consideration. Those are firstly, the geographical conditions in the main mining areas; secondly, the history of Sichuan's mining preceding the time period in the focus of this research and determining its social and political situation, and thirdly, the reasons that lead to an expansion of mint metal mining in Sichuan during the eighteenth century.

2.1.1 *Geographical background*

Few industries are more dependent on geographical circumstances than metal production. This begins very simply with the availability of ores in accessible layers of the earth but extends into various fields such as matters of transportation, supply in fossil and renewable fuels, food provisions and general living environment for the workers and many more.

As to the location of the ore it has already been mentioned, that especially the south of Sichuan as a part of the Chuan-Kang-Dian copper region with its very special geological conditions[1] is richly blessed with a great variety of mineral resources such as the mint metals copper, zinc, tin and lead, but beyond that also gold, silver, iron and other minerals occur in remarkable amounts and a good part of them can indeed be mined

[1] Ding Wenjiang (2008), Li Chunyu (1959), Chang Longqing (1939), Alexander Hosie (1922).

without efforts like the establishment of particular deep shafts or other techniques confined to modern Techniques and machinery.

Opposed to this favourable resource situation, transportation constituted a major problem for almost the entire mining region. While in its northernmost part in the vicinity of the Chengdu basin, the landscape consists in gentle hills with several navigable rivers in between, its by far largest and most important portion lays more southward in the triangle formed by the three rivers Dadu River 大渡河, Yalong River 雅礱江 and Jinsha River 金沙江. This area predominantly consists in steep mountains of an altitude between 2000 and 4000 meters. The few rivers in this region run in deep cut valleys forming rather an obstacle than a channel for traffic and transport with traditional means. The geographical conditions thus posed a major challenge to any attempt of carrying out mining on a larger scale.

Fuel for the smelting of metal could generally be procured from two types of sources, either from wood or from coal. Since during most of the time until the 19th century, except for the case of Huili Department 會理州 at the Yunnan border, no coal deposits in a convenient distance from any important mint metal mine in Sichuan were known, fuel supply relied almost entirely on charcoal and thus on wood. While at the beginning of Sichuan's large scale mining activities, trees must still have been available in sufficient numbers, during the later times deforestation, erosion and land use conflicts with an increasing number of peasant settlers complicated the situation and led to a drastic fuel scarcity.

Another problem of the mountainous landscape beside the difficult transport conditions was that few areas close to the mines and smelters were suitable for intensive agriculture. As a consequence, food for the mine workers needed to be produced in other places and brought to the mines under the same precarious transport conditions. Beside food this concerned also for example oil for the illumination of the mine galleries, tools and so on.

The general conditions for mining in the southern part of Sichuan were thus already from the very beginning largely characterized by their geographic setting. Sichuan's copper mountains were a place that promised great profit to the one willing to take risks but it also became the stage for numerous examples of failed enterprises in spite of great natural resources.

2.1.2 *History of mint metal mining in Sichuan before the Qing period*

Exploitation of copper ores and use of copper in Sichuan can be traced back through archaeological discoveries until the Sanxingdui culture, which was discovered in 1987 and dates back to the 12th or 11th century BC.

During the Western Han period (202 BC - 9 AD), Qiongdu 邛都, nowadays Xichang 西昌, the capital of Liangshan Yi autonomous Prefecture, was already famous for producing copper[2]. Copper was already at that time mainly used for casting coins[3]. The copper mines in nowadays Ya'an City 雅安市, Mingshan District 名山縣, Tianquan District 天全縣, and Lushan District 蘆山縣 were granted by the Wen Emperor (222 BC- 157 BC) to his minion Deng Tong 鄧通 for the purpose of casting coins. This made Deng extremely rich and his coins spread all over the country[4]. At the same time, Chengjiang District 澄江縣 and Mengzi City 蒙自市[5] in Yunnan were also mentioned as copper producing regions. While the copper mines of the Huili region and of northern Yunnan had not appeared in any historical records of the Western Han Dynasty yet, at least the two ends of the "Chuan-Kang" copper region, Xichang in the north and Mengzi in the south, were already discovered[6].

However, this copper region was long forgotten after the breakdown of the Han Dynasty and only from the Southern Qi period (479- 502 AD) onwards, it was explored again. Because of the too high costs, copper mining for the purpose of casting coins was soon given up[7].

During the Sui and Tang Dynasties (581-907), Sichuan copper mining began to further develop again. Two out of four mining officials of the Sui Dynasty were stationed in Sichuan[8]. Also more districts around Chengdu were now as copper producing areas[9].

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[2] *Hanshu* 漢書 (Book of the [Western]Han Dynasty [202BC-9AD]), chap. 28a.

[3] Xia Xiangrong et al. (1980), p. 55.

[4] Shiji 史記(Records of the Great Histrorian), chap. 65.

[5] *Hanshu* 漢書, chap. 28a.

[6] Xia Xiangrong et al. (1980), p. 55. Xue Yaling (2001), p. 104.

[7] *Nanqishu* 南齊書 (Book of the Southern Qi Dynasty [479-502]), chap. 37, "biography of Liu Quan" 劉悛傳.

[8] Xia Xiangrong (1980), p. 68.

[9] Xia Xiangrong (1980), p. 74.

During the Song Dynasty (960-1276), although the copper mining output on the national level reached its unprecedented peak[10], there was only one copper producing area left in Sichuan, which was Zizhou 梓州 and even this one was soon abolished[11]. One reason was that a big part of nowadays Sichuan was not under Song control, but ruled by the kingdoms of Dali and Nanzhao, which made the mining situation there difficult to judge due to the lack of sources. Another reason was that the use of iron coins was enforced in Sichuan, while copper coins were forbidden to even enter the province[12], which lead to a severe economic crisis. When the Mongols took over Sichuan into their territory, this situation did not improve. Since the Yuan Dynasty predominantly relied on paper money, consequently no mint metal had to be mined in Sichuan[13].

During the Ming Dynasty, gradually, the border region between Yunnan and Sichuan began to gain importance in producing copper and lead and to be regarded as holding the richest deposits of those within the entire country[14]. According to *Tiangong kaiwu* 天工開物 (Exploitation of the works of nature), copper was produced in Liangshan 梁山[15] and Huichuan 會川[16], lead was produced in Jiazhou 嘉州[17], Lizhou 利州[18], Jianzhou 劍州[19] and Yazhou 雅州[20]. *Hongya xianzhi* 洪雅縣志 (Gazetteer of Hongya District) (1562) draws a quite detailed picture of copper mining at that time:

"The entrance of the gallery is only a little more than two chi [c. 64 cm] high and of the same width. The depth is sometimes some one hundred bu [c. 160 m] sometimes one to two li [c. 576 – 1152 m], even up to four or five li [2304 -2880 m]. People all crawl in

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[10] Song has the highest output in Imperial China. The copper mines concentrated in Jiangxi, Guangdong and Fujian. See Xia Xiangrong, p. 89.

[11] Wang Shengduo (2003), p. 288.

[12] JQ-SCTZ, chap. 70, p. 4; Wang Shengduo (2003), pp. 487-488.

[13] Xia Xiangrong, p. 123.

[14] *Tiangong kaiwu*, chap. 14, p. 11b.

[15] Now Liangping 梁平.

[16] Now Huili 會理. Xia Xiangrong, p. 144.

[17] Now Leshan 樂山.

[18] Now Guangyuan 廣元.

[19] Now Jiange 劍閣.

[20] *Tiangong kaiwu*, chap. 14, p. 22a.

nakedly with bare feet. They carry bamboo baskets in front, with oil lamps, hammers, and chisels in them in order to chop the ores. As soon as the ores fill the baskets, they pull them out of the gallery and then go in again. Everyday one can get five to six jin [c. 3-3.6 kg] of copper ore. However, the lamps become dark when entering the gallery and only become brighter when they meet wind. That is why people make a hole and blast wind into the gallery like a bellow to keep the lamps on. The employees' wage is only 0.03-0.04 tael per day. Sometimes galleries collapse and people get buried and die. Nonetheless, people are willing to do it and do not care [about the danger], because they are poor and without other skills. Without being hired they would just starve."[21]

In the fourth year of the Wanli reign-period (1576), a provincial mint was established in Sichuan with ten furnaces to cast copper coins and successfully maintained until the end of the Ming period, thanks to the abundant local copper resources[22]. The copper procured by the mint was purchased from merchants at a price 0.08 tael per *jin*[23]. The increasing development of a private-owned copper mining business led to difficulties for the management of the mints: "The more copper is needed in the mint, the less copper arrives"[24], because "the copper mining was either controlled by the merchants or taken by the local people"[25], instead of being controlled by the government.

2.1.3 *Ethnic setting in Sichuan in Qing*

Although naturally certain deposits were known long before and also certain mining activities were carried out earlier, mining on a large scale in Sichuan did not start until 1736. A fairly stable and peaceful political and social environment needed to be provided before this was necessary.

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[21] *Hongya xianzhi*, chap. 3, "products" (*wuchan* 物產).

[22] Chen Shisong et al. (1993), pp. 234-235.

[23] JQ-SCTZ, vol. 70, p. 9.

[24] *Mingshi* 明史 (Hisotry of the Ming Dynasty), vol. 81, "food and money" (*shihuo* 食貨).

[25] *Xu wenxian tongkao* 續文獻通考 (Comprehensive investigations based on literary and documentary sources, contiued), by Wang Qi 王圻 , chap. 11, p. 24.

After Sichuan was conquered by Qing, Wu Sangui's rebellion soon began. When Sichuan finally settled down, Qing government got the energy to think about how to deal with the ethnic minority here.

Yi people officially got the name "Yizu 彝族" only in 1954. At present most of them live in Sichuan, Yunnan and Guizhou. In the Qing period Yi in Liangshan called themselves Nuosu 諾蘇, Nasu 納蘇, Niesu 聶蘇 and other dozens of names, while Qing government in the documents, decrees or edicts called them "Luoluo 倮倮", "Yi 夷" (the barbarian), or "Luoyi 羅夷" (the Luo barbarian). Concerning their general behaviour, Han Chinese observed two different types of Yi or areas inhabited by them: "wild Yi" (*shengyi* 生彝) and "tamed Yi" (*shuyi* 熟彝), a classification mainly referring to their level of sinisation. Corresponding to this division, the tribal area of the Yi, namely Liangshan, the "Cool Mountains", were also divided into "Great Cool mountains" (Da Liangshan 大涼山) and "Small Cool Mountains" (Xiao Liangshan 小涼山). It needs to be noted here that the so-called "Cool Mountains" did not specifically refer to a mountain range, but included a large area from the west of Leibo to the east of Xichang, and from the south of Ebian until the northern bank of the Jinsha River. The border areas of the "Cool Mountains", where Yi and Han had more communications and interactions, were called "Small Cool Mountains", while the core region was called "Great Cool Mountains"[26]

The ancestors of Nuosu probably entered the Liangshan area early in the first millennium of the Christian era. For most of their time living in the Liangshan area, the Nuosu have been relatively independent of political control or even suzerainty from Chinese imperial dynasties or other local rulers. From the Yuan Dynasty on, members of those parts of the Nuosu elites, which were on good terms with the government, were enfeoffed at various times in various places Aboriginal Offices (*tusi* 土司) and they owed allegiance and tribute to the imperial dynasties.[27]

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[26] Chang Longqing (1935), p. 8.

[27] Stevan Harrell (ed.) (2001).

The structure of the Yi society in Liangshan during the Qing Dynasty consisted in five classes: Zimo 茲莫, Nuohuo 諾伙, Qunuo 曲諾, Anjia 安家, and Gaxi 呷西. Simply speaking, the former two were nobility classes, the middle one consisted in commoners, while the latter two were slaves.

Zimo, also called Zi 茲, means "people who own the power". They were the highest class of nobility and were called *tusi, tumu* 土目 or *tushe* 土舍 in Han Chinese sources since the Yuan Dynasty. In 1956, they constituted only 0.1% of the Liangshan Yi population.

Nuohuo, also called "Nuo 諾" or "Nuohe 諾合"[28], means "black", in Chinese they were named "Black Yi" (*heiyi* 黑彝) or "Black bones" (*heigutou* 黑骨頭). They had a lower status than the Zimo and made up 6.9% of the Yi population.

The Qunuo, also called Quhuo 曲伙 were called "White Yi" *(baiyi* 白彝) or "White bones" (*baigutou* 白骨頭) in Chinese, since "Qu" means white. They were controlled by the nobility classes over generations. They were labourers in the society and constituted 50% of the Yi population.

Anjia, also transliterated as Ajia 阿加, means "slaves for guarding the gates". They can be divided into two types: those who had an Yi lineage and those who were Han or from other nations. The specialty of them was that they had their own families and lived separately from their masters, thus were defined by scholars as "slaves outside of home" (*jiawai nuli* 家外奴隸). They formed 33% of the Yi population.

Gaxi is the short form of Gaxigaluo 呷西呷洛, which means "hands and feet beside the woks". The Han Chinese called them Wazi 娃子. Most of them were unmarried and enslaved at their masters' home. The rest could be married but either still lived with their masters or lived separately but did not cook meals separately, thus they were "slaves inside of home" (*jianei nuli* 家内奴隸). They were 10% of the Yi population. Anjia and Gaxi together were called Pujie 濮節, which means male and female slaves[29].

[28] *Liangshan yizu nuli shehui* bianxiezu (1982), p. 29.

[29] Concerning the five classes, see Hu Qingjun (1985), pp. 94-95.

The system of the Liangshan Yi society in the Qing dynasty was based on families linked by patrilineal blood relationship (*jiazhi* 家支). The *tusi* were the heads of families. In the Yuan Dynasty, they were entitled as Pacification Commissioners (*xuanfusi* 宣撫司, *xuanweisi* 宣慰司, *anfusi* 安撫司, *zhangguansi* 長官司) and Bandit-suppression Commissioners (*zhaotaoshi* 招討使). They were given seals (*yinxin* 印信) and certificates (*haozhi* 號紙) which became hereditary and were called "seal-holding local rulers" (*zhangyin tusi* 掌印土司). The *tusi* did not directly control their people but commanded Aboriginal Chiefs (*tumu* 土目) such as Aboriginal Battalions (*tuqianhu* 土千戶) and Aboriginal Company Commanders (*tubaihu* 土百戶) within their territories. The *tumu* led the so-called "Black Yi" who again exerted direct control over the "White Yi" commoners and slaves.

After the disorders of the Ming-Qing transition and the succeeding Revolt of the Three Feudatories (1674-1681), which wrested China's Southwest away from Qing control again, by the end of the 17th century, vast parts of Yunnan and Sichuan were, despite of now being integrated into the empire, in fact controlled by *tusi* on the local and regional levels. While during the reign of the Kangxi Emperor (1662-1722), this status quo was largely accepted, with the ascendance of the Yongzheng Emperor to the throne in the year 1722 the so called *gaitu guiliu* policy prevailed, meaning that it became the aim of the state to replace the local rulers i.e. *tusi* gradually by appointed officials (*liuguan* 流官) and to integrate the respective regions into the Chinese-style administrative system of the Qing.[30]

This policy was carried out in Yunnan and Sichuan likewise but with different levels of dedication and success. As a result, it not only led to the primarily intended enforcement of governmental control in certain areas but also to a change of provincial borders and influence spheres thus determining many of the factors discussed in the following chapters.

Until 1726, the mineral-rich mountain areas to both sides of the Jinsha River belonged to the territory of Sichuan although especially the part at its southeastern banks

[30] Smith (1970), p.40 ff, 102 ff.

including the Prefectures of Dongchuan 東川, Wumeng 烏蒙 and Zhenxiong 鎮雄 were much easier to reach from Kunming, the capital of Yunnan than from Chengdu, the capital of Sichuan. When in 1725 a minor conflict among local Yi and Han settlers broke out and required action from the Qing army, Yunnan troops under the leadership of the newly established Governor-general of Yunnan and Guizhou, E'ertai 鄂爾泰 settled the case before Sichuan troops could even get into reach. The ambitious E'ertai took this as a reason to apply to the Yongzheng Emperor to incorporate the three prefectures into Yunnan and thus to pose them under his rule. This was approved by the emperor to the special dismay of Yue Zhongqi 岳鐘琪, the Governor-general of Sichuan and Shaanxi. In the following years, E'ertai undertook various measures to enhance governmental control in the new areas. He established new garrisons, disposed Yi leaders of any higher or middle level, launched a large-scale land clearing and settlement campaign and encouraged the opening of those copper mines in Dongchuan and other places, which were to become the most productive ones of China during the next decades. One consequence of his rigorous policies was several Yi uprisings, which were defeated harshly. The Yi people in Dongchuan, Zhenxiong and Wumeng suffered massacres during this time[31]. After their defeat, the population fell sharply. The Qing government in the following encouraged Han Chinese and other ethnicities to immigrate into the region[32]. In Wumeng, which was originally a Yi settlement, nowadays the Yi population accounts for less than 5% of the inhabitants[33]. The suppression measures E'ertai used in Yunnan ensured the execution of the *gaitu guiliu* policy here. Those Yi remaining on the Yunnanese side became assimilated to Chinese ways and ceased to play any important political role of their own at any time in the future.

The situation in Sichuan was however different. After the defeat, many of the Yi rebels fled from Yunnan to the other side of the Jinsha River, which still remained under

[31] *Qing shilu*, Yongzheng 8/10/renzi, E'ertai reported what his tropp did: in Zhenxiong, more than two thousand Yi rebels were killed; in Dongchuan, thirteen Yi villages were destroyed and killed countless people; in Wumeng, severel ten thousand people were defeated, more than eighty military camps were destroyed. etc. *Zhupi yuzhi*, Yongzheng 8/12/17, E'ertai reported that his policy was "not to leave one single rebel" (*buliu yinie* 不留一孽). He calculated that by report time more than 10,000 people were killed in battle or committed suicide, and several thousands were beheaded or chopped their right hands after being arrested.

[32] *Zhang Yunsui zougao*, Yongzheng 10/3/12.

[33] Fang Guoyu (1984), p. 495.

Sichuanese control and where *gaitu guiliu* policies had only been executed *pro forma* if at all. The political system of the Yi society in Liangshan did not get changed to any remarkable extent.[34]

After the Yi rebels had fled to Sichuan, Huang Tinggui 黃廷桂, the Provincial Military Commander (*tidu* 提督) of Sichuan, also mobilized troops and sent them into Liangshan to suppress the revolt[35]. However he did not succeed in exterminating the Yi people like E'ertai did in Yunnan. The complicated topographic conditions in the region may have been one of the main reasons for this. The Yunnanese side of the Jinsha River is much flatter than the Liangshan side in Sichuan. Besides, the unique relationship between E'ertai and the Yongzheng Emperor was also a factor. The unlimited trust from Beijing enabled E'ertai to carry out his policy with fierce military means[36]. As a result, in contrast to the massacres in Yunnan, Sichuan chose to offer amnesty and enlistment (*zhaofu* 招撫) to the Yi people. The first method was suggested by Huang Tinggui that after the chief criminals were already arrested and the minority region had become pacified, the Yi people who submitted to the government sincerely should be allowed to live in their old places as before and the government would order them to pay taxes every year[37]. The second method was to use the titles of *tumu* as baits to attract the submission of the leaders of Yi tribes and thereby split the joined forces of the Yi people[38]. The third method was to establish political units such as Ningyuan Prefecture, Xichang, Mianning and Yanyuan Districts, Huili Department, Yuexi, Ebian, Leibo and Mabian Subprefectures and to appoint regular officials there. The fourth method was to add military garrisons to control the *tusi* and *tumu*.[39] These were the measures which were taken in the course of the *gaitu guiliu* policy in Sichuan.

However, they were not successful and could not change the structure of the Liangshan Yi society. Firstly, the system of appointing *tumu* was unstable. Unlike *tusi*,

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[34] Fang Guoyu (1984), p. 558.

[35] JQ-SCTZ, chap. 95, pp. 1-2.

[36] Smith (1971).

[37] JQ-SCTZ, chap. 95, pp. 41-43.

[38] Hu Qingjun (1981), pp. 243-244.

[39] JQ-SCTZ, chap. 95, pp. 37-40.

tumu were either not given seals or not even issued certificates[40]. Instead, they were just given one piece of appointing plate (*weipai* 委牌) on a non-hereditary base. By this, the Qing government intended to guarantee their subordinate position to the *tusi* but actually weakened the status of the *tumu* too much and thus could not gain control over the Black Yi[41]. Secondly, conflicts between the Aboriginal Officials and other Black Yi were intensified. After being given titles by the government, *tusi* and *tumu* gained a higher position than other Black Yi. In order to show off and maintain their special noble lineage, marriage was limited among them rather than within the group of all Black Yi[42]. Besides, *tusi* and *tumu* charged contributions as well as labour services from the subordinate Black Yi, which also activated conflicts. As a result, the plan of the Qing government in Sichuan Province since the Yongzheng reign-period that local political and military administration making use of *tusi* would strengthen the control over the Black Yi turned out to be unfruitful.[43] The original intention of replacing local rulers by appointed officials in the end reached the gain of no more than "having local rulers under the system of appointed officials" (*liu xia she tu* 流下設土), which indicated the failure of the *gaitu guiliu* policy in the Yongzheng reign-period[44].

As a result of these events, mining and other activities of Chinese economic expansion could take place in Yunnan comparatively easily, while in the Liangshan mountains on the Sichuan side considerable areas remained more or less under Yi control even as long as until 1949 and were termed "Independent Lololand" by a number of western travellers arriving there around the turn of the 19th and 20th centuries. In those regions any larger economic activity always faced special difficulties and risks, especially when governmental interests were involved as in the case of mint metal production. Although this often formed an obstacle to the development, at times still mining flourished, successful arrangements were made and the provincial and even the

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40 See JQ-SCTZ, chap. 97.

41 Fang Guoyu (1984), p. 559.

42 JQ-SCTZ, chap. 95, p. 38b.

43 Fang Guoyu (1984), p. 560.

44 Hu Qingjun (1981), p. 221.

imperial government could make use of the region for the copper procurement of its mints.

2.1.4 *Sichuan mining's necessity*

Yunnan's copper production was already remarkable during the Ming period[45], but it reached its heyday under the Qing, especially after 1738. The Qing government needed copper for its mints to cast copper coins. The vast amounts of copper which became available through the exploitation in Yunnan encouraged the development of a monetary system heavily relying on copper cash. In the following the provincial mints were established one after another.

Sichuan's provincial mint, namely Baochuanju, was established in 1732[46]. It needed 160,000 *jin* of copper, 132,800 *jin* of zinc, and 27,200 *jin* of lead[47]. At this time the Baochuanju mint purchased its copper from Yunnan, zinc and lead from Guizhou, was thus dependent totally on its neighbour provinces. Since 1739 because of the enlargement of the mint, the amount of purchased copper from Yunnan increased to 300,000 *jin* per year[48]. The purchase lasted until 1745[49]. However, with its own copper deposits and due to the difficulties as well as high costs of long distance transporting, suggestions were made to use Sichuan's local copper deposits for minting purposes[50]. As a consequence of this, large scale mining for mint metals in Sichuan came into being.

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[45] Vogel (1989), p. 261.

[46] JQ-SCTZ, chap. 70, p. 12.

[47] SCBZL, p. 149.

[48] SCBZL, p. 149.

[49] RM. 2.175.14227.16.

[50] QDDKY, pp. 212-213.

2.2 *The establishment of copper mining*

Before the large scale mining activities in the Qing period began, although mining was at the beginning officially forbidden, private minor enterprises always existed.[51] However, the attitude of the Yongzheng Emperor towards mining was fairly negative. In 1729, Huang Tinggui submitted a memorial to him to suggest mining copper and lead in Huanglang 黄螂 in Leibo Subprefecture but got strictly rejected in an edict:

"Huanglang and Leibo['s territories] are interlocking with [those of] the newly pacified barbarians in Liangshan. The only thing that should be done is to enhance peace and control, how can we start the desire for profit? If commoners were allowed to extract minerals, migrant unregistered people would definitely come to gather there and cause incidents. Quickly [you and] Governor Xiande of Sichuan [should] close all the copper and lead mines in the areas of Jinzhuping and Bailashan without any exceptions. If [the situation] develops to dispute and chaos, using all the lives and fortune of Huang Tinggui and Xiande's families are not enough to expiate the guilt!"[52]

However, this attitude did not last long. Actually in the same year, Yongzheng agreed to start mining in Sichuan. When observing the establishment process of large-scale copper mining in Sichuan, the involvement of the state and especially the distribution of the yields by taxation and monopoly purchases played a crucial role. This establishment process can be divided into three phases preceding the fairly balanced final regulations:

2.2.1 *The initiating phase (1729-1740)*

The time from Yongzheng 7 (1729) to Yongzheng 10 (1732) can be seen as the initiating phase. Copper mining in Sichuan first started in Yongzheng 7 following a suggestion by the Governor of Sichuan and Regional Commander (*zongbingguan* 總兵官) of Jianchang Circuit 建昌道[53], Zhao Ru 趙儒[54]. He suggested that after the execution of

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[51] MNYZ, p. 354.

[52] *Qing Shigao*, chap. 323, biography of Huang Tinggui.

[53] The circuit of Jianchang was identical with the Qing prefecture of Ningyuan which is now mainly covered by Liangshan Yi Autonomous Prefecture.

the *gaitu guiliu* policy and the establishment of additional garrisons, the prohibition of mining should be loosened. Eight mines[55], which produced copper, zinc, paktong 白銅[56] and lead and which were located in the south of Ningyuan Prefecture, were allowed to be operated. The original regulation was that 30% of the copper production had to be directly handed over to the government as a tax; the entire rest would then be bought by the government for 7 tael silver per 100 *jin* (ca. 60kg)[57]. Besides, preliminary administrative regulations were also established: mine officials were selected among Assistant Prefects (*tongpan* 通判) or Registrars (*jingli* 經歷) of a prefecture with responsibilities of taxation, accounting, reporting and so on[58]. Because of the extra work of the mine affairs in the jurisdiction of Ningyuan Prefecture, one Vice Prefect for mining affairs (*changwu tongzhi* 廠務同知) was installed[59].

However, the operation did not last longer than two years until a conflict with the Yi led to the destruction of one of the eight mines. Although according to Zhao Ru, garrisons were set up to insure the regional security, apparently the problem of pacifying the Yi tribes was not yet successfully solved. In 1732 in Qi'erbao 七兒堡 when Han merchants started to operate the Ziguba 紫古哵 mine, Yi people killed twenty-two Han Chinese and burnt the infrastructures of the mine[60]. Although the uprising was soon put down by the governmental troops and more than one hundred Yi rebels were arrested, the Qing government did not regard the incident as any success[61]. To the opposite, Qing officials blamed the unrest on the mining activities. They believed that it was the mining which incited the conflicts and thus suggested to close down all the eight mines

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[54] QDDKY, p. 207.

[55] Those eight mines were: Yibei 迤北 (copper), Xinglong 興隆 (copper), Ziguba 紫古哵 (copper), Shaji 沙基 (lead), Jiulong 九龍 (paktong and zinc), Shagouling 沙溝嶺 (copper and lead), Gongmu 公母 (copper), and Lixi 黎溪 (paktong).

[56] Paktong 白銅, lit. "white copper", which is cupronickel, is a specialty of Huili, in the south of Sichuan and beloved metal for utensils. It is not a mint metal, thus of no interest of being monopolized.

[57] QDDKY, pp. 207-209.

[58] QDDKY, p. 208.

[59] QDDKY, p. 208.

[60] Hu Qingjun (1981), p. 167.

[61] MNYZ, pp. 355-356.

indiscriminately[62]. As a consequence, the Yongzheng Emperor ordered the closure of the mines in the same year, to strengthen the military control in Qi'erbao, and the above mentioned Vice Prefect for mining affairs to be was withdrawn from his position and transferred there to keep an eye on the Yi people[63].

2.2.2 *The reverting phase (1741)*

Within a period of ten years since 1732, there was no officially proved mining business going on in Sichuan. In fact, in the areas without such Yi-Han conflicts, private mining activities remained existing[64]. During this period, the provincial mint of Sichuan was in operation and had to purchase copper from its neighbouring province Yunnan. As the mint expanded and demand for copper increased, mining its own copper was again brought into discussion. In the sixth year of the Qianlong reign-period (1741), it was already suggested to reopen the mines. There were several reasons for this: firstly, new garrisons had been established in the region, which ensured safety and protection against raids by the Yi; secondly, the copper demand of the provincial mints was increasing; thirdly, more copper deposits had been found which made the enterprise more promising and fourthly, an exploitation of Sichuan's copper deposits was not alone interesting for Sichuan's provincial mints any more but was also seen as a possible copper supplier for so called metropolitan copper, i.e. copper for the capital mints in Beijing[65].

2.2.3 *The negotiating phase (1742-1745)*

In the following, regulations were repeatedly adjusted in order to serve the governmental interests well but also to keep investing attractive for merchants and to ensure an economically stable financing of the mine enterprises.

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[62] MQDA, A107-120, p. 2.

[63] *Qiongxi yelu*, chap. 57, p. 19.

[64] MNYZ, pp. 356-358.

[65] MQDA, A107-120, p. 3.

In 1742, the regulation thus changed to 20% tax and 80% governmental purchase at the same fixed price[66], which was more profitable compared to the old regulation during the Yongzheng reign-period. However, soon the Sichuan government added like its neighbour province Yunnan another 4.5% of production as an extra tax for wastage (*hao* 耗) and special expenses, thus reducing the merchant's profit again.[67]

In 1743 consequently the price for governmental purchase was re-discussed. Shuose 碩色, the Governor of Sichuan, suggested to fix the copper purchase price by the government at eleven tael silver for 100 *jin* (ca. 60kg), which would have been 4 tael more than in the old regulation and the same regulation like in Yunnan, but the reply from the Board of Revenue ordered Shuose to reduce his suggested price. After reconsideration, Shuose applied again for nine tael per 100 *jin*, which he was asked by the central government to reduce again. The order was passed to the mining officials, and they replied uniformly "it can really not be reduced anymore" [68]. After a long process of negotiation, a price of nine tael was finally fixed[69]. Compared to the price of seven tael before, this was at least a small improvement.

Only one month later, another policy was introduced to grant merchants higher profits: all the merchants contributing red (i.e. ordinary) copper received the permission to mine paktong as well, paying only 20% tax and selling 80% on the free market. This tax would be collected in silver, at a fixed price of 30 tael per 100 *jin*. By this, merchants obtained the opportunity to make profits through the sale of paktong, in order to compensate their less profitable business of copper mining.

Nonetheless, the profit was still too low to attract a sufficient number of merchants to stay in the game. In 1745 thus another decisive change was made: the regulation changed to 20% tax copper (*ketong* 課銅), 4.5% wastage copper (*haotong* 耗銅), and

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[66] QCWXTK, vol.30, pp. 5130-5131.

[67] QDDKY, pp. 211-212.

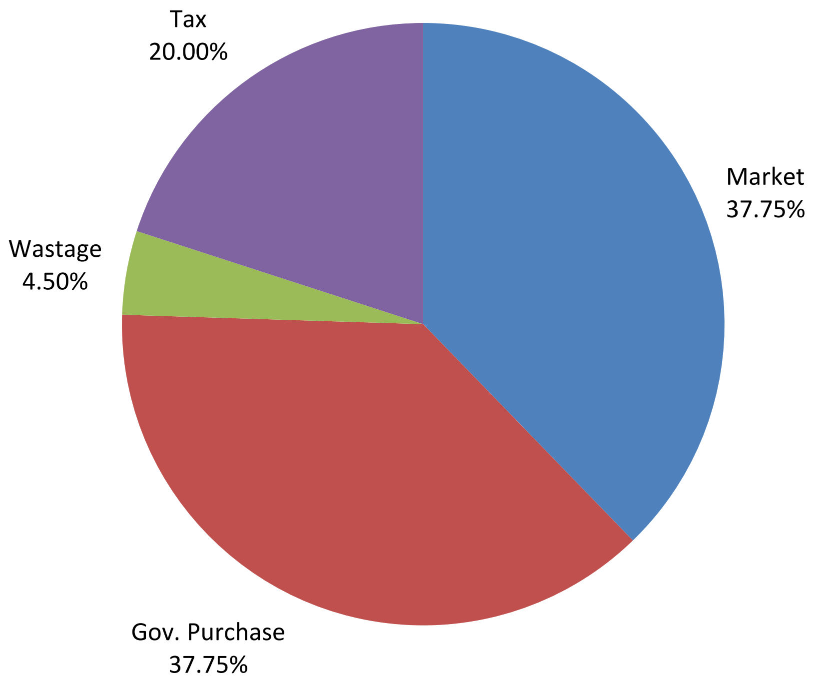
[68] ZPZZ-CZ, 1233-013.

[69] ZPZZ-CZ, 1233-012.

among the rest surplus copper (*yutong* 余銅), one half (37.75%) for governmental purchase at nine tael silver per 100 *jin* and the other half to be sold on the free market[70].

After three more years of negotiation, the regulations were finally fixed. We can see from the process as a whole, how merchants achieved under many difficulties slightly higher profits and thus were able to find a balance between their own financial interests and the demands of the government. These regulations could for the moment keep the merchants in business. However, the resulting balance was still rather weak and breakable. As soon as the production costs increased just a little, the benefit of continuing the operation of a mine would immediately be at stake again.

Graph 1: Distribution of Sichuan copper according to the regulations from 1745



[70] Li Rulan, JJCLF, 03-0770-035, QL9/10/12. QDDKY, pp. 347-349.

2.2.4 *The final administrative regulations*

The setting up of administrative regulations started in Qianlong 6 (1741). In the memorial of Shuose 碩色, the Governor of Sichuan, he made six suggestions concerning all aspects of the mining in Sichuan, such as the employment of mine officials and other personnel, the examination of merchants, taxation, the prices of state-purchased copper, transportation, the control of mine workers, the fighting against contraband copper, the construction of mine buildings, and the payments to the mine personnel.[71]

Based on these suggestions, the administrative regulations of Sichuan mining were established. In the *Qinding Hubu guzhu zeli* 欽定戶部鼓鑄則例 (Imperially Endorsed Regulations and Precedents for Minting of the Ministry of Revenue) in 1769, they were recorded.

2.2.4.1 Responsibilities of officials on different levels

There were four levels of administrative installations. The mining affairs were under the overall leadership of the Provincial Treasurer (*buzhengshi* 布政使). The second level consisted in the officials of the related circuit (*dao* 道) and prefecture (*fu* 府), who were currently in charge (*jianguan* 兼管) and command (*dushuai* 督率). The third level consisting in the Magistrate (*zhixian* 知縣) or Department Magistrate (*zhizhou* 知州), in whose territory the mines located, had the responsibility to inspect (*jicha* 稽查) the mines from time to time. The fourth and last level was called "Official for Controlling the Mines" (*guanchang guan* 管廠官) or simply "Mine Official" (*changyuan* 廠員). They were selected among the petty officials (*zuoza guan* 佐雜官) on the prefecture level. For a big mine, the mine official was chosen among second class Sub-prefects (*tongpan* 通判), while for a small mine a Registar (*jingli* 經歷) would be taken[72]. A Mine Official

[71] MQDA, A107-120, QL 6/11/24.

[72] QDDKY, p. 208.

was sent to a mine for one year. Sometimes he could also be in charge of several neighbouring mines at the same time[73]. He had the following responsibilities:

a) To charge tax copper.
b) To distribute funds (*gongben* 工本).
c) To purchase "surplus copper" (*yutong* 余銅).
d) To supervise copper transportation.
e) To prevent sneaking and stealing (*toulou* 透漏).
f) To observe the actions of merchants and craftsmen.
g) To judge in trivial matters (*xigu* 細故) directly at the mine, such as quarrelling, fighting and gambling.
h) To keep accounting books (*qingce* 清冊) and report to the higher authority.

Besides, for those prefectures where mining played a particularly crucial role and those Mining Officials' tasks were many, as for example Ningyuan Prefecture, one Vice Prefect for mining affairs (*changwu tongzhi* 廠務同知) was installed again[74].

However, this administrative establishment gradually showed its problem: a too loose control of the mines themselves. In the forty-ninth year of the Qianlong reign-period (1784), Fukang'an 福康安, the Governor-general of Sichuan at that time, suggested to change the regulation according to the mode in Yunnan, that instead of the petty officials, the principal seal-holding officials (*zhengyin guan* 正印官) who were familiar with the mining affairs should be sent to the mines and exert special controls (*qianwang zhuanguan* 前往专管) there[75] for a fixed working period of three years. He also planned in detail how to encourage the officials to work more efficiently on mining

[73] For example, mines of Yibei 迤北, Shagou 沙溝 and Ziguba 紫古哵 shared one Mine Official. See GZZL, p. 114.
[74] QDDKY, p. 208.
[75] See GZDQL, vol. 59, pp. 567-569.

issues, which was to clarify awards and punishments: if the production increased by several times they would be promised to be suggested to the Emperor for promotion; if the production increased more than half, they also had chance to be promoted; even if the increase was less than half, still they would get recorded a merit. To the opposite, if the production decreased, the officials would be dismissed from their posts and get punished.[76]

However, this method soon turned out to be problematic, too. The fact that they were missioned officials without authority over the territory as well as the complicated ethnic conditions in the mining areas hindered their work. Thus Fukang'an's successor Li Shijie 李世傑, after an investigation trip to Ningyuan, suggested to accommodate and take actions that suit local circumstances (*yindizhiyi*, *shaoweibiantong* 因地制宜, 稍为变通). He considered the better solution would be letting the magistrates of the local districts and departments take care of the mines, for they were closer to the spot, thus more familiar with the local conditions.[77]

2.2.4.2 Administrative personnel and their salaries.

The installation of administrative personnel varied slightly from mine to mine. However, in general the situations were still quite similar to each other providing a picture as shown in Table 2.

[76] SCBZL, p. 182.

[77] GZDQL, vol. 59, pp. 567-569.

Table 2: Administrative personnel in a copper mine and their salaries

Personnel	Number	Responsibly	Monthly Payment
Mine official	1	see above.	20-22 tael
Secretary (*shuji* 書記)	2	to check furnace households' smelting, to record and make accounting books.	2 tael
Inspecting runner (*xunyi* 巡役)	6-12	to inspect at the customs as well as copper production.	1.5 tael
Tax chief (*kezhang* 課長)	1	to check tax collecting and to inspect illegal selling	1 tael

2.2.4.3 Organizing merchants and craftsmen

Merchants or local natives (*turen* 土人) could first make trial excavation and smelting; this was called "trying the fire" (*shihuo* 試火). If the trial showed possible profit, they could apply to the government for a permission to operate a mine. After that clerks needed to inspect the location and ensure that the mining area would not affect any farmland, houses or tombs (*fang'ai tianlu fenmu* 妨礙田廬墳墓)[78]. besides, his recommendations of conduct (*baojie* 保結) as well as the capital at his disposal would be checked and reported to the Office of the Provincial Treasurer (*buzhengsi* 布政司), who would then decide if he was qualified for the enterprise and, if so, give out a Merchant License (*shangzhao* 商照) to him. This license would then be examined by the Mine Official, the merchant would register the mine's name, its location and bounds in the license. The signed and sworn documents (*yin gan ge jie* 印甘各結) would be handed over to the Board of Revenue again for further checking.[79]

The merchants first employed gravellers and other helpers (*rang sha ren deng* 勷砂人等), organized them into several shifts and started excavation. After they found

[78] *Mabian ding zhilue*, chap. 4, p. 75.

[79] GZZL, p. 114.

indicators of ore, the ore itself could normally only be obtained after continuing to dig into the mountain for another 20 to 30 or even up to 100 or 200 *zhang* (ca. 64-640 m). Then they could open a gallery (*caodong* 礶硐). Afterwards, charcoal households (*tan yao deng hu* 炭窑等戶) would be employed to build up furnaces, houses, bellows and other infrastructure (*lu fang xiang zhen* 爐房箱甄) for smelting purposes[80].

One day before the furnaces were finally set up, the copper merchant should appear in front of the Mine Official together with the Inspecting Runner in order to inform him. Then the merchant would be given a ticket (*piao* 票), on which was written:

"X month, X day, Furnace household X, operated the furnace (chelu 扯爐) once. Inspecting Runner X supervised."[81]

After this first time that the furnace operation was executed, i.e. when once smelting process was done, the exact quantity of produced copper should be reported. At the same time, the merchant should hand in the mentioned ticket and exchange it for a new one. The report would then be checked together with the Tax Accounts (*chouke yinpu* 抽課印簿). "Private smelting" (*sijian* 私煎) without reporting was strictly forbidden.

Under the name of a copper merchant, there were workers (*huoji* 夥計), "gallery heads" (*dongtou* 硐頭) and other employees and fellows. They had to be listed and reported to the Mine Official, too. If there was any change, hiring or firing, it should be indicated to the mine official immediately. Among every ten workers, one should be identified as a leader (*toumu* 頭目), given a "tablet attached on the waist" (*yaopai* 腰牌) and he should be entrusted with the responsibility for settling minor quarrels and conflicts among them. If he could not solve the problem, the "gallery head" should take over. Then the copper merchant, who should decide whether to fire the worker if the problem was small, or to file a law suit in front of the Mine Official and other officials (*mingguan* 鳴官)[82].

[80] *Mabian ting zhilue*, chap. 4, p. 75.

[81] GZZL, p. 114.

[82] QDGGZL, p. 115, p. 117.

Among all the merchants, one or two, who were the most capable and experienced, would be selected to be "Chief Merchants" (*shangzong* 商總). They had to take over the responsibility to inspect the other merchants in order to prevent phenomena like contraband copper (*sitong* 私銅) and tax evasion (*louke* 漏課).[83]

2.2.4.4 Obtaining funds

The funds of the mines were provided by the provincial treasury. they had three origins:

a) silver from miscellaneous levies of the provincial treasury (*siku zashui yinliang* 司庫雜稅銀兩)；

b) silver from surplus and wastage taxes of salt and tea (*yan cha haoxian* 鹽茶耗羨)

c) retained extra-day of nourishing virtue silver (*jiekuang yanglian* 截曠養廉)[84]

The funds needed to be picked up by the responsible Mine Official separately. The regulation concerning this identifies in detail the number of escort personnel during the silver transport, their payment, employed transport means, cost, etc.

For example, to pick up the funds for the Laodonggou mine 老洞溝廠, in Jiading Prefecture[85], which was ten stations (*zhan* 站)[86] away from Chengdu, for every 10,000 tael of silver, one escort person was needed, receiving a payment of two tael of silver. Each escort person had to be provided with one riding mule. For each station the transport cost was given as 0.238 tael of silver. On the way back, for carrying the funds, i.e. the silver, mules were employed as pack animals. Every mule carried 2,000 tael of silver, requiring the same transport cost of 0.238 tael silver per station. Besides, so called "oil

[83] QDGGZL, p. 115, p. 117.

[84] Jiekuang 截曠, "retain" means to keep. That is, keeping the duties collected on the thirtieth day of a large month to be used for administrative expenses.

[85] Nowadays Leshan District 樂山縣.

[86] Post stations were established along the roads between the Provincial capitals and the minor administrative units and offered accommodation facilities, horses and mules to change etc. as a measure of length, *zhan* usually refers to a one day's journey.

baskets" (*youlou* 油簍), "packing clothes" (*baobu* 包布) and ropes (*shengsuo* 繩索) were needed costing altogether 0.33 tael of silver.

The escort persons were normally recruited among a type of runners called "family members" (*jiaren* 家人)[87], supposedly private runners of the responsible Mine Official.

87 See Guo Runtao 郭潤濤 (1999): "Qingdai de 'jiaren'" 清代的"家人" ("Family members" in the Qing period), in: *Ming Qing luncong* 明清論叢 (Collection of essays about Ming and Qing history), vol. 1.

2.3 *Production*

2.3.1 *Names and locations of the mines*

The copper mines were mainly located in the south partly also in the middle of Sichuan linking up with the southern part of the so called Chuan-Kang-Dian copper region in Yunnan. Not all of them can be located precisely at the present day, for most of them not more than the jurisdiction they belong to can be known. For some mines there are indicators allowing estimation or a more distinct location which will be discussed below.

2.3.1.1 General introduction to the mines.

Most of them belonged to the four prefectures of Jiading 嘉定, Ningyuan 寧遠, Xuzhou 敘州 and Yazhou 雅州. The names and locations of the mines will be introduced in four categories. The information for the first two categories are based on data from the Routine Memorials (until 1882). They include firstly fourteen big mines contributing the lion's share of the copper used by the provincial mint and operating relatively stable over a long period of time and besides, twenty-two other mines delivering their copper only up to five times to the provincial mint.

During the second half of the nineteenth century, most active copper mines were located in Ningyuan Prefecture. Thus, the third category of mines consists in those recorded in *Ningyuan fushu tongkuang qingxing qingce* 寧遠府屬銅礦情形清冊 (Comprehensive handbook of copper mining in Ningyuan Prefecture).

The last category include all those mines which were in operation for only a short period of time either because already soon after their opening ore findings proved to be scarce, or due to the disturbances by Yi people. The information about these abandoned mines originates from various different sources, such as gazetteers, Palace Memorials and private writings. Although they did not contribute copper to the provincial mint, their existence itself reveals valuable information on the general situation and the difficulties of the copper mining business, and, even more important than that, can serve as indicators for potential sources of contraband copper and thus offer a possible explanation for the origin of the huge amount of so called "market copper".

2.3.1.2 Major copper mines, 1743-1882

Map 2: Major copper mines in Sichuan, 1743-1882

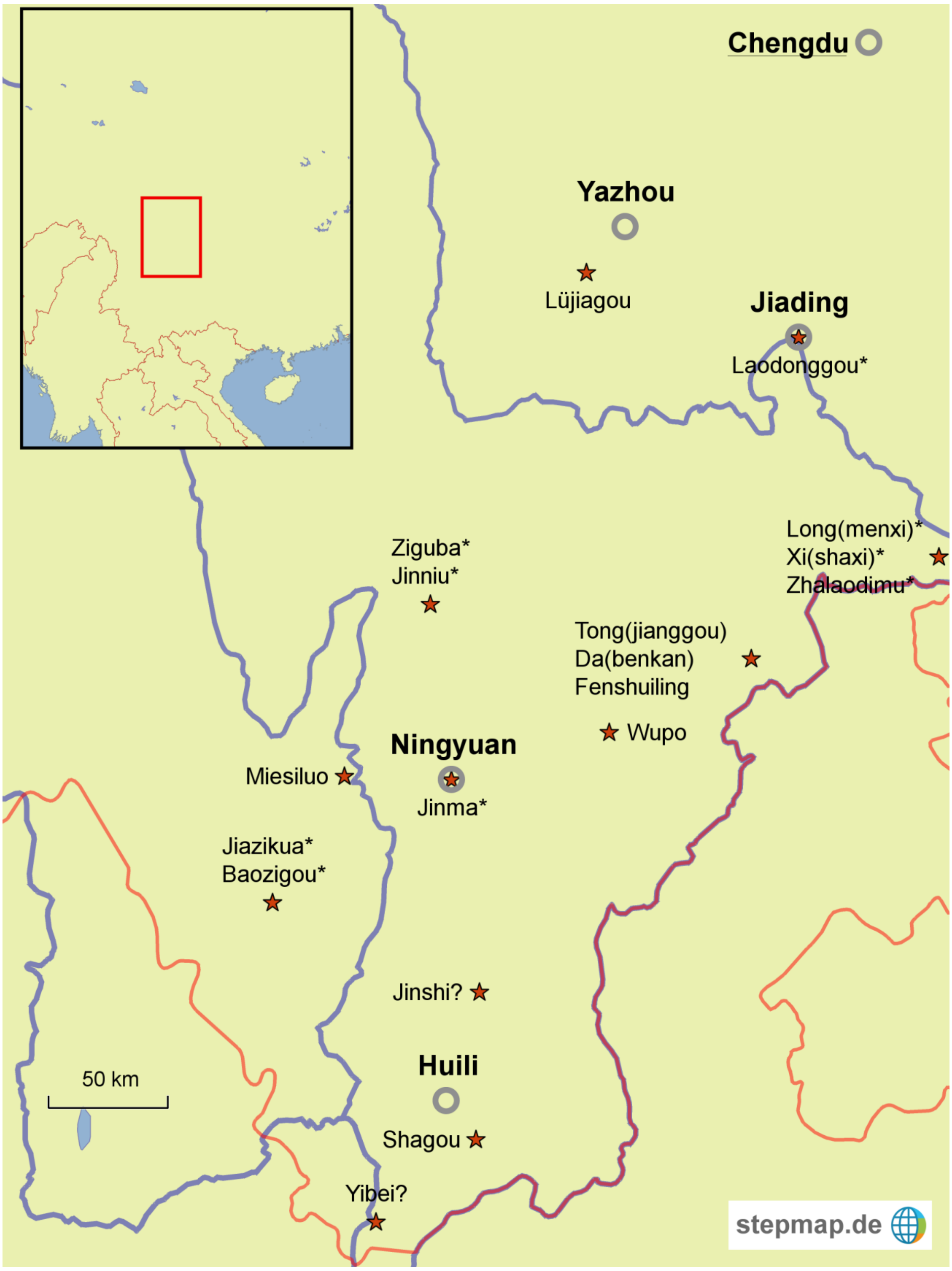


Table 3: Major copper mines in Sichuan, 1743-1882

Mine	Jurisdiction		Coordinates	Open	Close
Laodonggou 老洞溝	Leshan District	Jiading Prefecture	no more detailed information available	1745	1805[a]
Yibei 迤北	Huili Department	Ningyuan Prefecture	North: 26.163 East: 101.923[b]	1742[c]	
Shagou 沙溝	Huili Department	Ningyuan Prefecture	North: 26.500 East: 102.380[d]		1784[e]
Jinshi 金獅	Huili Department	Ningyuan Prefecture	North: 27.083 East: 102.399[f]	1784[g]	

[a] *Leshan xianzhi*, chap. "products" (*wuchan* 物產).

[b] A place with the name Yibei 迤北 is nowadays not known but to the southwest of Huili a small valley called Yiwan 迤灣 can be found. Yibei may have been located tot he north of this valley. This argumentation would be supported by the fact, that only a few kilometers north of this location the modern Lala copper mine 拉拉銅礦 is located.

[c] *Shu gu*, chap. 4.

[d] A place with the name Shagou 沙溝 can be doubtlessly identified tot he southeast of Huili in the vicinity of other modern and historical copper mines.

[e] *Qing Gaozong shilu*, vol. 1203, p. 23. QL49/閏 3/28.

[f] This location is very doubtful. No modern nor historical place in Huili with this name can be found. What can be found is a village to the north of Huili named Jingshicun 井獅村 meaning "well lion village" which can be seen as an altered pronounciation with the charcter *jing* 井 at times also being used for mine pits. Beside this village a place called Shizidong 獅子洞 meaning "lion's cavern" or "lion's [mine] gallery" can be found. The character *shi* 獅 (lion) is relatively scarce for place names in southern Sichuan.

[g] *Qing Gaozong shilu*, vol. 1203, p. 23. QL49/閏 3/28.

Ziguba 紫古哵	Mianning District	Ningyuan Prefecture	no more detailed information available		1784[a]
Jinniu 金牛	Mianning District	Ningyuan Prefecture	no more detailed information available	1784[b]	
Jiazikua&Baozigou 甲子夸豹子溝	Yanyuan District	Ningyuan Prefecture	no more detailed information available		
Miesiluo 蔑絲蘿	Yanyuan District	Ningyuan Prefecture	North: 27.908 East: 101.818[c]		1784[d]
Jinma 金馬	Xichang District	Ningyuan Prefecture	no more detailed information available	1784[e]	
Wupo 烏坡	Xichang District	Ningyuan Prefecture	North: 28.069 East: 102.952[f]	1818[g]	

[a] *Qing Gaozong shilu*, vol. 1203, p. 23. QL49/閏 3/28.

[b] *Qing Gaozong shilu*, vol. 1203, p. 23. QL49/閏 3/28.

[c] A village Miesiluocun 蔑絲蘿村 can be clearly identified above the western Banks oft he Yalong River West of Xichang within The jurisdiction of Yanyuan. Due to the uniqueness of the name it can be assumed that this is also the mine's location.

[d] *Qing Gaozong shilu*, vol. 1203, p. 23. QL49/閏 3/28.

[e] *Qing Gaozong shilu*, vol. 1203, p. 23. QL49/閏 3/28.

[f] A place of this name can be identified tot he east of the modern district town of Zhaojue 昭覺. The French traveller d'Ollonne who passed the place decades after its closure still noticed ruins of houses and several impoverished Han families in exactly this place (D'Ollonne (1911)). This can be seen as an indication due to the fact that this region is until the present day almost entirely inhabited by Yi and population density is very sparse.

[g] ZPZZ-CZ, 1359-010.

Long(menxi)&Xi(shaxi) 龍(門溪)細(沙溪)	Pingshan District	Xuzhou Prefecture	North: 28.789 East: 104.374[a]	1760[b]	1852[c]
Tong(jianggou) Da(benkan)&Fenshuiling 銅(匠溝)大(奔坎)分水嶺[d]	Leibo and Mabian Subprefectures	Xuzhou Prefecture	North: 28.342 East: 103.566[e]	Tongda, 1763[f]; Fenshuiling, 1773[g]	1812[h]
Zhalaodimu 渣澇底母	Yibin District	Xuzhou Prefecture	no more detailed information available		
Lüjiagou 呂家溝	Yingjing District	Yazhou Prefecture	no more detailed information available		

[a] This location remains still largely unclear. The US Army maps from 1954 still contain a place several kilometers south of the Min river above Yibin which is called Longmenao 龍門坳. The character *ao* 坳 including the meaning "valley" could possibly have replaced the character *xi* meaning "creek". Furthermore, the indicated village is located at a small rivulet. The place name Xishaxi 細沙溪 can not be identified.

[b] *Pingshan xianzhi*, chap. 2.

[c] *Leibo tingzhi*, chap. 31, "mine affairs" (*changwu* 廠務), p. 2.

[d] This name see Gazetteer of *Pingshan xianzhi*, chap. 2.

[e] Here only the name Fenshuiling 分水嶺 can be identified being the name of an entire mountain range to the north of Leibo. This allows at least a somewhat more precise location.

[f] *Pingshan xianzhi*, chap. 2.

[g] *Leibo tingzhi*, chap. 31, "mine affairs" (*changwu* 廠務), p. 1.

[h] JQ-SCTZ, chap. 70.

2.3.1.3 Minor copper mines, 1743-1882

These 22 minor mines contributing copper to the Baochuanju altogether no more often than five times between 1743 and 1882.

Table 4: Minor copper mines in Sichuan, 1743-1882

Name of the Mine	Jurisdiction	
Dabaoshan 大寶山	Peng District	Chengdu Prefecture
Sanfushan Luchiping 三撫山鹿馳坪	Peng District	Chengdu Prefecture
E'mei 峨眉	Emei District	Jiading Prefecture
Yulinqiao 玉林橋	Emei District	Jiading Prefecture
Zhangjiawan 張家灣	Emei District	Jiading Prefecture
Shangbaoshan 尚寶山	Wushan District	Kuizhou Prefecture
Yunyang 雲陽	Yunyang District	Kuizhou Prefecture
Anjiashan 安家山	Pingwu District	Long’an Prefecture
Limagou 立麻溝	Yanyuan District	Ningyuan Prefecture
Tuojiaoshan Baiguoshan 拖角山白菓山	Xichang District	Ningyuan Prefecture
Jianshanzi 尖山子	Shizhu Independent Subprefecture	
Dabenkan 大奔坎	Pingshan District	Xuzhou Prefecture
Feiyundong 飛雲垌	Mabian Ting	Xuzhou Prefecture
Huanglongshan 黃龍山	Yibin District	Xuzhou Prefecture
Meizi'ao 梅子坳	Yibin District	Xuzhou Prefecture

Tongchanggou 銅廠溝	Pingshan District	Xuzhou Prefecture
Yingxiyan 鶯喜巖	Pingshan District	Xuzhou Prefecture
Hongchungang 紅春崗	Tianquan Department	Yazhou Prefecture
Jianzhugang 箭竹崗	Yingjing District	Yazhou Prefecture
Xinglong 興隆	Tianquan Department	Yazhou Prefecture
Hanniu 焊牛	unknown	
Jianzishan 尖子山	unknown	

2.3.1.4 Copper mines in Ningyuan prefecture, ca. 1899

Around the year 1899, most active mines were located in Ningyuan Prefecture, detailed information on them is obtained from the *Ningyuan fushu tongkuang qingxing qingce* 寧遠府屬銅礦情形清冊 (Comprehensive handbook of copper mining in Ningyuan Prefecture)[88].

Table 5: Copper mines in Ningyuan Prefecture, ca. 1899

Jurisdiction	Mine	Remarks
Huili Department	Tong'an 通安 (Jiangjunshi 將軍石)	branch excavation of the Jinshi mine
	Bajiaojing 芭蕉箐	branch excavations of the Tong'an mine
	Hongya 紅崖	

[88] Source: NYFS, chap. 7, "各廠礦地遠近名目".

Xinpu 新鋪	
Daduntang 大墩塘	
Liuhedong 六合硐	
Luchang 爐廠/鹿廠	branch excavation of the Yibei mine
Datongchang 大銅廠	branch excavations of the Luchang mine
Dakuangshan 大礦山	
Baiyangdong 白羊硐	
Jincheng 金成	branch excavation of the Jiazikua mine
Baolian 寶聯	branch excavations of the Jincheng mine
Ziluo 紫騾	
Bailu 白鹿	
Baoxing 寶興	
Tongxing 同興	
Mouzigang 眸子崗	
Daxing 大興	
Yuanmu 圓木 Tongxing 同興	
Tian’en 天恩	
Tianma 天馬	

	Songlin 松林	
	Jubao 聚寶	
	Yicheng 義成	
	Xinshan 新山	
	Huilong 回龍	
	Huajulu 華苴蘆	
	Qiucheng 秋成	
	Bailinshan 白林山	
Yanyuan District, Hangzhou copper bureau 杭州銅局	Baozigou 豹子溝	
	Shuikaijing 水開箐	branch excavation of the Baozigou mine
	Tongchangping 銅廠坪	
	Mawang 瑪旺	
	Fucheng 阜成	
	Baoshu 寶樹	
	Yongquan 湧泉	
	Daba 大垻	
	Huizhe 灰折	
	Qinglongzui 青龍嘴	
	Lumabao 祿馬堡	

	Luzilin 蘆子林	
	Old Miesiluo 老蔑絲蘿	
	Shuangbao 雙寶	
	Baima 白馬	
	Erdaogou 二道溝	
Xichang District	Wupo 烏坡	
	Faju 發聚	branch excavation of the Wupo mine
Yuexi Subprefecture, Zidadi copper bureau 子打地銅局	Huilong laochang 回龍老廠	branch excavations of the Wupo mine
	Huilong xinchang 回龍新廠	
	Tianlian 天蓮	
	Guili 歸里	
	Zhichang 紙廠	
	Xieluo 蟹螺	
	Xichang 西成	
	Bijushan 蓽苴山	

2.3.1.5 Short-operated copper mines during the entire Qing period

Based on the materials of gazetteers, memorials as well as private writings, the information of other short-operated mines are collected in this table.

Table 6: Short-operated copper mines in Sichuan during the entire Qing period

Mine	**Jurisdiction**		**Source and remark**
Gongmu 公母	Huili Department	Ningyuan Prefecture	QDDKY (1730), p. 208
Shagou 沙溝	Huili Department	Ningyuan Prefecture	QDDKY (1730), p. 208
Xinglong 興隆	Huili Department	Ningyuan Prefecture	JQ-SCTZ, chap. 70
Huajiaoyuan 花椒園		Kuizhou Prefecture	GZDQL (1753), vol. 6, pp. 170-171.
Boyugou 玻玗溝		Yazhou Prefecture	GZDQL (1753), vol. 6, pp. 170-171.
Chaotianma 朝天馬	Hongya District	Yazhou Prefecture	GZDQL (1753), vol. 6, pp. 170-171.
Longdong 隴東		Yazhou Prefecture	GZDQL (1753), vol. 6, pp. 170-171.
Tiantaishan 天臺山	Pingwu District	Long'an Prefecture	GZDQL (1753), vol. 6, pp. 170-171.
Anlebao 安樂堡	Guangyuan District	Baoning Prefecture	*Shu gu* (1833), chap. 4.
Fangfengping 防豐坪	Chongqing Department	Chengdu Prefecture	*Shu gu* (1833), chap. 4.
Tongmaping 銅麻坪	E'mei District	Jiading Prefecture	*Shu gu* (1833), chap. 4.
Wubaodun Manpodang 五寶墩蠻坡璫	Weiyuan District	Jiading Prefecture	*Shu gu* (1833), chap. 4.
Jinfengshan Longtanhe 金鳳山龍潭河	Wan District	Kuizhou Prefecture	*Shu gu* (1833), chap. 4. GZDQL (1753), vol. 6, pp. 170-171.
Jingqingshan 箐青山	Pingwu District	Long'an Prefecture	*Shu gu* (1833), chap. 4.

Tongkuangchui 銅礦硾	Pingwu District	Long'an Prefecture	*Shu gu* (1833), chap. 4.
Banqiao Houshan 板橋後山	Wenchuan District	Mao Independent Department	*Shu gu* (1833), chap. 4.
Menghong 孟洪		Mao Independent Department	*Shu gu* (1833), chap. 4.
Luoguada 羅卦搭	Wenchuan District	Mao Independent Department	*Shu gu* (1833), chap. 4.
Zhaojianba 照見壩	Wenchuan District	Mao Independent Department	*Shu gu* (1833), chap. 4.
Qianxi Yongle 乾溪永樂	Pingshan District	Xuzhou Prefecture	*Shu gu* (1833), chap. 4.
Jieduo Jiexing 嗟哆節興	Mianning District	Ningyuan Prefecture	*Shu gu* (1833), chap. 4.
Huangshuihe 黄水河	Xichang District	Ningyuan Prefecture	*Shu gu* (1833), chap. 4.
Changyaogang Bajinfeng 長腰崗八金峰	Hongya District	Yazhou Prefecture	*Shu gu* (1833), chap. 4.
Dajianfeng Ma'er 大尖峰馬耳	Hongya District	Yazhou Prefecture	*Shu gu* (1833), chap. 4.
Dachuan 大川	Tianquan Department	Yazhou Prefecture	*Shu gu* (1833), chap. 4. GZDQL (1752), vol. 4, p. 363.
Baozishan 寶子山	Yingjing District	Yazhou Prefecture	*Shu gu* (1833), chap. 4.
Majiachang 馬家廠	Yingjing District	Yazhou Prefecture	*Shu gu* (1833), chap. 4.
Liushapo 溜沙坡	Ya'an District	Yazhou Prefecture	*Shu gu* (1833), chap. 4.
Huameichang 畫眉廠	Mabian Subeprefecture	Xuzhou Prefecture	*Mabian ding zhilue*, chap. 4.
Yingzuiyan 鷹嘴巖	Mabian Subeprefecture	Xuzhou Prefecture	*Mabian ding zhilue*, chap. 4.
Nanmuping 楠木坪	Mabian Subeprefecture	Xuzhou Prefecture	*Mabian ding zhilue*, chap. 4.

Fenghuanggou 鳳凰溝	Leibo Subprefecture	Xuzhou Prefecture	*Leibo tingzhi*, chap. 31, “mine affairs” (*changwu* 廠務). Opened in 1831.
Gushuaixi 古帥溪	Leibo Subprefecture	Xuzhou Prefecture	*Leibo tingzhi*, chap. 31, “mine affairs” (*changwu* 廠務). opened in 1842.
Dabaoding 大寶鼎	Leibo Subprefecture	Xuzhou Prefecture	*Leibo tingzhi*, chap. 31, “mine affairs” (*changwu* 廠務). opened in 1844.
Tongchanggou 銅廠溝	Leibo Subprefecture	Xuzhou Prefecture	*Leibo tingzhi*, chap. 31, “mine affairs” (*changwu* 廠務). opened in 1844
Huangmaogang 黃茅岡	Leibo Subprefecture	Xuzhou Prefecture	*Leibo tingzhi*, chap. 31, “mine affairs” (*changwu* 廠務). opened in 1849
Jianchangba 建昌壩	Leibo Subprefecture	Xuzhou Prefecture	*Leibo tingzhi*, chap. 31, “mine affairs” (*changwu* 廠務). opened in 1864.
Niuniuba 牛牛壩	Leibo Subprefecture	Xuzhou Prefecture	*Leibo tingzhi*, chap. 31, “mine affairs” (*changwu* 廠務). opened in 1878.

2.3.2 *Technology of mining*

Compared to the abundant records concerning mining technology in Yunnan, e.g. in the famous *Diannan kuangchang tulüe* 滇南礦廠圖略 (Illustrated account of the mines and smelters in Yunnan), the source situation in Sichuan itself is rather scarce. However, in the *Mianning xianzhi* 冕寧縣志 (Gazetteer of Mianning District), a fairly comprehensive entry about the techniques of mining in Sichuan can be found. The information provided in the following subchapters predominantly relies on this source. Although it can be assumed that technological exchanges between Yunnan and Sichuan were the rule and that the level of techniques applied on both sides of the Jinsha River was surely not very different due to the fact that many miners in Sichuan first came from Yunnan and later some of them returned there[89], sources from Yunnan used only in order

[89] *Mianning xianzhi*, chap. 5, Mine Affairs. See also Kang Shouyong’s family story in Chap. 2.5.5.

to complement where information from Sichuan is missing. A detailed discussion of mining techniques as seen through Yunnanese sources is e.g. provided by Ding Wenjiang (1947)[90], Yan Zhongping (1957)[91], Golas (1999)[92] and Vogel (2008)[93].

2.3.2.1 Prospection

The first and most important step for the opening of a promising copper mine is the choice of the right location. This requires expertise and knowledge about phenomena indicating the existence of larger amounts of ore in exploitable layers of the earth and the methods of analysing them.

This begins with the shape and structure of mountains:

"The mountains that contain ores (kuang 礦) *are definitely high, their aura and nimbus are rich and thick. [The mountains that contain ores look like the places, where a] dragon comes down to land in [his] cave. [They are] surrounded and embraced from left and right, enclosed and blocked from front and back. [Their] topographical features are different from the ones of other mountains. Silver ores can mainly be yielded on snowy and rocky mountains. Copper ore is mainly located at the foot of the mountain close to a river."*[94]

The second concern for ore prospection is the outcrops. From the following quotations it can be seen that even without actual knowledge of modern geology, central features were comprehended as a consequence of long-lasting experience:

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[90] Ding Wenjiang 丁文江 (1947): "Geological Reports of Dr. V.K.Ting", in: *Ding Wenjiang xuanji* 丁文江选集 (Selected works of Ding Wenjiang (V.K.Ting)).

[91] Yan Zhongping 1957): *Qingdai Yunnan tongzheng kao* 清代雲南銅政考 (An investigation on the copper administration of Yunnan in the Qing Period).

[92] Golas (1999): *Science and Civilisation in China. Vol. 5: Chemistry and chemical Techniques. Part 13: Mining*.

[93] Vogel (2008): "Copper Smelting and Fuel Consumption in Yunnan, Eighteenth to Nineteenth Centuries", in: Thomas Hirzel and Nanny Kim (eds.): *Metals, Monies, and Markets in Early Modern Societies: East Asian and Global Perspectives*.

[94] *Mianning xianzhi*, chap. 5, Mine Affairs.

"[If there is] one mountain containing ore, then there are ten mountains having veinlets. If there is ore in the centre, the veinlets come out through all the directions. One should attack and extract towards the central cave. "[95]

"The colour of earth can indicate the ore deposits. The yellow earth is called 'egg-yolk' (jidanhuang 雞蛋黃*); the red earth is called 'red-ore' (honghuang* 紅塃*); the black earth is called 'dragon-bone-mud' (longgun* 龍骨泥*); the white earth is called 'earwax' (erbani* 耳巴泥*)[…]"*[96]

Chang Longqing's observation in 1939 may explain more clearly about these above-mentioned terms:

"The mining work in Tong'an completely uses the native methods (tufa 土法*). When one wants to open a pit, one follows the indicator of a quartz vein (shiying mai* 石英脈*) or one of black slate (heise pianyan* 黑色片岩*) and chisels in. The quartz vein is produced by the [copper] ore itself while the black schist is turned from soft shale (yeyan* 頁岩*) and easily gets penetrated by a copper vein. The former indicator is called 'horse-teeth-cut' (mayashan* 馬牙删*) and the latter is called 'earwax' (erbani* 耳巴泥*). However, the rock is severely decayed due to weather and the topography here is rugged thus it is not easy to find the bedrock neither to recognize a vein inside of the rock. Hence people always just randomly chisel into the mountain from the edge. Whether they can get the ore depends on luck. Those who open many pits have more chances to hit the goal."*[97]

While the first quotation describes the shape in which copper deposits can appear at the surface of the earth and continue in deeper layers, the second quotation alludes to different materials and their way of outcropping around copper deposits with the 'black

[95] *Mianning xianzhi*, chap. 5, Mine Affairs.

[96] *Mianning xianzhi*, chap. 5, Mine Affairs.

[97] Chang Longqing (1939), p. 65.

earth' for instance describing softened black slate[98]. Examples for other outcrops of this kind are the so called "decayed gold", which contains so called "gold-leaves" (*huangjinbo* 黃金箔) with dots and spots like gold, which is actually chalcopyrite[99], "horse-teeth" (*maya* 馬牙), consisting in "white-oil-stone" (*baiyoushi* 白油石), which stands for the indicator of a quartz vein.[100]

From the Huili region similar terms are known for the shape of veinlets and outcrops, too. For example, the so-called "tree-growing-cut" (*shushengshan* 樹生刪) indicating upright or almost upright veins (*kuangmai* 礦脈), while those with and horizontal direction were called "millstone-cut" (*mopanshan* 磨盤刪), which stood for mainly very thick veins and thus very precious findings. However the "millstone-cuts" were mostly deep underground and their excavation thus rather difficult.[101]

2.3.2.2 Striking

After an ore deposit worth to be worked had been identified by means of the prospection methods sketched out above and the covering layers of earth and dust had been gravelled away or had been penetrated with a shaft or tunnel, the solid rock needed to be worked in order to obtain the ore. For this purpose the application of a whole set of tools was necessary. The Mianning Gazetteer roughly distinguishes four types:

- Hammers (*chui* 錘), made of iron, each one weighing eleven to twelve *jin* (ca. 6.6-7.2 kg)
- Spike-chisels (*jian* 尖), iron spikes with steel added on the tip, each one weighing two *jin* (ca. 1.2 kg)
- Striking-chisels (*zhuozi*, 鎵子), iron chisels looking like eagle beaks, each one weighing more than ten *jin* (ca. 6 kg)

[98] Chang Longqing (1939), p. 65.

[99] Vogel (2008), p. 122.

[100] Chang Longqing (1939), p. 65.

[101] Chang Longqing (1939), p. 64.

- Ore-rakes (*huangpa* 塃扒), iron digging-hoes, looking like a Mugwort leaf, each one weighing one *jin* (ca. 0.6 kg).
- Jumping hammers (*tiaochui* 跳錘), iron sledge hammers with a long handle weighing 20-30 *jin* (12-18 kg)

The process of the ore striking itself is described in the Mianning Gazetteer in the following way:

"If one meets stones, which are called "hard spikes" (ying jian 硬尖*), one uses a steel spike-chisel and a sledge-hammer (tiaochui* 跳錘*, lit.: jumping hammer), which is an iron hammer with long handle, each one weighs twenty to thirty jin, to dig through the stones. If one meets earth, which is called "loose ore" (songhuang* 松塃*), one uses an ore-rake and striking-chisel to excavate, looking for ores.*

If the veinlets are on top, which is called "emerging [at the] ceiling" (maopeng 冒蓬*), one excavates upwards. If the veinlets are underneath, which is called "fishing-in-a-well" (diaojing* 弔井*)*[102] *or "floor planks" (diban* 底板*), one gouges downwards. If the veinlets incline downwards, which is called "ox-drinking-water" (niu chi shui* 牛吃水*) or separated into left and right, which is called "diverging" (cha jian zi* 岔尖子*), one always excavates according to the trends."*[103]

Another description complementing those information can be found in a memorial from Zhou Wan 周琬, the Provincial Judge (*anchashi* 按察使) of Sichuan to the Qianlong Emperor in the year 1753.

"Those 'thin' mines whose ores are exposed and easily to be obtained, are called 'grass-skin-ore' (caopikuang 草皮礦*) or 'hen-nest-ore' (jiwokuang* 雞窩礦 *by the folks.104. They can be obtained by simple excavation. However, these mines easily get*

[102] In DNKCTL it is written in 釣井, so here I use the translation of "fishing".

[103] *Mianning xianzhi*, chap. 5, Mine Affairs.

[104] See Xia Xiangrong (1980), p. 263.

exhausted and can only produce limited amounts of copper. The merchants who have no long sight and prefer quick income always go for these mines. Only the broad and massive ores with a sunken cavity (tangkuang 塘礦 *lit. pond ore) can last for months and years and yield thousands and millions of jin and do not get exhausted. The indicators or veinlets suddenly appear and disappear, sometimes a lot sometimes not. One follows the veinlet and explores it., only as far as fifty to eighty zhang (ca. 160-256m) away one can reach the "pond ore"*[105].

Finding ore is called "approaching the bustling pond" (*zhuo nao tang* 著鬧塘)[106]. Commonly people pay the most attention to "the bustling pond" because of its abundant ores. It can also be called "hall ore" (*tangkuang* 堂礦), like in the Jiangjunshi mine in Tong'an, where much "pond ore" could be obtained. According to the experience of the miners there, that as soon as small fauls with very tiny displacements in between appeared in the vein, the big deposits of "pond ore" could only be several *chi* away.[107]

The Gazetteer of Mianning District states concluding that the rules, where ores appear in abundance and where rather scarcely cannot be applied generally and that similar appearances can yield very different results.

"Some [people] explore deep but find few ores, while some dig shallow but find many. If the [amount of] ore is big, it is easy to start [a fire] in the furnaces (che lu 扯爐*), thus work is saved and profit is hundredfold. If ore is little, it is only worth the daily food. [Mines with] many ores are called "yellow-flower-domain" (huanghua dipan* 黃花地盤*), which are prosperous mines. Mines with few ores are called*

[105] GZDQL, vol. 6, pp. 265-267.

[106] Tangkuang 塘礦 (lit. pond ore) means the broad and massive ores with a sunken cavity. The surface of the ore [body] is narrow, while at the floor it is wide; it looks like a pond (*chitang* 池塘). See DNKCTL, 33b, 40b. "*naotang* 鬧塘" can also be written as "*laotang* 澇堂".

[107] Chang Longqing (1939), p. 65.

"keep-a-living-mine" (yangshen chang 養身廠). If the mining of ore cannot be continued any more, this is called [reaching the] "earth point" (huang jianzi 壙尖子)[108].

2.3.2.3 Illumination

For illumination of the underground mine galleries oil lamps were used[109]. There were two types of lamps: One was so called "light pot" (*lianghu* 亮壺). It was made of copper or clay. The other type was a "hanging lamp"(*guadeng* 掛燈), an iron lamp with a handle. They could both keep oil for lightening.[110]

2.3.2.4 Timbering

Timbers (*xiangmu* 廂木) were used to hold up the mined space, sustaining it upwards and downwards. The left and the right sides were blocked horizontally according to the position with big firewood, which was called chopped firewood (*pichai* 劈柴), in order to prevent accidents.[111]

2.3.2.5 Smelting

As in the chapters above this chapter exclusively focuses on actual accounts of copper ore dressing and smelting in Sichuan. For the largely comparable situation in Yunnan see the comprehensive research carried out by Hans Ulrich Vogel (2008).[112] One particular point of the smelting techniques applied in Sichuan which exceeds the information available about the situation in Yunnan, is the use of coke as a fuel in the Region of Huili.

In the Gazetteer of Mianning District, the process of roasting and smelting copper ores is described as following:

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[108] A "point" (*jianzi* 尖子), i.e., "working-face", is where the mining is carried on; it is also called "walking point" (*xing jian* 行尖). See DNKCTL, 40b.

[109] Yu Xiyou (1940), p. 42.

[110] *Mianning xianzhi*, chap. 5, Mine Affairs.

[111] *Mianning xianzhi*, chap. 5, Mine Affairs.

[112] Vogel (2008), pp. 119-170.

"People who are good at distinguishing and recognizing ores are called 'mine guests' (changke 廠客*). People who are good at separating the melt are called 'furnace guests' (luke* 鑪客*) or 'furnace heads' (lutou* 爐頭*). To separate the melt, one piles up the obtained ores into the fire pond (huotang* 火塘*), first roasts them with firewood, then uses a charcoal fire in the great smelting furnace, installs the bellows and adds ore in succession to make it melt. Four men are employed and divided into two shifts, or eight men are employed, or a water wheel is used. They are operating of the bellows' handles, blowing the bellows in turn. This work is called 'starting a fire' (chehuo* 扯火*). When the fire is started, its light shines very far. The melting lasts day and night. [The melt which] immediately turns into copper or lead, is called 'water-fluid' (shui zhi* 水汁*). If the ore to be smelted is neither [pure] copper nor [pure] iron, but mixed with sand and slag, it keeps its resisting character and cannot be finished [successfully even] after long smelting. It is called 'non-separating liquid' (bu fen zhi* 不分汁*)*[113]*. The people who can use Wuxing [the five elements] to smelt ores get silver out of it by using cupellation furnaces or get copper and lead by burning, are master-hands. In distinguishing ores and in separating liquids, Yunnan people are first best, Huguang and Guizhou people come second, then follow the Xifan [tribes people] and the Yi . [If] the smelting starts from the morning (7-9 am) today, then it lasts until the same time tomorrow, this is called "starting a big fire" (chedahuo* 扯大火*)."*[114]

In a source about the Dongda & Fenshuiling 銅大分水嶺 mine at the border between the Mabian and Leibo Subprefectures, the terms of "great smelting furnace" (*dalu* 大爐) and "crab shell furnace" (*xiekelu* 蟹殼爐) appear. Thus it can be assumed, that the smelting methods applied there must indeed have been similar to the ones of Yunnan.[115]

The investigation carried out by Chang Longqing in the 1930s in the Datongchang 大銅廠 mine in the Luchang 爐廠/鹿廠 and Tong'an 銅安 towns of Huili Department

[113] See DNKCTL, 21a. "The molten metal does not separate out" (*bu fen zhi* 不分汁).

[114] *Mianning xianzhi*, chap. 5, Mine Affairs.

[115] see Vogel (2008), p. 163

shows that still the same smelting methods like during the Qing period were in use. As an important particularity it needs to be noted that coal was used as fuel instead of charcoal or firewood.

Figure 1: Copper smelting furnace in Dongchuan, Yunnan[116]

To smelt the tenorite, i.e. CuO (*heitongkuang* 黑銅礦) in Luchang, the 'great copper smelting furnace' (*yatong dalu* 冶銅大爐) has a height of 15 *chi* (5 m), width and length are both 5 *chi* (1.7 m). Its shape is narrow at the top and wide at the bottom. At the back wall there is a big bellow installed. There are two doors into the furnace, one at the top called 'high door' (*gaomen* 高門), the other at the bottom called 'metal door' (*jinmen* 金門), with a distance of 3 *chi* (1 m) in between. From the 'high door' to the ground it is 6 *chi* 7 *cun* (2.2 m). The door sill of the 'metal door' is 7 *cun* (23 cm) high and from there to

[116] http://www.dcxxg.net/pic/gif/20100519/201005191274236816858.jpg. This is a picture of a copper furnace in the ruin of Maolu mine, operated from 1723-1861 at the south bank of Jinshajiang River, in Dongchuan Prefecture, Yunnan. Thanks to the close location and similar operating period, this picture can be used to show the furnaces in Sichuan described by Chang Longqing.

the top of the ‘metal door’ it is 1.5 *chi* (50 cm). There is a little pit inside of the ‘metal door’, which serves to store the copper slag. About 5 *cun* (16.7 cm) away from the furnace, there is another little pit placed on the even ground to receive the molten copper flowing from the furnace.

Before smelting, one first fills the small pit inside of the furnace with coal powder firmly, then places three big pieces of coke (*jiaotan* 焦炭) on it like a tripod, After that one adds coking coal *(jiaomei* 焦煤) above the tripod and then uses pine wood to light a fire. As soon as the furnace is heated, more coke is added to the amount of half of the furnace‘s size, which is about 1,000 *jin* (500 kg). After five to six hours, another half furnace full of coke is added. Then 160 *jin* (80 kg) of ore which are already beaten into small pieces are placed on top of the fuel together with 100 *jin* (50 kg) of limestone. Now one starts to blow the bellows to strengthen the fire. One hour later, the copper is melting and pours out into the little pit on the ground. Then one adds four ladles (*piao* 瓢) of coke, which equals ca. 80 *jin* (40 kg), eight ladles of ore, which equals ca. 160 *jin* (80 kg) as well as three ladles of limestone, which equals ca. 100 *jin* (50 kg). This is called ‘one layer’ (*yiceng* 一層). Afterwards every hour one new layer can be added, thus on one day 24 layers can be smelted. One arranges four people into one group, which is called ‘one hand’ (*yishou* 一手), i.e., one shift. Every ‘hand’ of people can smelt five layers, then one switches to the next shift and continues the smelting. Three days and nights are together called ‘one fire’ (*yihuo* 一火), after which a certain amount of refined copper (*jingtong* 精銅) and ‘frozen copper’ (*bingtong* 冰銅, which is a combination of copper monosulfide, i.e. CuS and Iron (III) sulfide, i.e. Fe_2S_3)[117] are obtained.

Thereafter one puts the ‘frozen copper‘ and other still unsmelted ore into a roasting kiln (*duanlu* 煅爐)[118]. The kiln has a shape like a partition (*geqiang* 隔牆), with a width of about two *chi* (67 cm) and a height of about three *chi* (1 m). To the front it has no wall. The coke is laid out on the bottom, then coke powder (*tanmo* 炭末) is added. After that, the ‘frozen copper’ is put on top of it. Then one adds again one layer of coke and one layer

[117] Chang Longqing (1939), pp. 67.

[118] It was called *yao* 窑 in Yunnan, see Vogel (2008), p. 132.

of ‘frozen copper‘ and burns it with fire. For roasting every 100 *jin* (50 kg) of ‘frozen copper‘, 30 *jin* (15 kg) coke is needed. Every kiln can roast 2,000 *jin* (1000 kg) of ‘frozen copper’ which takes about 48 hours. After being roasted once, the ‘frozen copper‘ and the ore need to be moved to the second roasting kiln, this is repeated five times. Only then is the sulfur in the ‘frozen copper’ completely reduced. Then one puts it into a ‘small copper smelting furnace‘ (*xiaotonglu* 小銅爐) which is similar to the ‘great copper smelting furnace‘ mentioned above and uses the same smelting method. Then refined copper is obtained.

To sum up, for every time of smelting, the ore needs to be put into the great smelting furnace and the small smelting furnace once each, and needs to be roasted five times in the roasting kiln. Altogether more than 16,000 *jin* (8000 kg) of ore and 7,500 *jin* (3750 kg) of coke are consumed for a yield of 420 *jin* (210 kg) of refined copper.[119]

In the Tong’an mines there were two types of copper ore, chalcopyrite, i.e. $CuFeS_2$ (*huangtongkuang* 黃銅礦) and bornite, i.e. Cu_5FeS_4 (*bantongkuang* 斑銅礦). The smelting methods for these two types of copper ores were different.

The first step to deal with chalcopyrite ore was roasting it six to seven times.[120] The roasting kiln is divided with mud into partitions, each 0.8 m wide, 2.7 m high and 3.4 m long. The thickness of the wall is 0.7 m. First one puts one layer of firewood on the bottom with a height of about two *chi* (67 cm), then one layer of ore with a height of about 1 *chi* [c. 33 cm], then another one layer each of firewood and ore. One prepares a chimney at the ore beside the inner wall of the kiln. Each kiln can roast about 2,000 *jin* (1200 kg) of ore and needs 40 *jin* (20 kg) of firewood. If the firewood is not dry, people add one layer of charcoal under the bottom layer of firewood and throw burning charcoal into the kiln through the chimney so that the fire will gradually inflame all the firewood. After about three days the firewood burns out and the sulfur contained in the chalcopyrite will still continue burning for another seven to ten days. This is called ‘roasting ore by itself’ (*yi kuang duan kuang* 以礦煅礦). When the fire goes out completely, one transfers the ore into a second kiln and repeats the same process six to seven times until the ore expands

[119] Chang Longqing (1939), pp. 59-60.

[120] According to Ding Wenjiang (1947), it was seven to eight times, p. 36.

like a sponge and copper granules become separated out from it. This process is applied to reduce the content of sulfur in the chalcopyrite ore. The chalcopyrite ore of Tong'an, which has already changed its quality, needs only twice roasting; the others need seven times."[121]

Ding Wenjiang gives information about the size of the roasting kilns, too. According to his account they were 9 feet (2.74 m) high, 17 feet (5.18 m) long and 3.5 feet (1.07 m) wide, with a capacity for 20,000 *jin* (10,000 kg) of ore[122].The roasted ore was called "cooked ore" (*shukuang* 熟礦)[123]. The process altogether took 15 to 20 days[124].

The next step after the roasting was smelting. The smelting furnace is generally called 'high furnace' (*gaolu* 高爐). It is 2.4 m high and has a square shaped bottom with a width of 2.5 m and a top with a width of 1 m wide. The furnace is divided into two parts: an upper one and a lower one. Each of them has a door with a distance of 0.5 m in between of them. The lower one is called 'metal door' and its bottom lines up with the ground. The door is 0.5 m high and 0.7 m wide. The upper door is called 'ore door' (*kuangmen* 礦門) and consists is an opening on the top of the furnace. It is 0.5 m deep, 0.3 m wide. The furnace does not have a cover.

At the beginning, one pounds the anthracite (*wuyanmei* 無煙煤) into fine powder, places it on the bottom of the furnace in a shape similar to a wok. Then one arranges three large pieces of coke like a tripod, above which coking coal in broken pieces is stacked up. Then one uses mud, sand and carbon residues (*tanzha* 炭渣) to seal the metal door. One Drills just a little hole right in the middle of the metal door in order to observe the firing process. Now the fire is started One waits until it burns intensely, then fills the furnace with roasted ore through the opening on the top and adds 10 *jin* (5 kg) calcite or limestone. After about one hour, the metal is molten and sinks to the furnace bottom. Now one adds coke until the furnace is half full, waits until it blazes, and puts in again ore and limestone to continue the smelting process until slag flows out of the little hole in the

[121] Chang Longqing (1939), p. 66.

[122] Ding Wenjiang (1947), p. 36.

[123] Chang Longqing (1939), p. 67.

[124] Ding Wenjiang (1947), p. 36.

middle of the golden-door. Then also this hole is plugged. When slag also flows out of the little holes at the right and left side of the door[125], one pierces another little hole at the bottom part of the door. The molten refined copper will flow out of it and become copper lumps. When continuing like this, within twenty-four hours, 14 smelting processes can be operated, each time 300 *jin* (150 kg) roasted ore and 10 *jin* (5 kg) limestone can be added in. In general every 3,000 *jin* (1500 kg) ore require 1,000 *jin* (500 kg) coke and 6,000 *jin* (3000 kg) firewood for roasting. If some bornite is added during the process, the amount of limestone can be reduced. The result is refined copper and still some frozen copper remains, which needs to be roasted and refined again.

As to the bornite, because it contains relatively few sulfur and is always accompanied by malachite (*kongqueshi* 孔雀石), it does not need to be roasted but can be directly be smelted. This is called 'raw ore firing' (*shengchekuang* 生扯礦). The method here is the same with the one for chalcopyrite, only the flux is siderite (*lingtiekuang* 菱鐵礦) instead of limestone."[126]

One description of certain facts of the smelting process is provided by Alexander Hosie in 1922 but certainly also referring to experiences and observations during his earlier travels through Sichuan:

"The smelting is done by packing layers of ore with alternate layers of charcoal in cone-shaped furnaces. The contents are brought to a red heat by means of a bellows made of part of the hollowed-out trunk of Sterculia platanifolia, in blowing which five or six men are engaged at one time. The smelting occupies a day, and when this has been effected, dry rice and rice with the water in which it has been milled are poured into each furnace to bring out the colour in the copper which is afterwards drawn out in round rough layers of the diameter of the furnace, and, therefore, differing in size and weight according to their position in the cone. It is again fused and run into slabs."[127]

[125] It is described so in Chang Longqing's article although he did not mention these two holes before.

[126] Chang Longqing (1939), p. 67.

[127] Hosie (1922), p.165f.

One smelting furnace operated in this way could yield 500 *jin* (250 kg) of refined copper[128].

After comparing to the smelting methods in Yunnan, we can see that the above introduced methods in the Luchang and Tong'an mines belonged to the categories of smelting "thorough" and poor copper ores[129].

2.3.2.6 Drainage

The depth of galleries varied between less than 20 *zhang* (ca. 64 m) and as much as 200 *zhang* (ca. 640 m). The deeper and longer the galleries became, the more water and thus drainage became a problem especially when they followed a complicated structure. If possible, water was drained by using bamboo pipes[130]. However, in many cases, when the water could not be drained, the galleries would be abandoned.[131] This was for example the case in the Tong'an mines.[132] The mines in Tong'an town were located very close to the Jinsha River, thus unavoidably the digging of galleries reached under the river bank. The underground water, which was called Yin-water 陰水 in the sources, together with rain, which was in contrast called Yang-water 陽水 and was especially abundant in autumn, soaked into the galleries and excavations had to stop.[133]

The method to drain the water was called "placing dragons to pull the water" (*bailong cheshui* 擺龍扯水), here the dragons refer to bamboo pipes. More than ten pipes were needed to be combined together for drainage and each of them was pulled by eight people. Altogether over one hundred people were employed for one operation[134].

The exact operation of these bamboo pipe pumps is not contained in any of the available sources from Sichuan. Fortunately in Yunnan, where mines faced the same

[128] It is recorded that every month from four furnaces each one was operated once, which could thus yield altogether 2,000 *jin*. See Chang Longqing (1939), p. 69.

[129] See Vogel (2008), pp. 131-135.

[130] Yu Xiyou (1940), p. 42.

[131] Chang Longqing (1939), p. 65.

[132] NYFS, chap. "各廠礦地遠近名目"

[133] NYFS, chap. "各廠成本多少辦法"

[134] NYFS, chap. "各廠成本多少辦法"

problem, a fairly detailed account has survived in the *Records of the Mines and Smelters of Yunnan:*

"one must see if the excavation opening is high enough on the mountain side and that below there is an open expanse. Then an [almost] level (pingtui 平推*) adit can be driven straight in to drain the water in a downward flow and thus reveal the ore. Hence, this is an inexpensive and labour saving method. In some cases, mines have been excavated at a lower elevation and below is narrow and confined, so that one cannot excavate an adit with a rise to drain off the water. Here one can only set up staged sumps. [For this purpose,] one makes pumps out of long bamboos with their septae pierced. At each level a pump is set up perpendicularly and by means of the pump handle the water is raised and collected in a sump. [Thus the water] is raised from each level up to the next to be finally drained off at the mouth of the excavation. The number of stages can run from a few to 10+ or even 20 or 30. The labour costs are considerable."*[135]

2.3.2.7 Results and quality

The results of the smelting process varied according to the purity of the different ores. The situation in Mianning District was the following:

"[If] one thousand jin [c. 600 kg] of copper ore are put into the fire and five hundred jin [300 kg] extra are added in scale, one can get three to four hundred jin [of copper out of it] when [the output is] high, or no more than two to three hundred when [the output is] low."[136]

Concerning the situation in Huili, Edward Colborne Baber's account contains a mention of the particular situation of one mine merchant, reporting that "during rather less than a month he had smelted about 50 tons, yielding 30% of metal."[137] Ding Wenjiang states, that in one mine in Tong'an "averagely the ore contained 10% copper and thus 2500 *jin*

[135] DNKCTL, pp. 47-48.

[136] *Mianning xianzhi*, chap. 5, Mine Affairs.

[137] Baber (1882), p. 91.

(1250 kg) of ore could produce 250 *jin* (125 kg) of copper"[138]. According to Chang Longqing it can be calculated, that in the Luchang mine, altogether more than 16,000 *jin* (8000 kg) of ore and 7,500 *jin* (3750 kg) of coke, could yield 420 *jin* (210 kg) of refined copper."[139]

In Mabian Subprefecture, every furnace could smelt more than 3,000 *jin* of ore and yield 700 to 1,000 *jin* copper when the quality was good, compared to 200 to 400 *jin* when the quality was inferior.[140] In the Tongda mine in Mabian and in the Fenshuiling mine in Leibo, 3,000-4,000 *jin* of ore produced an amount of 300 *jin* pure copper [141]. In Yuexi Subprefecture, every 100 *jin* of ore could yield 30 *jin* of pure copper after twenty times roasting[142].

[138] Ding Wenjiang (1947), p. 36.

[139] Chang Longqing (1939), p. 60.

[140] *Mabian ting zhilue*, chap. 7, p. 75.

[141] *Qingdai chaodang*, see Peng Zeyi (1962), p. 351.

[142] Chang Longqing (1939), p. 6

Table 7: Different mines, their ores and their smelting results

Mineral (modern term)	Mineral (Chinese term)	Location	Purity Cu	Ore: Copper	Remarks (sources)
Chalcocite Cu_2S	*huitongkuang* 輝銅礦	Anshuncheng 安順場, Yuexi Subprefecture	24.75%	3.3:1	Chang Longqing (1939), p. 6.
Malachite $Cu_2CO_3(OH)_2$	*kongqueshi* 孔雀石	Haitang 海棠, Yuexi Subprefecture	7.27%	30:1	Chang Longqing (1939), p. 7.
Tenorite CuO	*heitongkuan* 黑銅礦	Luchang, Huili Department	5.45%	38:1	Chang Longqing (1939), p. 60.
Chalcopyrite $CuFeS_2$	*huangtongkuang* 黃銅礦	Tong'an, Huili Department	10.45-11.26%	10:1	Ding Wenjiang (1947), p. 36.
Bornite Cu_5FeS_4	*bantongkuang* 斑銅礦	Tong'an, Huili Department	25.74-27.37%		Chang Longqing (1939), p. 63.
-	-	Miangning District	-	3.75-7.5:1	*Mianning xianzhi*, vol. 5, Mine Affairs.
-	-	Huili Department	-	3.3:1	Baber (1882), p. 91.
-	-	Mabian Subprefecture	-	3:1-4.3:1, 7.5-15:1	*Mabian ting zhilue*, chap. 7, p. 75.
-	-	Mabian Subprefecture and Leibo Subeprefecture	-	10-13.3:1	*Qingdai chaodang*, see Peng Zeyi (1962), p. 351.

Table 7 shows that the proportion between the crude ore and the refined copper varied greatly between 3:1 and 38:1, according to the purity of the ore. Furthermore, the smelting results of each of the mines also differed again in respect to their purity. Generally speaking, the copper of the Laodonggou mine was the best of its time, the one from Lüjiagou the second best while all others were of a rather low quality and could thus only be used after a long refining process[143]. An exception was the copper produced by the Wupo mine since 1818, which was regarded as "the treasure of the spontaneity of Heaven and Earth" (*tiandi ziran zhi bao* 天地自然之寶), and which other copper mines could not compare with[144].

2.3.3 *Labour*

In Sichuan like anywhere else in the world, mining was a very labour-intensive enterprise. Much manpower was necessary at all the steps of copper production from the gravelling of the earth through the striking, hauling, dressing, roasting, smelting and refining of the copper ore.

2.3.3.1 Worker's origins

Since many of the mines in Sichuan were situated in scarcely populated areas and to the opposite large numbers of workers were necessary for the execution of mining, workers were often migrants from outside the immediate areas, mostly from other provinces. They formed an important part of the huge amount of immigrants that moved into Sichuan during the course of the 18th and 19th centuries from overpopulated regions especially in the centre and in the south of China. In the local context they had a low social status and were termed disparagingly "rascals and vagabonds" (*wulai youmin* 無賴遊民) [145] by the Qing official elites.

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143 GZDQL, vol. 37, pp. 21-22.

144 *Leibo tingzhi*, chap. 31, p. 3.

145 *Tingyulou suibi*.

Concerning their origins, in chap. 2.3.2.5 it was already mentioned that workers from Yunnan, Huguang, Guizhou as well as Xifan and Yi people were employed in the mines. From this we can see that the origins of workers still varied, while immigrants surely must have made up a large percentage.

Before the mining started on a large scale, there were already illegal mining activities registered. In the fourth year of the Yongzheng reign-period (1726) five miners were arrested because of mining without permission in the copper mine of Ziguba. Four of them were from other provinces rather than Sichuan: two from Huguang, one from Jiangxi and one from Yunnan. Only one was a local.[146] Another inquiry from the first year of Qianlong (1736) shows that among eleven miners in the lead mine of Shaji, one came from Huguang, one from Shaanxi, six from Jiangxi and the origin of three others were unknown.[147]

2.3.3.2 Labour division

The numbers of workers employed in a copper mine in Sichuan could vary greatly according to the scale of its output and the difficulties involved into the production process. A single mine in Huili described by Baber employed only as few as 20-25 men[148], while the Wupo mine during its best time must have been worked by several thousand miners.[149] The French expedition of Henri-Marie Gustave d'Ollone passing the region in 1906 even reported, that alone in the Tong'an mine near Huili 5000 people were excavating and smelting.[150] In Liushapo 溜沙坡 in Yingjing 滎經 District, there were three lead mines, each of them had 1,000-2,000 workers[151].

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[146] MNYZ, p. 354.

[147] MNYZ, pp. 357-358.

[148] Baber, p. 91.

[149] Hu Qingjun (1981).

[150] D'Ollone (1911), p.16

[151] *Tingyulou suibi*, chap. 3.

Work among such large numbers of labourers needed to be well organized. This concerned labour division as well as issues of worker's everyday life.

The different functions on the organizational level of a mine by merchants and craftsmen has been sketched in chap. 2.2.4.3. Besides, the Mianning Gazetteer also provides information about the work in the galleries which was in the hand of "excavation managers" and common "mine men" working in shifts:

"The [different] galleries are called Dong 硐, *for example the gallery of the Zhao family is called Baoxing Dong [lit.: Treasure-Flourishing-Mine], the one of Qian family is called Fengyu Dong [lit.: Abundant-Rich-Mine]. Every [family] has its own mine. These mines cannot be excavated together. [In] each gallery there are two excavation managers (xiangtou* 廂頭, *lit. timbering head), also called "hammer hands" (chuishou* 錘手*), who are in charge of holding spike-chisels and hammers and who take the lead. They guide eight "gravellers" (shading* 砂丁*), also called "mine-men" (kuangfu* 礦夫*). They are divided into two shifts during day and night, which are called "day and night shift" (zhouyeban* 晝夜班*). Or, there are four excavation managers and sixteen gravellers, divided into four shifts during day and night, which is called "four water shift" (sishuiban* 四水班*). The shifts and times are fixed for either ten days or half a month, changing shifts in turn. One turn means the day-shift changes to night-shift, or evening-shift to morning-shift. They excavate by following the veinlets."*[152]

Chang Longqing adds, that "averagely, each worker could obtain a dozen of *jin* (7.2 kg) of ore per day"[153].

After the striking and collection of the ore, during the smelting process, labour was distributed among different types of workers again. According to Chang Longqing, in the mines in Luchang and Tong'an, sixteen workers divided into two shifts, were employed to work at one smelting furnace. [154] Within one shift the labour division is listed below:

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[152] *Mianning xianzhi*, chap. 5, Mine Affairs.

[153] Chang Longqing (1939), p. 66.

[154] Chang Longqing (1939), p. 60.

Table 8: Labour division during the smelting process in Luchang and Tong'an.

Type of workers	Number for one furnace	Description
"furnace head" (*lutou* 爐頭)	1	
"furnace filler" (*zhuanglu* 裝爐)	1	
"fire starter" (*shenghuo* 生火)	1	
petty worker (*xiaogong* 小工)	1	
"wind beater" (*dafeng* 打風)	4	blasting the bellows

Operating in two shifts, the number of workers for one furnace was 16.

2.3.3.3 Payments

How much a mine worker could earn depended firstly on his abilities. In general workers were divided into three levels. Those who could prospect ores (*shi kuanglu* 識礦路), build timbering and also possessed knowledge about smelting were the best ones and thus received the highest payments; those who could do two out of these three tasks were paid somewhat less while those who were only able to perform one of them were paid the least.[155]

Secondly, the payment of mine workers varied from mine to mine. The example of the Tongda & Fenshuiling mine in 1790 can provide a detailed picture of the situation.

The unit used for calculation was "once operating a fire" (*chedahuo yige* 扯大火一個), which involved the application of eight great smelting furnaces and one "crab shell furnace" (*xiekelu* 蟹殼爐) and could yield 300 *jin* of copper consuming 3,000-4,000 *jin* of ore.

[155] NQSBSC, „雷波銅礦局章程".

Table 9: Payments of workers in the Tongda & Fenshuiling mine for one smelting process, 1790[156]

Occupation	Number of workers	Payment (silver tael) per person
ore digger (*wakuang renfu* 挖礦人夫)	170	0.1
hauler (*chuikuang beiyun renfu* 捶礦揹運人夫)	12	0.1
furnace head of the great smelting furnace (*duanlian zhang dalu lutou* 鍛煉掌大爐爐頭)	8	0.15
bellow operator for the great smelting furnace (*che fengxiang fu* 扯風箱夫)	16	0.1
furnace head of a crab shell furnace (*xiekelu lutou* 蟹殼爐爐頭)	1	0.15
bellow operator for the crab shell furnace	2	0.1
SUM	21.35	

Table 10: Costs of materials in the Tongda & Fenshuiling mine for one smelting process, 1790[157]

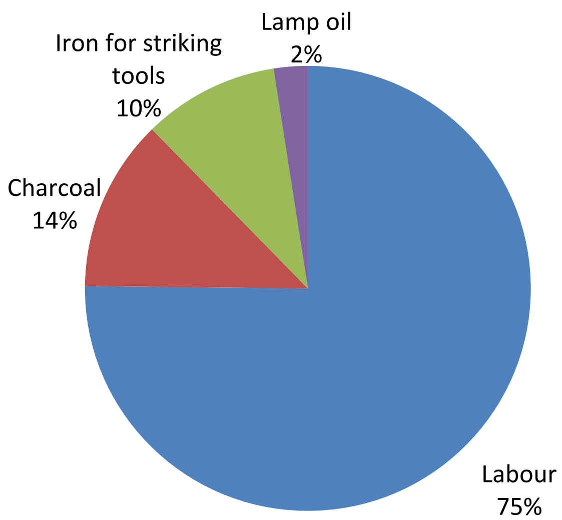
Material	Quantity (*jin*)	Price (silver tael)	SUM
iron e.g. for hammer heads (*chuijiantie* 錘尖鐵)	35	0.08 per *jin*	2.8
lamp oil (*dengyou* 燈油)	14	0.05 per *jin*	0.7
charcoal	2,500	0.13 per 100 *jin*	3.25
"wool charcoal" (*yangmaotan* 羊毛炭)	100	0.3 per 100 *jin*	0.3

[156] *Qingdai chaodang*, see Peng Zeyi (ed.) (1962), pp. 351-352.

[157] *Qingdai chaodang*, see Peng Zeyi (ed.) (1962), pp. 351-352.

To understand the payment situation of the workers better, it is necessary to place it within the entire cost of copper production, thus a comparison with the prices for other materials needed at a copper mine is necessary. From the information in tables 9 and 10 it can be seen that the labour cost must have accounted for the biggest part of the total cost:

Graph 2: Expenses for labour and material, Tongda & Fenshuiling mine, one smelting process, 1790



However, it was not everywhere the case that the labour cost occupied such a big percentage. For instance, in Luchang, where the ore was purchased instead of being excavated by workers, the labour cost only concerned the smelting process. In this case, the major cost was the fuel, i.e. coke[158]. The payments from 1930s in Huili, where the mining and smelting methods remained the same, are another two examples.

[158] Chang Longqing (1939), p 61.

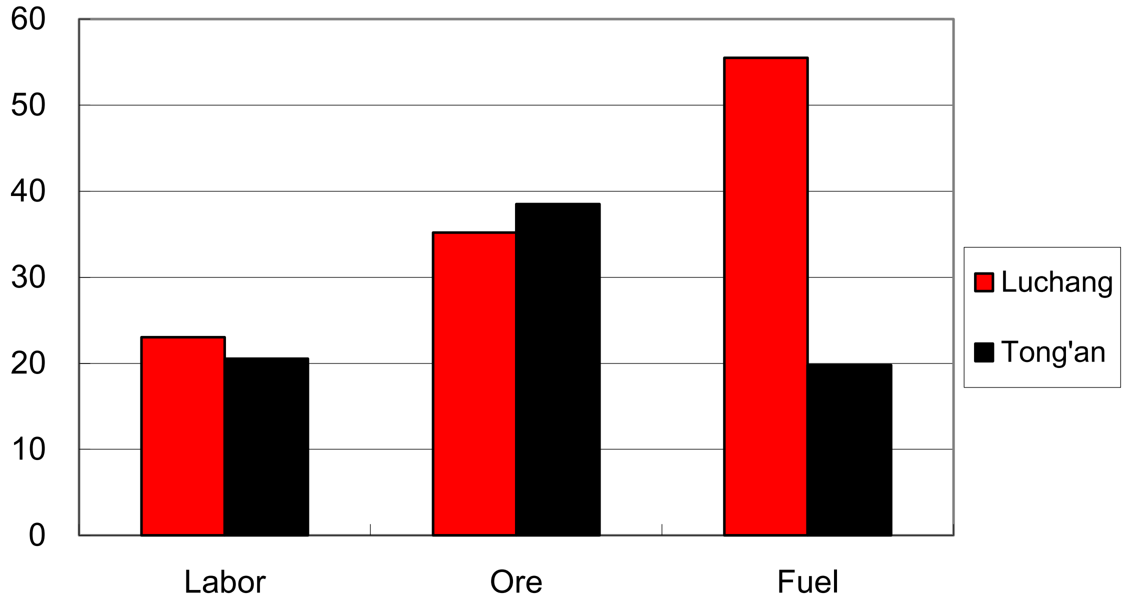
Table 11: Mining workers' payment in the Luchang and Tong'an mines, Huili, ca. 1939[a]

Labor	Payment (in *yuan* 元) per person		Remarks
	Luchang	Tong'an	
"hammer hands" (*chuishou* 錘手)		1.4/month	Food offered by the mine: Twice a month a good meal (*yaji* 牙祭), which was half a *jin* of beef per person.
hauler (*beigong* 揹工)		0.7/month	
furnace head (*lutou* 爐頭)	0.27/day	0.44/day	
"filling the furnace" (*zhuanglu* 裝爐)	0.11/day	0.25/day	
"starting the fire" (*shenghuo* 生火)	0.09/day	0.13/day	
petty worker (*xiaogong* 小工)	0.05/day	0.11/day	
bellow operater, "beat the wind" (*dafeng* 打風)	0.05/day	0.11/day	

[a] Chang Longqing (1939), pp. 60-6, 66, 69; Yu Xiyou (1940), pp. 46-47.

By integrating information about the numbers of different workers and their working days as well as the quantity and prices of ore and coke, it becomes possible to calculate a production cost consisting in labour payments, ore and fuel costs in the Datongchang mine in Luchang[159] and in the Jiangjunshi mine in Tong'an.[160]

Graph 3: Costs for one smelting process, Luchang and Jiangjunshi, Huili, ca. 1939



Besides providing information about the all over production costs of copper, the information on the payments of mine workers also gives an idea about their possible living conditions and their eventual wealth or poverty. The payment numbers according

[159] 16 workers together per day needed payment for 1.44 *yuan*. 3 days and night smelting in the great furnace, 5 times 48 hours in the roasting kiln, and another 3 days and nights in the small smelting furnace, make the entire smelting 16 days. Thus the payments for labor of one smelting process was 11.52 *yuan*. Consuming 16,000 *jin* ore with the price of 0.22 yuan per 100 *jin*, the total ore cost was 35.2 *yuan*. Consuming 7,500 *jin* coke with the price of 0.74 *yuan* per 100 *jin*, the total coke cost was 55.5 *yuan*. See Chang Longqing (1939), pp. 59-60.

[160] Since in Jiangjunshi the ore was also purchased, thus the payments of "hammer heads" and porters can be left out. Thus 16 workers together per day needed payment for 2.74 *yuan*. Within one month four times furnaces were operated, so we can calculate that the working period of one smelting as 7.5 days, so together 20.55 *yuan*. One smelting consumed 3,000 *jin* ore with the price of 3.85 *yuan* per 300 *jin*, so the total ore cost was 38.5 *yuan*. Consuming 1,000 *jin* coke with the price of 1.26 *yuan* per 100 *jin*, the coke cost was 12.6 *yuan*. Consuming 6,000 *jin* firewood with the price of 1.2 *yuan* per 1000 *jin* makes it cost 7.2 *yuan*. Thus the total cost of fuel was 19.8 *yuan*. See Chang Longqing (1939), pp. 67-69.

to Chang Longqing from the 1930s can therefore be contrasted with his data on the prices paid for commodities of daily use during the same period of time in Huili:

Table 12: Prices of groceries in Huili, ca. 1939[161]

Item	Price	Unit
rice	0.025-0.04	yuan per *jin*
soybean	c. 0.02-0.03	yuan per *jin*
wheat	c. 0.02	yuan per *jin*
corn	0.016-0.026	yuan per *jin*
pork	0.1-0.12	yuan per *jin*
cloth	0.09-0.1	yuan per *chi*
salt	from Yunnan: 0.15-0.18	yuan per *jin*
	local: 0.12-0.14	yuan per *jin*

From this it can be seen that a petty worker or bellow operator could use his daily income of 0.05 *yuan* to purchase two *jin* (1 kg) of rice or half a *jin* (250 g) of pork. An ore digger reached a similar income. A leading worker like a furnace head had up to 0.44 *yuan* to spend per day and thus could afford as much as 17 *jin* (8.5 kg) rice or 4.5 *jin* (2.7 kg) of pork daily.

161 Source: Chang Longqing (1939), *nongmu men*, pp. 81-83.

2.3.4 *Fuel supply*

Fuel for roasting and smelting copper in Sichuan consisted in charcoal, firewood and coke or coal. Except for the mines in Huili Department[162], only charcoal and firewood were commonly used[163]. At the mines, there were workers who specialized on producing charcoal for the supply of the smelters. they were called "charcoal households" (*tanhu* 炭戶 or *yaohu* 窑户) [164].

Concerning the proportion between charcoal and refined copper, one example from the Tongda & Fenshuiling mine shows that 2,500 *jin* of charcoal were used for smelting 300 *jin* of copper, thus the ratio was 8.3:1[165]. Of course this ratio varied greatly according to the purity and chemical consistence of the ore, which is further discussed in chap. 2.3.2. Besides, in the Tongda & Fenshuiling mine 100 *jin* of a so-called "wool charcoal" (*yangmaotan* 羊毛炭) was also used. In comparison to the situation in some Yunnanese mines, its copper – charcoal – ratio is still a quite efficient one. According to Yang Yuda (2004) this ration in Yunnan was in the estimated average 10:1[166], according to Vogel (2008) even as high as 14-15:1.[167] Furthermore, Yang estimates the ratio between firewood and charcoal as commonly achieved during the charburning process as 3:1.

The mines in Huili, i.e. Luchang, Tong'an and others used coke or coal as only fuel for smelting ore, while for the roasting process charcoal and firewood were used as well. In chap. 2.3.2.5 data about coke consumption for roasting and smelting copper have already been discussed. In the mines of Luchang, where the purity of ore was as low as 5.45%[168], coke was used for both roasting and smelting purposes, the proportion was ca.

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[162] It was mentioned in an investigation made in 1959 that the Wupo mine consumed coal and that only the workers who were in charge of digging coal already amounted to more than 100, see "Jiefang qian de yi han guanxi" 解放前的彝漢關係 (Relation between Yi and Han before Liberation), in: *Yijiuwujiu nian zonghe diaocha ziliao* 一九五九年綜合調查資料 (Material of a comprehensive survey made in 1959), N. 28. Quoted in Hu Qingjun (1981), p. 183. It seems like that there was coal mine directly at the copper mine. However, in Zeng Zhaolun's field research in 1940s he reported that the region was so lack of fuel, i.e. firewood. Without further information, it would be difficult to picture the fuel consumption in the Wupo mine.

[163] Mabian subprefecture, see *Mabian ting zhilue*. chap. 7, p. 77; Peng District, see Ding Wenjiang (2008, first edition 1928), p. 92; Mianning District, see *Mianning xianzhi*, chap. 5; Leibo subprefecture, see *Qingdai chaodang*, in Peng Zeyi (ed.) (1962), p. 352.

[164] Chang Longqing (1939), pp. 59- 67. It is also mentioned in DNKCTL that Huili had coal as fuel, see p. 12b.

[165] *Qingdai chaodang*, see Peng Zeyi (1962), pp. 351-352.

[166] Yang Yuda (2004), p. 157-174.

[167] Vogel (2008), p. 140.

[168] See chap. 2.3.2.7

17.9:1[169] while in Tong'an, where the ore's purity was with 10.45-11.26%[170] remarkably higher, only the smelting process consumed coke leading to a proportion of 2:1[171].

Coke for Huili's mines was produced in Baiguowan 白菓灣, "a flourishing village" as Baber describes it[172]. From there it was transported to Yimen 夷門 (nowadays written 易門 or 益門) and sold there, thus it was called "Yimen coal"[173]. Originally this coal was produced in the shape of a powder; it first had to be made into coke lumps for transport. Averagely 100 *jin* (50 kg) coal powder (*meimo* 煤末) could yield 70 *jin* (35 kg) of coke after three days' roasting. Besides being consumed by local households and by the zinc smelters in Baiguowan, the majority of the production was sold to the copper mines of Huili and Tong'an. Davies introduces the situation in 1900 and reports that he saw "quantities of mules, donkeys, and coolies carrying this coal towards Hui-li in the forms of coke. All the smelting at the copper mines is done with this fuel."[174] More detailed information on this process can be obtained from the later research of Chang Longqing, of which one interesting aspect are the prices for Baiguowan coal in different places with copper mines and smelters:

[169] 7,500 *jin* of coke for 420 *jin* of refined copper. See Chang Longqing (1939), pp. 59-60.

[170] See chap. 2.3.2.7.

[171] In general every 3,000 *jin* ore needs 1,000 *jin* coke and 6,000 *jin* firewood for roasting, see Chang Longqing (1939), p. 67. It is recorded that every month four furnaces each was operated once, which could yield 2,000 *jin*, thus one furnace operating once could yield 500 *jin* copper. See Chang Longqing (1939), p. 69.

[172] Baber (1882), p. 92.

[173] Chang Longqing (1939), p. 83.

[174] Davies (1909), p. 215.

Map 3: Coal transport routes in Huili Department, ca. 1939

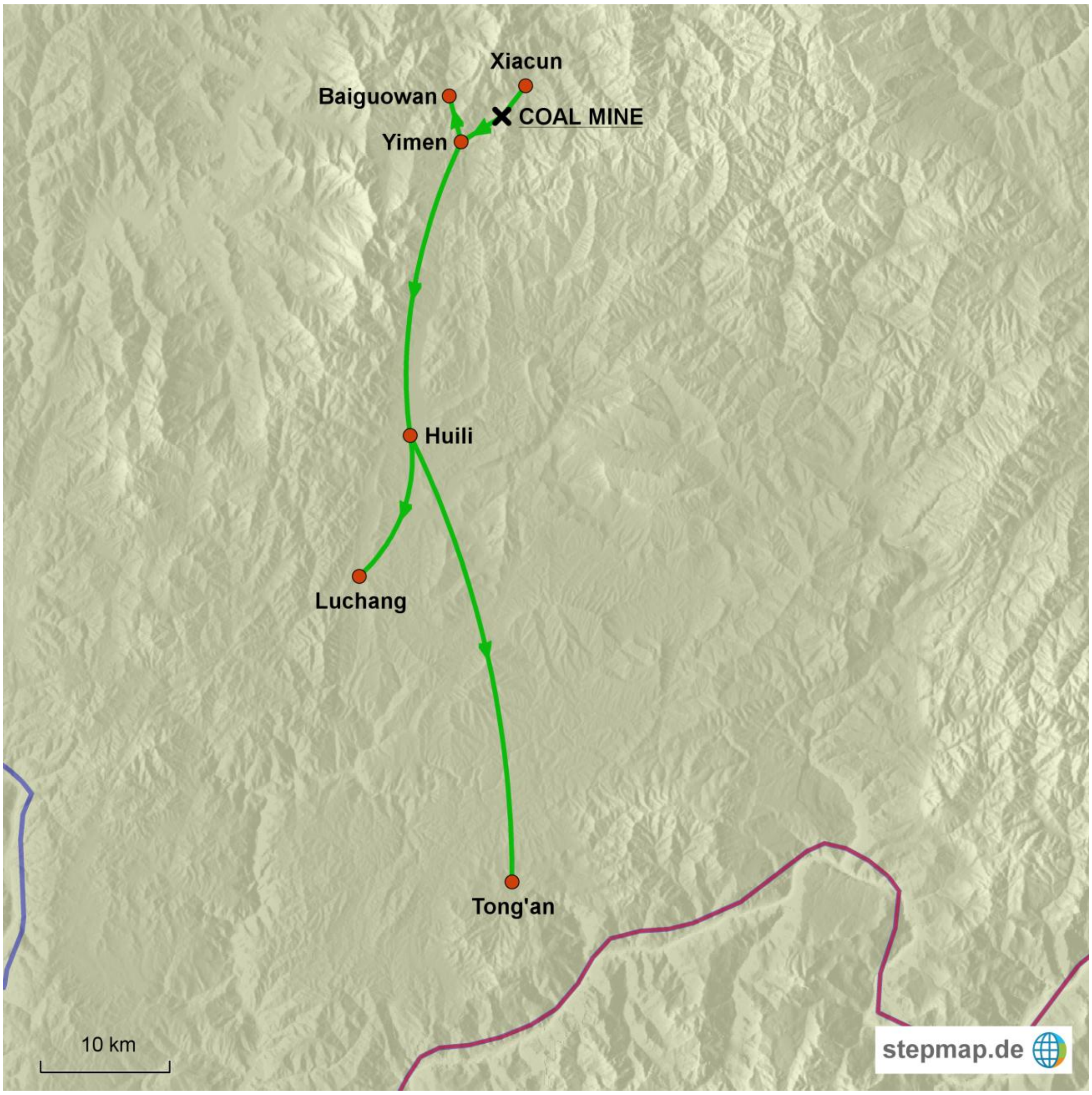


Table 13: Prices of coal from Baiguowan, Huili, ca. 1939[175]

Destination	Price coal powder (*yuan* per 100 *jin*)	Price coke (*yuan* per 100 *jin*)	distance from the producing area (*li*)
local	0.06	0.12	-
Xiacun 下村		0.22	
Yimen 夷門		0.33	60 *li* north of Huili[176]
Huili 會理		0.55	
Luchang 爐廠		0.74	30 *li* the south of Huili[177]. Yimen and back: 4 days[178].
Tong'an 通安		1.26	90 *li* south-east of Huili[179], 150 *li* away from Yimen[180].

From this price structure it can be seen that the transport cost must have been very high; the costs for fuel namely for coke thus made up the majority of the entire cost for producing copper in the Luchang mine.[181]

The source situation for the mines in Tong'an provides the chance to exemplary compare the prices for the different fuels involved in copper production with each other:

[175] Source: Chang Longqing (1939), p. 86.

[176] Chang Longqing (1939), p. 61.

[177] Chang Longqing (1939), p. 56.

[178] Tan Xichou (1959), p. 201.

[179] Chang Longqing (1939), p. 61.

[180] Chang Longqing (1939), p. 68.

[181] Chang Longqing (1939), p 61.

Table 14: Prices of different fuels in Tong’an, Huili, ca. 1939[182]

Fuel	Price (*yuan* per 100 *jin*)	Origin
coke	1.26	Yimen
firewood	0.12	
Anthracite coal	0.38	Bajiaojing 芭蕉箐

To have a clearer understanding of these fuel prices, they can be compared to the contemporary prices for copper ore in Tong’an, which varied between 1.28 and 2.38 *yuan* per 100 *jin*[183]. Thus coke was almost as expensive as the cheapest copper ore.

2.3.5 *Food, oil and other supplies*

Mines needed to be supplied with a variety of other goods. For the striking of ore from the mountain, iron was constantly necessary to provide wooden tools with new metal tips or to replace worn-out iron striking devices; to make work in the deep galleries possible at all they needed to be illuminated, which consumed large amounts of lamp oil. Besides iron and lamp oil many more goods had to be purchased for the operation of mines and smelters such as timber for the construction of the galleries, limestone for the smelting process and building materials for the furnaces.

Since mines were often situated in remote or barren areas and at least full-time miners did not have the time to carry out agriculture, the food supply for miners remains another aspect that cannot be left out under this aspect. Grain transport to remote

[182] Source: Chang Longqing (1939), p. 68.

[183] The ore smelted by the furnace households in Tong’an was purchased from other places. In the Jiangjunshi region, every 300 *jin* cost 3.85-5.50 yuan; in Hongyan 紅岩 and Bajiajing the prices were 5.5- 7.15 yuan per 300 *jin*. Transportation cost was not included. See Chang Longqing (1939), p. 68.

mountain mines was often costly and grain prices at the mines thus very high. At the other hand selling products to miners in the more fertile Huili region must at times even have formed a source of revenue for the local administration as noted by the French traveller Louis de Carné, who passed Huili between 1866 and 1869:

"Le yamen du gouverneur que nous allons visiter ne répond guère à la réputation que s'est faite ce personnage, âpre au gain et concussionnaire émérite. Il prélève un droit considérable sur les négociants qui vont prendre un chargement aux mines de cuivre."[184]

2.3.6 *Output*

2.3.6.1 Problems of reliability

For this statistic, firstly data from the Routine Memorials were used, providing information on the copper quantity procured by the Baochuanju mint. In chap. 2.2.3 it is explained that according to the regulations a certain percentage of the total production would be procured by the Baochuanju mint. Since 1742 the entire production should be handed over to the governmental mint, 20% of them as a tax and 80% purchased at a fixed price. After 1745 only 62.25% of the entire production of a mine needed to be handed over, 20% as tax copper, 4.5% as wastage copper and 37.75% was purchased at a fixed price. But the actual execution of this policy became efficient only with several years delay[185].

By using this information, it is however possible to reproduce the total output of the mines. Due to the incompleteness of the Routine Memorials as well as due to the intention of mine merchants to report lower production numbers in order to avoid paying taxes, the numbers obtained like this need to be regarded as a minimum and definitely remarkably lower than in reality. To supplement these minimum numbers, records from other

[184] De Carné (1872), p. 442.

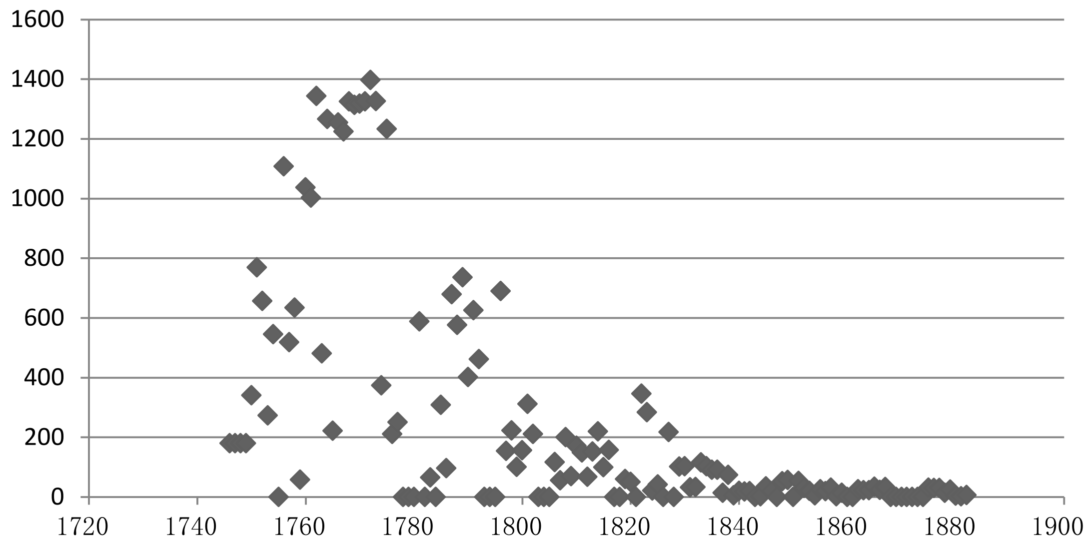
[185] In Laodonggou mine, it was not until 1753, eight years after the policy was made, that the new percentage was obeyed. See RM, 2.179.14817.11; 2.180.14974.12.

sources, such as gazetteers, Palace Memorials, etc., will be consulted in order to achieve realistic estimates.

2.3.6.1 Estimated output of the copper mines

Firstly, the total output of the fourteen most important mines, which covered 98.7% of the entire copper production output of the province[186], is shown in Graph 4.

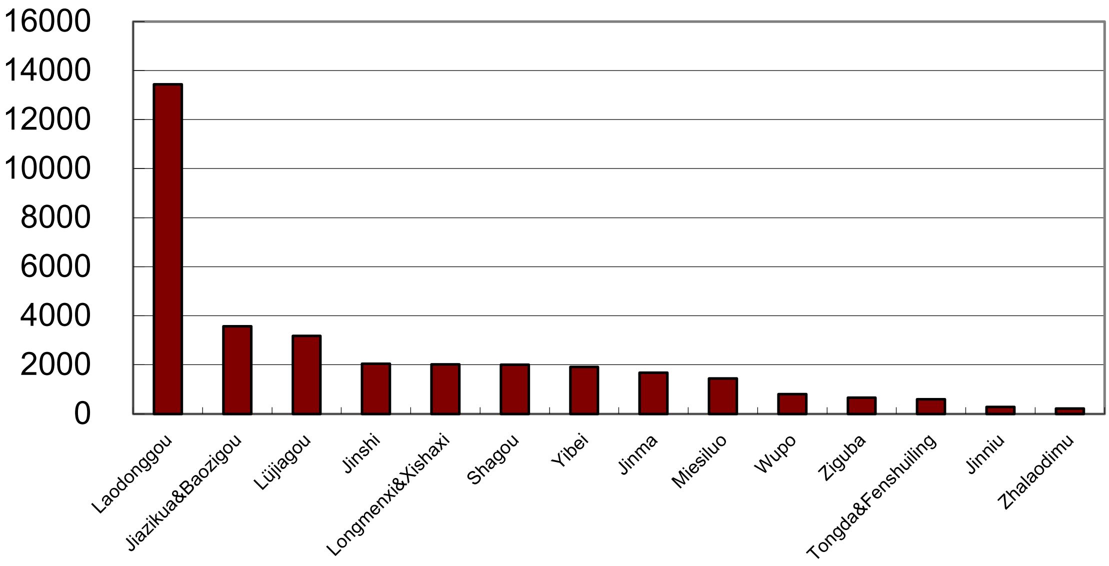
Graph 4: Yearly output of the most important copper mines, 1743-1882 (in ton)



Secondly, the individual output of the fourteen most important mines is introduced. They are displayed in a descending order in in Graph 5.

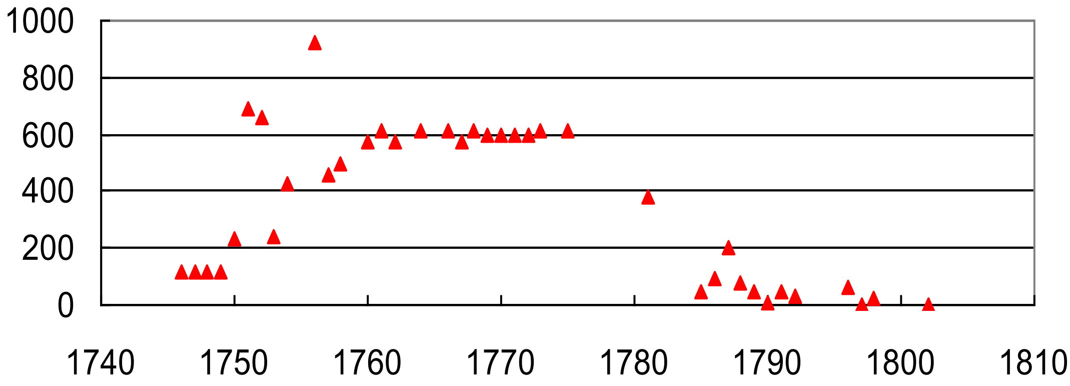
[186] According to the existing routine memorials, the total procured copper from these 36 mines was 37,093,001.5 *jin*, among which 36,612,488 *jin* was from the fourteen big mines, only 480,513.5 was from the rest 22 mines.

Graph 5: Total output of the most important copper mines, 1743-1882 (in ton)



The Laodonggou 老洞溝 mine contributed copper to the mint from 1746 to 1802 and was especially productive between 1751 and 1777. During this period of time, the average annual production reached 585 tons, with a peak of 921 tons in 1756. After 1778, the production declined quickly. The total output over the entire period under observation was 13439 tons, which made it the biggest supplier to the mint. Besides, its production was of the best quality during its time in the whole province.[187]

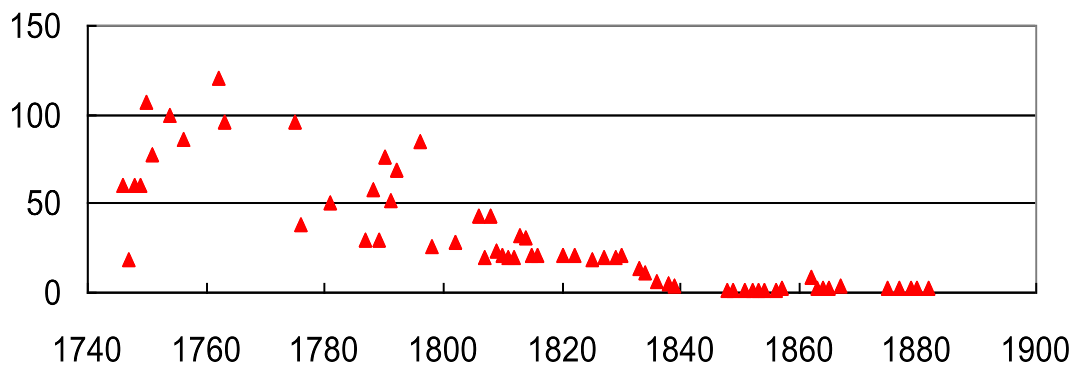
Graph 6: Laodonggou mine: estimated yearly output, 1746-1802 (in ton)



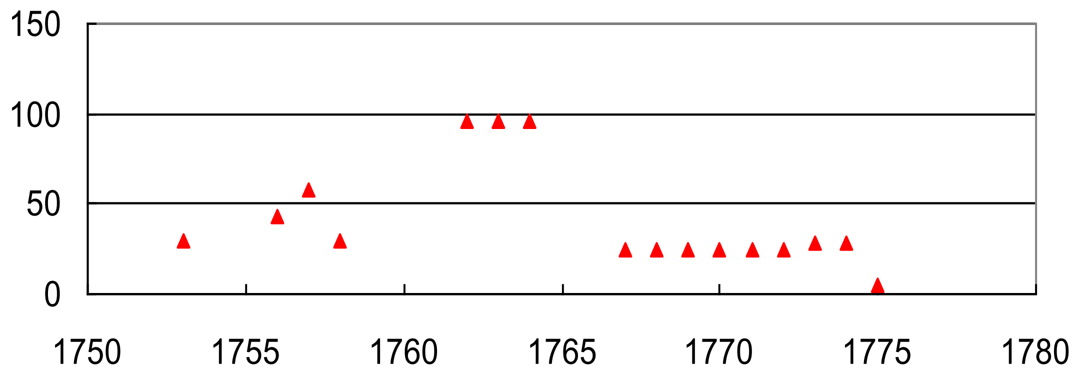
[187] GZDQL, vol. 37, pp. 21-22.

The Yibei 遮北, Ziguba 紫古哵 and Shagou 沙溝 mines are counted together because they shared one Superintending Official (*zongliguan* 總理官) and until 1751 their production procured by the mint was calculated together, too. Among them, the Yibei mine was operated the longest, from 1743 until the end of the Qing period. Shagou and Ziguba were both closed in 1784. Since 1777, the production of Yibei mine declined gradually, but its operation continued with a low output over more than half a century.

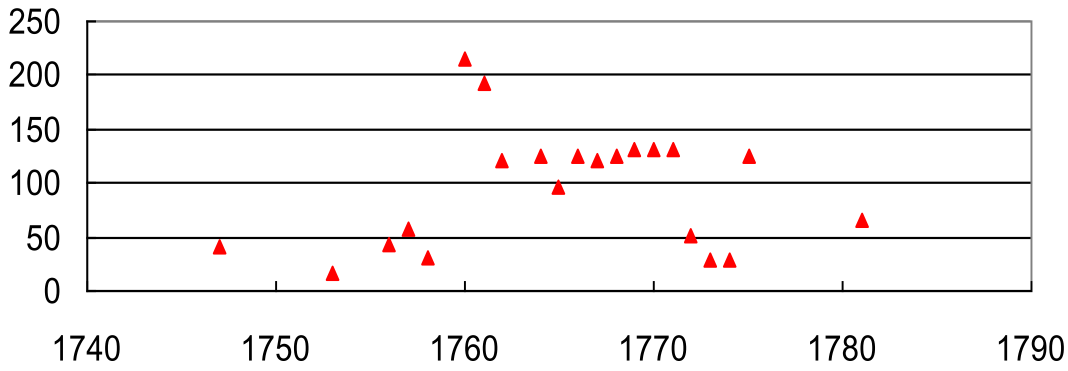
Graph 7: Yibei mine: estimated yearly output, 1743-1882 (in ton)



Graph 8: Ziguba mine: estimated yearly output, 1749-1775 (in ton)

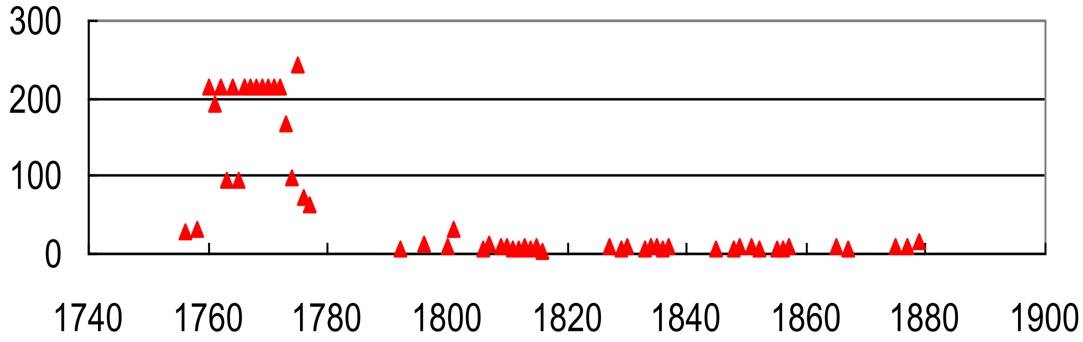


Graph 9: Shagou mine: estimated yearly output, 1747-1781 (in ton)



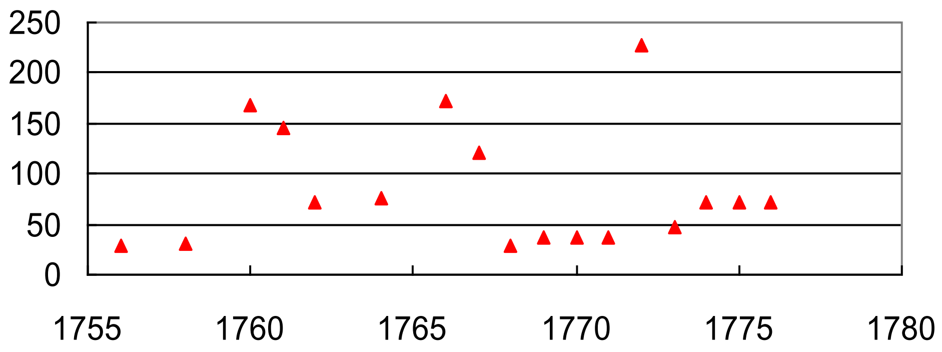
The Jiazikua 甲子夸 & Baozigou 豹子溝 mines were together the second biggest contributor to the mint. Similar to the Yibei mine, it was operated over a long time, declined after 1775, but kept up a low level of production until the end of the Qing period.

Graph 10: Jiazikua & Baozigou mines: estimated yearly output, 1755-1879 (in ton)



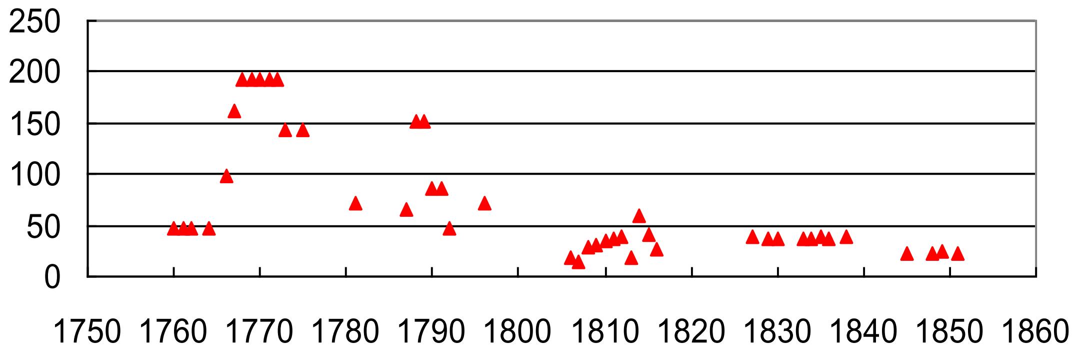
The Miesiluo 蔑絲蘿 mine was closed in the same year as the Shagou and Ziguba mines, and also displays a similar production situation.

Graph 11: Miesiluo mine: estimated yearly output, 1755-1776 (in ton)

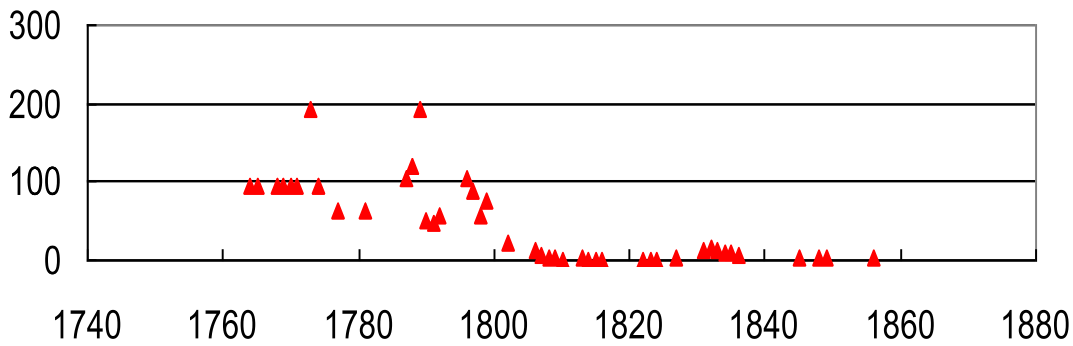


The Lüjiagou 呂家溝 mine was the third biggest contributor to the mint. It showed a long and rather stable output development.

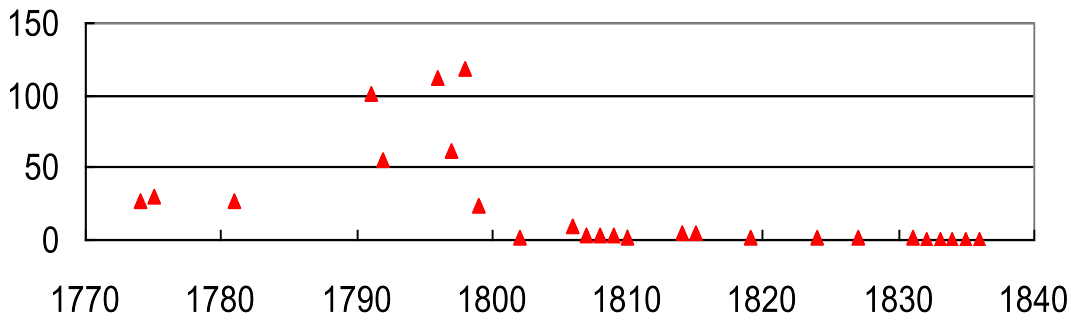
Graph 12: Lüjiagou mine: estimated yearly output, 1759-1851 (in ton)



Graph 13: Longmenxi & Xishaxi mines: estimated yearly output, 1764-1856 (in ton)

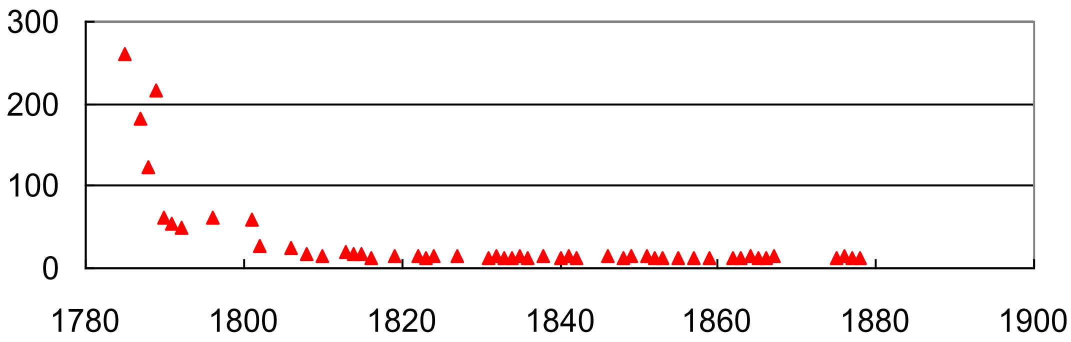


Graph 14: Tongda &Fenshuiling mines: estimated yearly output, 1774-1836 (in ton)

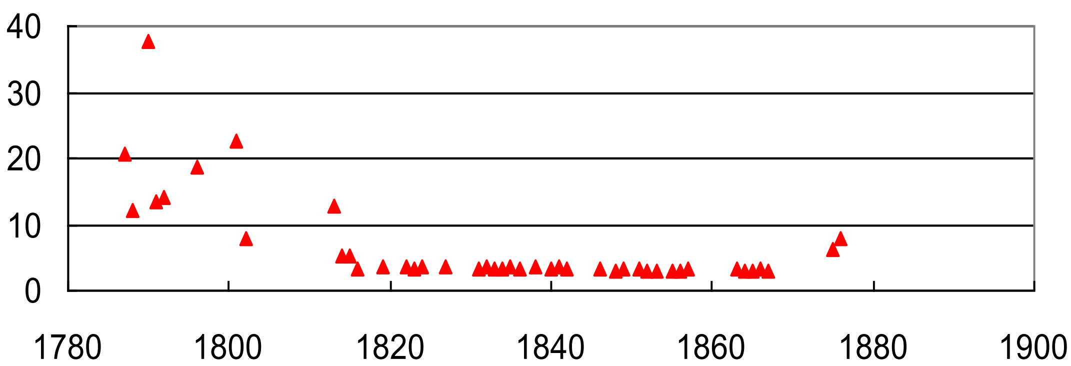


The Jinma 金馬, Jinniu 金牛, and Jinshi 金獅 mines were all opened in 1784 when the old mines of Shagou, Ziguba and Miesiluo were already exhausted and closed down. Their production numbers developed as follows:

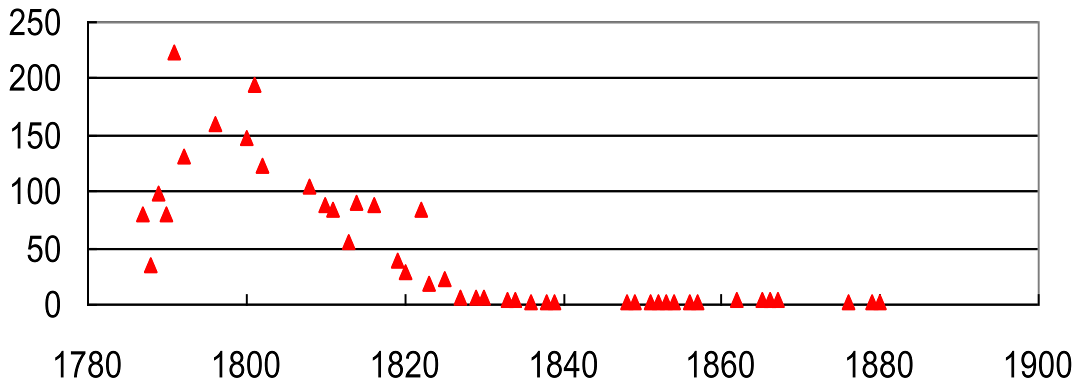
Graph 15: Jinma mine: estimated yearly output, 1785-1878 (in ton)



Graph 16: Jinniu mine: estimated yearly output, 1787-1876 (in ton)

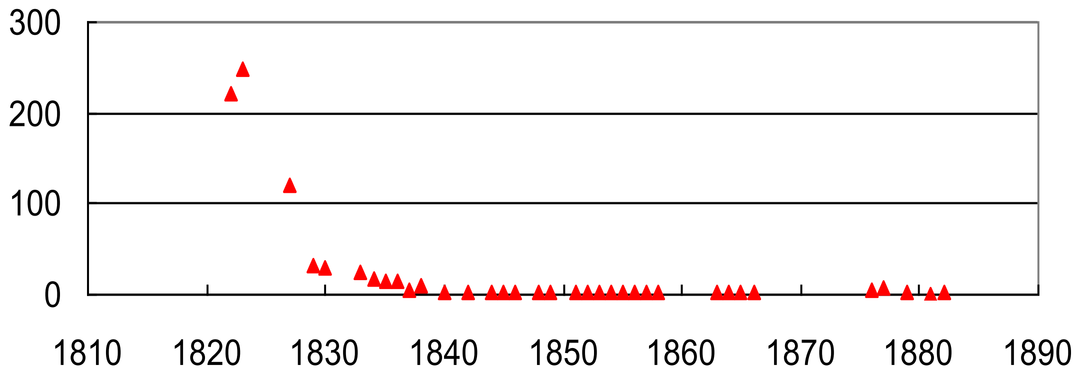


Graph 17: Jinshi mine: estimated yearly output, 1787-1880 (in ton)



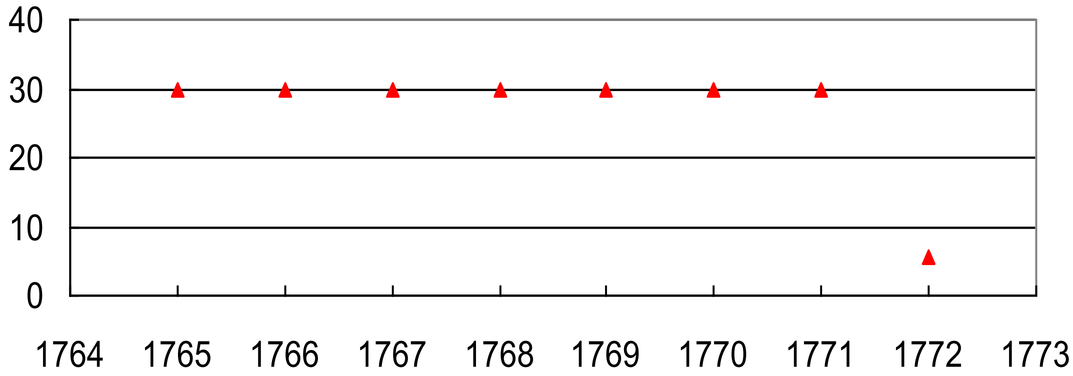
The Wupo 烏坡 mine was opened only in 1818 when the copper overall copper production in Yunnan and Sichuan already declined and was thus given great hopes. At the beginning it yielded over 200 tons per year, but very soon reduced its output due to disturbances by the Yi people.

Graph 18: Wupo mine: estimated yearly output, 1822-1882



The Zhalaodimu 渣澇底母 mine was only in operation for seven years:

Graph 19: Zhalaodimu mine: estimated yearly output, 1765-1772



Due to the scarcity of sources, the other 22 smaller mines' annual output is difficult to analyse. However, compared to the above 14 mines, they only accounted for 1.3%[188] of the total output of copper which was delivered to the mint. From these output numbers and their developments over the time under consideration several observations can be made:

a) The Laodonggou mine contributed the biggest amount of copper, which was 40% of all the copper procured to the mint among all the individual mines. The nine mines which belonged to Ningyuan Prefecture altogether contributed 41.4% of the total copper and thus slightly more than Laodonggou.

b) The shape of the graphs displaying the output development of the Yibei, Jiazikua & Baozigou, Jinma, Jinniu, Jinshi and Wupo mines should be paid special attention to. They all have one feature in common, which is that the production stayed low and stable over a long period from 1800 until the end of the Qing Dynasty. It can thus be suspected that a part of their production was not procured by the mint but leaked onto the free market. Another indicator for this is that just at this time a particularly big amount of merchant copper needed to be purchased by the mint. Hence, the here estimated output numbers of those mines are almost certainly much lower than in reality.

[188] According to the existing routine memorials, the total procured copper from these 36 mines was 37,093,001.5 *jin*, among which 36,612,488 *jin* was from the fourteen big mines, only 480,513.5 was from the rest 22 mines.

2.4 *Distribution*

2.4.1 *Regulations of distribution*

2.4.1.1 General regulations

After the negotiations of the early Qianlong reign-period (see chap. 2.2.3), since 1745 the copper production of a mine was divided into four parts:

a) 20% of it had to be handed over to the government as tax. This was called "tax copper" (*ketong* 課銅);
b) 4.5% of it had to be handed over to the government, but in the form of silver, with a varying value according to the copper price in each mine. It was named "wastage copper" (*haotong* 耗銅). The usage of it was to compensate for the "mine cost" (*changfei* 廠費)
c) The remaining part of the copper was called "surplus copper" (*yutong* 余銅) and was again divided into two halves. One half, i.e., 37.75% of the production would be purchased by the government at various prices which were fixed by the regulations.
d) The other half or 37.75% could be sold by merchants on the free market[189].

2.4.1.2 Special cases

The Wupo mine was a special case: Yunnan made itself involved with Sichuan copper since Jiaqing 23 (1818), when its own copper production was declining. In this year, Yunnan started to buy copper from the Wupo 烏坡 mine in Sichuan's Zhaojue 昭覺[190] region in order to satisfy the demand for metropolitan copper[191]. In 1819 the regulation of Yunnan purchasing copper from Sichuan (*diansheng shoumai chuantong zhangcheng* 滇

[189] GZZL, pp. 113-123.

[190] Zhaojue belonged to Xichang District and only became a district of its own in 1910.

[191] ZPZZ-CZ, 1359-010, 1359-017.

省收買川銅章程), i.e. from the Wupo mine was set up. According to this regulation, there was no fixed quantity of purchase. The production of Wupo first should supply the demand of the provincial mint of Sichuan, all the rest could be purchased by Yunnan[192].

Besides, the Huili mines in the Guangxu reign-period (1875-1908) played a special role, too. In 1891 first Sichuan and then Yunnan both applied to mine copper in the Jiangjunshi 將軍石 area directly at the border between the two provinces. The distribution regulation was that Yunnan should take 60% of the production for supplying the metropolitan demand, while Sichuan took the remaining 40 % for its provincial mint[193]. In 1904 it was decided that there was no tax copper, and the capital had to be given by the state beforehand[194].

2.4.2 *Price statistics*

Concerning the prices of copper, state prices and market prices need to be distinguished. With "state prices" funds are meant, which were offered by the government for the purchase of mint copper. State prices were always lower than the actual market prices. This was possible because of the monopoly position the state held in producing copper.

2.4.2.1 State price (governmental fund)

Half of the "surplus copper" would be purchased by the government at a fixed price. Each mine had its specific price, varying from 6.3 to 12 tael per 100 *jin* (ca. 60 kg) as indicated in the following table[195].

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[192] ZPZZ-CZ, 1359-024.

[193] NQSBSC, "會川銅廠".

[194] Ibid. See also Chang Longqing (1939), p. 64

[195] RM.

Table 15: Copper prices for governmental purchase, 1743-1882

Mine Name	**Price (tael/ 100 *jin*)**
Tuojiaoshan & Baiguoshan 拖角山白菓山廠	12
Laodonggou 老洞溝廠	10
Jianzhugang 箭竹崗	9.8
Lüjiagou 呂家溝廠銅	9.8
Sanfushan Luchiping 三撫山鹿馳坪廠	9.5
Wupo 烏坡廠	9.2
Anjiashan 安家山廠	9
Dabaoshan 大寶山廠	9
Dabenkan 大奔坎廠	9
E'mei 峨眉廠	9
Feiyundong 飛雲垌廠	9
Hongchungang 紅春崗廠	9
Huanglongshan 黃龍山廠	9
Jianzishan 尖子山廠	9
Jinma 金馬廠銅	9
Jinniu 金牛廠銅	9
Jinshi 金獅廠銅	9

Limagou 立麻溝廠	9
Longmenxi & Xishaxi 龍門溪細沙溪二廠銅	9
Meizi'ao 梅子坳廠	9
Shagou 沙溝廠	9
Tongchanggou 銅廠溝廠	9
Tongda & Fenshuiling 銅大分水嶺廠	9
Xinglong 興隆廠	9
Yibei 迤北廠	9
Yingxiyan 鶯喜巖廠	9
Yunyang 雲陽廠	9
Zhalaodimu 渣澇底母	9
Ziguba 紫古哵廠	9
Shangbaoshan 尚寶山廠	8.38
Yulinqiao 玉林橋廠	8
Zhangjiawan 張家灣廠	8
Miesiluo 蔑絲蘿廠	7.5
Jiazikua & Baozigou 甲子誇廠/豹子溝	6.3

The price differences mostly due to the quality and purity of the copper produced in the respective mines. In the case of the first mine, i.e. Tuojiaoshan Baiguoshan Mine, the extraordinarily high price of 12 tael was an exception, because this mine was operated by local officials instead of merchants as an experiment in Jiaqing 12 (1807), at a time when the overall production of copper was very low.[196]

Except for this mine, the copper prices all extended over the range between 6.3 and 10 tael per 100 *jin* (60 kg), among which 9 tael was the most widespread case.

Even compared to the state purchase prices of Yunnan copper and Japanese copper, the price of Sichuan copper was very low. [197] This enabled the mint of Sichuan to cast coins at a lower cost. It also attracted other provinces, e.g. Hubei, Zhejiang and Shanxi to purchase copper from Sichuan.

However, since these prices were regulated prices allowing the government to purchase from the merchants, and since it did not change over time according to the rising market price, the difference between the two prices grew, making profitable mine operations for the merchants increasingly difficult. As a consequence of this, copper procurement by the mints became more and more problematic, too.

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2.4.2.2 Market prices

While governmental purchase prices are well documented in numerous official reports, as a matter of fact remaining information on market prices are much scarcer. Nonetheless several mentions in different types of sources provide a rough image about the scope of market prices, their development and the fact, that they were higher than governmental purchase prices at any time.

[196] ZPZZ-CZ, JQ 10.

[197] See for example, GZDQL, vol. 19, pp. 842-843, QL 28/12/8, Suolin, Provincial Treasurer of Zhengjiang reported that the state purchasing price for Japanese copper was 17.5 tael per 100 *jin* and for Yunnan copper was 13.4-13.5 tael (Jinchai mine 金钗廠) and 14.6-14.7 tael (Daxing mine 大興廠).

Table 16: Copper prices on the Market, 1763-1939

Time	Origin	Selling place	Price per 100 *jin*	Source
1763	Sichuan	producing area	10 tael	GZDQL, vol. 19, pp. 581-583
		Weining, Guizhou	12.1 tael	
1804	(Jianchang)	producing area	10 tael	ZPZZ-CZ, 1351-026
		Chengdu	16-17 tael	
1899	Huili	producing area	24-25 tael	NYFS
1904	Tong'an, Huili	producing area	28 tael	Liu Danwu 劉丹梧 (1934)
		Chengdu	40 tael	
1914	Tong'an Huili	producing area	20 tael	Ding Wenjiang (1947), p. 36
1939	Luchang, Huili	producing area	25-30 *yuan*	Chang Longqing (1939), p. 60
1939	Tong'an, Huili	producing area	23-25 *yuan*	Chang Longqing (1939), p. 69

2.4.3 *State part*

2.4.3.1 Mint metal

As described above, according to the regulation, 20% of the copper production would be handed over to the government as tax, 4.5% as wastage and 37.75% would be purchased by the government. Thus 62.25% of the entire production can be regarded as the state part. This part of copper mainly served the use as mint metal, in exceptional cases also the construction of weaponry.

The unit of the copper handed over to the mint was called *hao* 號, one *hao* being 128 *jin* (ca. 76.8 kg). The reason for the use of this unit laid in the convenience for calculation of the distribution according to the regulations: When procuring one *hao* of copper, exactly 100 *jin* had to be bought at the fixed state price while 20 *jin* were directly handed over as tax copper, and the remaining 8 *jin* were wastage copper for the possible loss due to abrasion.[198]

Most of this state part directly went to the provincial mint of Sichuan, i.e. the Baochuanju 寶川局 in Chengdu. This part will be discussed in detail in Chapter 4.

Besides providing copper for its own mint, Sichuan also supplied other provinces with mint metal. Between Qianlong 17 (1752) and Qianlong 28 (1763), Sichuan's copper industry had its most blooming period; during this time it even once supplied the central mints in Beijing and was several times purchased by Shaanxi, Hubei, Shanxi.

- **Shaanxi.** Since 1752, Sichuan stopped providing Shaanxi directly with finished coins but instead sold 250,000 *jin* (ca. 150 tons) of copper annually. This copper was fully supplied by the Laodonggou mine.[199] In 1754, another 10,000 *jin* (ca. 6 tons) were added, of which 80% came from Laodonggou, 20% from Jianchang.[200] Until when was it operated is still to be checked.
- **Beijing.** In Qianlong 19 (1754), Sichuan stored more than 2.2 million *jin* (ca. 1320 tons) of copper, which was much beyond the yearly demand of its mint at that time being just as few as 600,000 *jin* (ca. 360 tons). Thus the Qianlong Emperor ordered Sichuan to deliver its copper to support the metropolitan mints. Huang Tinggui 黃廷桂, Governor-general of Sichuan, decided to deliver 1,400,000 *jin* (ca. 840 tons) of copper from the Laodonggou mine to Beijing. This copper was attached to the copper convoy from Yunnan.[201]
- **Hubei.** In the same year, Hubei purchased 20,000 *jin* (ca. 12 tons) of copper from Sichuan. According to a report by the Governor of Hubei, Zhang Ruozhen 張若震, Hubei's provincial mint depended on copper from Japan and Yunnan as well as from

198 NYFS, chap. "旱運馱腳情形".

199 RM, 2.178.14692.4.

200 GZDQL, vol. 9, p. 820.

201 GZDQL, vol. 7, pp. 795-796.

the copper market in Hankou. Due to the lack of Japanese copper (*yangtong* 洋銅) as well as the high price of the copper in the Hankou market (*hantong* 漢銅), which cost as much as 17-18 tael per 100 *jin*, he decided to purchase copper from Sichuan. Having worked as Provincial Treasurer of Shaanxi, he already knew about the possibility and advantage of buying Sichuan copper was cheap and available in large amounts at the time. As a result, 20,000 *jin* (ca. 12 tons) were purchased.[202] Including transport expenses, Sichuan copper cost 11.1 tael per 100 *jin*.[203]

In QL 22 (1757), Hubei purchased 200,000 *jin*.[204] In QL 24 (1759), Hubei purchased again 200,000 *jin* of copper from Sichuan, among which 40,000 *jin* came from the mines in Ningyuan, 16,000 *jin* from the Laodonggou mine.[205] This also became a regular yearly action[206] until QL 28 (1763) when the production of Sichuan copper began to decline.[207]

- **Shanxi.** In QL 21(1756) Shanxi applied to purchase copper from Sichuan and once received 500,000 *jin* (ca. 300 tons).[208]
- **Zhejiang.** In QL 28 (1763) Zhejiang applied to purchase copper from Sichuan too. Zhejiang had always relied on copper from Japan and Yunnan, the former was sold at 17.5 tael per 100 *jin* and could not arrive on time, the latter at 13.4-14.7 tael per 100 *jin* but its purity proved to be not satisfying. Thus the Zhejiang mint also applied to purchase copper from Sichuan[209]. However, it is unknown whether this application got approved. From the cancel of the annual Hubei purchase in the same year, we can assume that this application was not carried out.

[202] GZDQL, vol. 9, pp. 827-829.

[203] GZDQL, vol. 19, pp. 842-843.

[204] ZPZZ-CZ, 1250-035.

[205] RM, 2.182.15200.9.

[206] ZPZZ-CZ, 1251-013.

[207] GZDQL, vol. 19, pp. 468-470.

[208] GZDQL, col. 19, pp. 837- 838.

[209] GZDQL, vol. 19, pp. 842-843.

Because of the blooming of its copper production Sichuan could supply various provincial mints as well as the metropolitan mints over a period of eleven years. However, on the long run, especially compared with Yunnan, Sichuan was not a stable supplier.

2.4.3.2 Weaponry

The state part of copper also served for the construction of weaponry when necessary. In QL 38 and 39 (1773-1774) during the Jinchuan 金川 Campaign, high quality copper was urgently needed for making canons. In this case the best copper stored in the Baochuanju needed to be delivered to the military camps. 60,000 *jin* (ca. 36 tons) of copper were needed per year.[210]

2.4.4 *Merchant and market part*

According to the regulations, 37.75% of the copper production belonged to the copper merchants, who could sell it freely on the market. This copper was for example used for making copper utensils but at times also integrated into the copper procurement of the mints. .In fact, the big difference between the market price and the state purchasing prices made it profitable for the merchants to increase the market part beyond the ratio determined in the regulations. To pursue this, a series of different types of abuses appeared, such as the production of contraband copper or counterfeiting, which will still be dealt with in chap. 2.6. The existence of abuse makes it extremely difficult to carry out a quantitative analysis of the actual amounts of merchant copper produced and sold in Sichuan beyond the method of purely deducting them from the 62.25% reported by the mints.

[210] GZDQL, vol. 36, p. 651; vol. 37, pp. 21-22. See also Theobald (2009), p. 226.

2.4.4.1 Mint

The question, how this merchant or market copper was distributed is much more complex one than in the case of the state part. Still, a big share was actually purchased by the mints. The Baochuanju counted on large amounts of market copper since 1790[211]. At the same time, Sichuan market copper was also used by the mints of Yunnan and Guizhou. For example, the mine in Huili liked to sell their “complete, big and good” copper (*zheng da hao tong* 整大好銅) to the mint in Dongchuan Prefecture 東川府 in Yunnan.[212] In the case of Guizhou, in QL 27 (1763), it was noted that annually ca. 200,000 *jin* (120 tons) of Sichuan market copper appeared in the market of Weining 威宁 in Guizhou. Its price was slightly above 10 tael per 100 *jin*, together with transport cost ca. 12.1 tael[213]. It was planned to establish the purchase on a regular yearly basis. However, after trying it for only one year it turned out that the market copper’s quantity was not stable and the price increased.[214]

2.4.4.2 Copper utensils

To the opposite of the copper which was “complete, big and good”, this being scattered and few and of lower quality (*lingxing di tong* 零星低銅) was sold to the local copper shops for making utensils.[215] Copper utensils were various and could be found in many fields of life. Alexander Hosie listed the scope of copper utensils produced in Sichuan as the following:

“Ch'engtu is a great centre for the manufacture of copper and brass ware. Kitchen utensils of all kinds, such as pots, pans, basins and spoons, tobacco pipes, lamps, candle-sticks, locks, hinges, buttons, images, bells, gongs, musical instruments, weighing

[211] See chap. 4.3.1.

[212] NYFS, chap. “各廠爐商積弊”.

[213] GZDQL, vol. 19, pp. 581-583

[214] GZDQL, vol. 19, pp. 581-583.

[215] NYFS, chap. “各廠爐商積弊”.

scales, and other articles too numerous to mention are here made of copper or a mixture of copper and zinc. "[216]

2.4.4.3 Rent and protection fee for the Yi people

In those mines which were located in the territories controlled by the Yi people, Han miners needed to pay rent, sometimes also called "protection fee" to their Yi landlords in order to be allowed to mine copper. For example, in Zhaojue 昭覺 region, where the famous Wupo mine was located, the rent could make up a certain percentage up to half of the entire annual copper production.[217] In the Jiangjunshi 將軍石 mine in Huili, the miner family Kang 康 also had to pay protection fee to a *tusi* 土司, the local Yi chieftain Lu Shouchun 祿壽春.[218]

[216] Hosie (1922), p. 166.

[217] Baber (1882), p. 91.

[218] Kang Bingkun (1997), p. 145.

2.5 *Delivery and transport*

2.5.1 *Organization*

The transportation of mint metal in Sichuan was originally planned in the way that rich "grain-tax-people" (*liangmin* 糧民) would be recruited to work as licensed brokers (*yahang* 牙行) and to take over the organization of transportation tasks. As soon as 5,000 *jin* (ca. 3 tons)[219] of copper were stored at a mine, the Mine Official should send his trusted runners out to escort the transport.[220]

From a later source it is known that there was a type of "protecting [transport] ticket" (*hupiao* 護票) which was given out by the prefecture with a seal of the Prefect (*fuyin* 府印) on it, in order to "distinguish the state [copper] and private [one]" (*yi bie gongsi* 以別公私).[221] However, on the tickets no time limitation nor the quantity of copper was recorded. Another distinction between private transports and those under the protection of the state can be seen from some observations the Australian traveller George Earnest Morrison made on his journey from China to Burma in 1894 and 1895 when crossing the border between Sichuan and Yunnan:

"For miles we mounted upwards. We were now in Yunnan, 'south of the clouds' — in Szechuen we were always under the clouds — the sun was warm, the air dry and crisp. Ponies passed us in long droves; often there were eighty ponies in a single drove. All were heavily laden with copper and lead, were nozzled to keep them off the grass, and picked their way down the rocky path of steps with the agility and sureness of foot of mountain goats. Time was beaten for them on musical gongs, and the echoes rang among the mountains. Many were decorated with red flags and tufts, and with plumes of the Amherst pheasant. These were official pack animals, which were franked through the likin barriers without examination."[222]

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[219] A source from later time shows that every 10,000 *jin* should be gathered before delivery. See GZDQL, vol. 59, pp. 567-569.

[220] MQDA, A107-120, pp. 16-17.

[221] NYFS, chap. "旱運馱腳情形".

[222] Morrison (1902), p.85f.

From the above mentioned plan, the issue of tickets and the facts that the transports from the mines were escorted by runners, it can be seen that at the early stage of the operation, there was neither responsible official nor time limitation in the process of mint metal transportation. This was different from the metropolitan copper (*jingtong* 京銅) transport. In Sichuan, the governmental control played a rather unimportant role and was rather loosen. This again resulted in many problems, among which frequent delivery delays and the production of contraband copper were the two biggest ones.

In order to speed up the transport, in the 49th year of the Qianlong reign-period (1784), time limitation was regulated. At that time, the production of copper was located mainly in Ningyuan Prefecture, thus the regulation was only concerning this area. Every mine belonging to Ningyuan should deliver its monthly production to the prefecture within the first ten days of the next month. As soon as it reached Ningyuan, it should be forwarded to Chengdu, no later than on the 15th of the month.[223]

At the same time, check points were set up to control the transportation.. Thus three check points were established at the "Flying-dragon-pass" (Feilongguan 飛龍關) in Ya'an District 雅安縣, "Bamboo-groove-ravine" (Jiancaogou 梘槽溝) and Rema-ravine (Remagou 熱麻溝)[224]. The Registrar (*jingli* 經歷) of Ningyuan Prefecture was ordered to be frequently present at those check points. Furthermore, secretaries (*shuji* 書記) and runners (*xunyi* 巡役) were employed for their operation. Holding official scales (*guancheng* 官秤) and stamps (*chuoji* 戳記), they were in charge of examining the tickets of transport. Only when the amount of transported copper was identical with the information on the tickets, they would let a convoy pass. Otherwise the transporters would be sent to the Magistrate for inquiry.

The intention was, that by limiting time and by setting up check points, the transport would be more efficient and under a better control.

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[223] TZBL, chap. 6, "寧遠府各廠銅解交本府運省期限". GZDQL, vol. 59, pp. 567-569.

[224] TZBL, chap. 6, "飛龍關等處書巡工食并稽查章程".

2.5.2 *Routes and transport means*

Generally speaking, the routes for copper transportation led from all the mines to the provincial mint, the Baochuanju in Chengdu.

Transport means can be divided into three types: carriers (humans) and pack animals (horses, mules, donkeys) for the land way, and rafts and ships for the waterway. Because the mines were mostly located in steep mountainous regions where the transport conditions were very difficult, in the cases of many mines, copper first needed to be transported by carriers, which was the most expensive means of transport. The transport by animals was a little cheaper and shipping was by far the cheapest.

- **Route 1.** Yibei 迤北 to Chengdu.
- **Route 2.** Shagou 沙溝 to Chengdu.
- **Route 3.** Ziguba 紫古哵 to Chengdu.

  For details about these routes, see the case study of the mint metal transport situation from Ningyuan Prefecture to Chengdu (see chap. 2.5.4)

- **Route 4.** Laodonggou 老洞溝[overland]Tonghe 銅河[waterway]Jiading Prefecture 嘉定府[waterway]Chengdu.
- **Route 5.** Longmenxi & Xishaxi 龍門溪細沙溪[horse]Tanku 炭庫[waterway]Niuhua Stream 牛華溪[waterway]Jiading Prefecture River 嘉定府河[waterway]Chengdu.
- **Route 6.** Lǚjiagou 呂家溝[carrier]Yingjing District 滎經縣[unknown] Chengdu.
- **Route 7.** Miesiluo 蔑絲蘿[carrier]Xichang District 西昌縣[horse]Chengdu.
- **Route 8.** Jiazikua 甲子夸[carrier]Changmajie 長馬街[horse]Yanyuan District 鹽源縣[unknown]Chengdu.[225]

[225] Route 1-8, see GZZL, pp. 115-116, p. 118, p. 120, pp. 121-122, p. 123, p. 125.

- **Route 9.** Tongda Fenshuiling 銅大分水嶺[horse]Shuitianping 水田坪[waterway]Chengdu.[226]
- **Route 10.** Jinshi 金獅 mine[carrier]Fenshuiling 分水嶺[landway]Jiancheng [landway]Chengdu.[227]
- **Route 11.** Jinniu 金牛 mine[carrier]Shuang'e 雙莪 to Chengdu.[228]
- **Route 12.** Jinma 金馬 mine[carrier]Jianchang 建昌 to Chengdu.[229]
- **Route 13.** Wupo 烏坡 mine[carrier]Jianchang 建昌 to Chengdu.[230]
- **Route 14.** Wupo 烏坡 mint[carrier]Huangcaoping 黄草坪[waterway]Luzhou 瀘州[231], from where the copper convoy would continue towards Beijing.

2.5.3 *Route lengths and funds*

For each transport means, there were regulations concerning the funds provided by the government:

a) Carriers: for one carrier carrying every 50 *jin* (ca. 30 kg) of copper over a distance of 50 *li* (ca. 29 km), the fund was 0.07 tael. When he returned without carrying copper (*konghui* 空回), for every 80 *li* (ca. 46 km) the fund was 0.03 tael.[232]

b) Pack animals: for every standardized distance between two landway stations (*zhan* 站), which was 80 *li* (ca. 46 km), the fund for transporting 100 *jin* (ca. 60 kg) was 0.1 tael.[233]

226 Route 9, RM, 2.204.18114.13.

227 Route 10, RM, 2.207.18472.13.

228 Route 11, RM, 2.209.18650.9.

229 Route 12, RM, 2.209.18650.7.

230 Route 13, RM, 2.224.20056.7.

231 Route 14, DNKCTL, chap. 2, p. 14.

232 TZBL, chap. 6, "四川銅斤運腳雜費".

233 TZBL, chap. 6, "四川銅斤運腳雜費".

c) Shipping: for every standardized waterway station, which was also 80 *li*, the fund for transporting every 100 *jin* was 0.024 tael.[234]

Besides, for every 3,000 *jin* of copper, one escort runner was employed also receiving a fund, which was 0.04 tael per station. The definition of the length measure "station" was also 80 *li* with copper and 50 *li* without copper.[235]

The table below provides an overview over the funds necessary for transporting copper from each mine to the provincial mint[236].

Table 17: Governmental funds for copper transport, 1743-1882

Nr.	Mines	Carrier (*li*)	Horse (*li*)	Waterway (*li*)	Route length (*li*)	Transport fund for 100 *jin* (tael)
1	Yibei		2160		2160	2.7
2	Shagou		1920		1920	2.4
3	Ziguba		1680		1680	2.1
4	Laodonggou		20	830	850	0.274
5	Longmenxi & Xishaxi		160	1020	1180	0.506
6	Lüjiagou	35	520		555	0.79
7	Miesiluo	250	1600		1850	2.887
8	Jiazikua	300	2260		2560	3.89

234 GZZL, p. 118.

235 TZBL, chap. 6, "四川銅斤運脚雜費".

236 Route 1-8, see GZZL, pp. 113-125; Route 9, see RM, 2.204.18114.13; Route 10, see TZBL, chap. 6, "四川銅斤運脚雜費"; Route 11, see RM, 2.209.18650.9; Route 12, see TZBL, chap. 6, "四川銅斤運脚雜費"; Route 13, see TZBL, chap. 6, "四川銅斤運脚雜費"; Route 14, see DNKCTL, chap. 2, p. 14, "附四川寧遠府經管烏坡廠".

9	Tongda & Fenshuiling		160	1020	1180	0.506
10	Jinshi	200	1840		2040	3.01
11	Jinniu	300	1840		2140	3.365
12	Jinma	200	1600		1800	2.71
13	Wupo	400	1600		2000	3.42
14	Wupo	415.5		640	1055.5	2.448

From the funding regulations a preliminary overview of the transport cost can be achieved. However, in reality, the funds could normally not meet the actual costs. The real transport cost was much higher than the governmental allowance. A case study of the transport situation of the copper from Ningyuan Prefecture can illustrate this.

2.5.4 *Case study: mint metal transport from Ningyuan to Chengdu*

In the late 19th century, Sichuan's copper production was focused in the Ningyuan Prefecture. In the book *Ningyuan fushu tongkuang qingxing qingce* 寧遠府屬銅礦情形清冊 (Comprehensive handbook of copper mining in Ningyuan Prefecture), the transport situation was recorded in two chapters, namely "situation of the landway 旱運馱腳情形" and "situation of the waterway 水運筏船情形". The whole process was divided into six steps.

The first step was to transport copper from the mines to the nearest copper bureaus (*ju* 局) in the districts and departments. The transport cost of this distance was covered by the mine merchants themselves. There were three copper bureaus at that time, one in Huili Department 會理州 and two in Yanyuan District 鹽源縣:

- Huili Department: the average distance from the mines to the bureau it was 130 *li*, cost 0.3 tael (per 100 *jin*).

- Yanyuan District: the average distance from the mines to the bureau Yanjing 鹽井 was 40 *li*. From the mines to the bureau Hangzhou 杭州 it was between 20 and 50 *li*.

The second step was to transport the copper from the copper bureaus in the districts and departments to the central bureau in Ningyuan Prefecture. Different from the last step, the unit of these distances were so-called "big *li*" (*dali* 大里) rather than *li*. From the Huili, Yanjing and Hangzhou bureaus to Ningyuan, the distances were respectively 310, 320 and 180 "big *li*". The transport cost of this distance was covered by the copper purchasing price, namely, the fund. However, the fund was not sufficient to meet the cost, for example, from the Huili bureau to Ningyuan, the distance was 310 "big *li*" and it took six days and cost 1,600 *wen*, while the allowance of the fund was only 0.4 tael, which equaled 520 *wen*, less than one third of the real cost. The rest needed to depend on the help (*bang* 幫) of brokers called "Help-transport-brokers" (*jiaogui banghang* 腳櫃幫行).

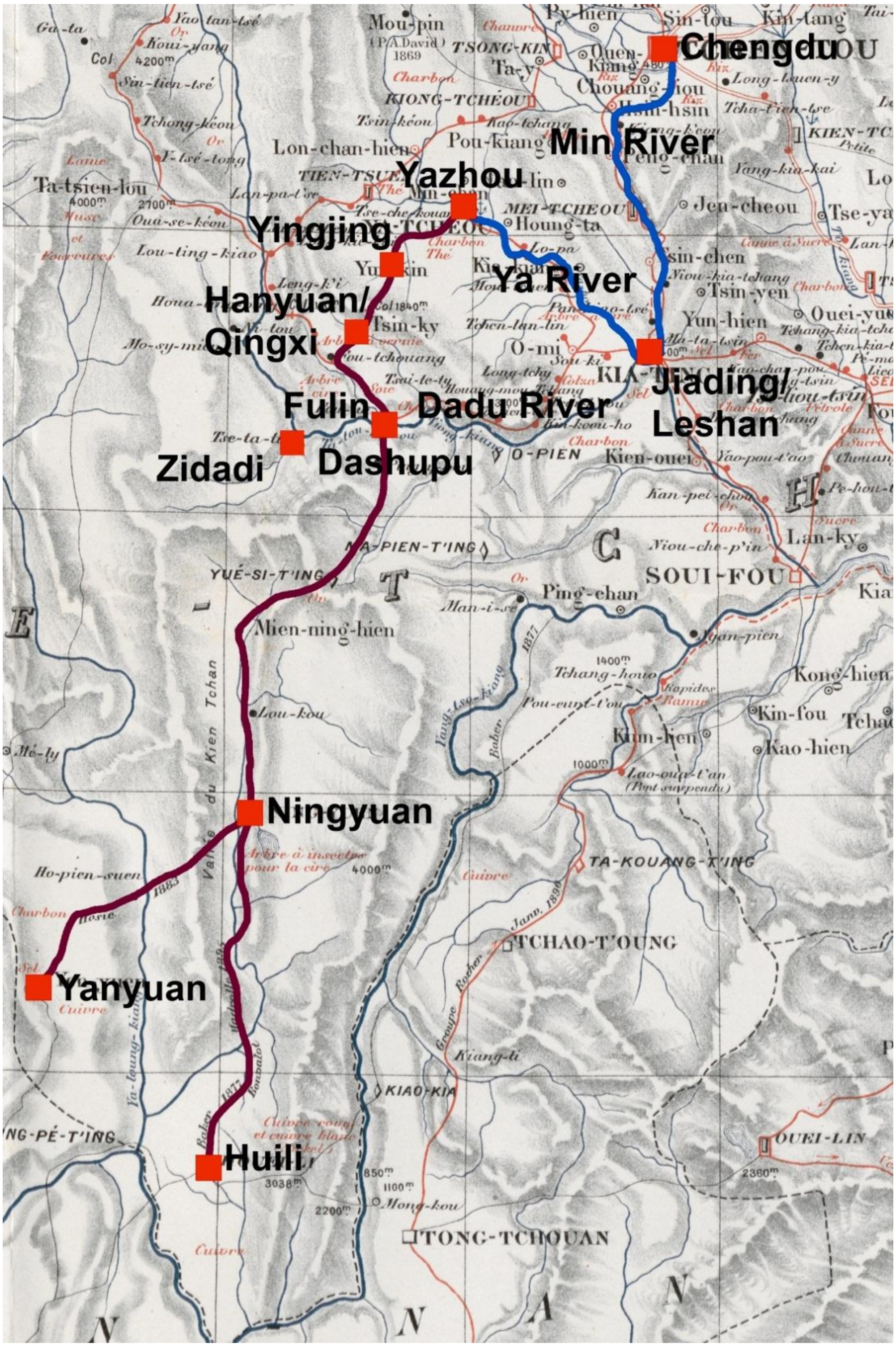
Table 18: Funds for transport from three copper bureaus to Ningyuan, ca. 1900

Origin	**distance (big *li*)**	**duration**	**fund per 100 *jin* (silver / coins)**	**actual cost per 100 *jin***
Huili Bureau	310	6 days	0.4 tael / 520 *wen*	1600 *wen*
Yanjing Bureau	320	6 days	0.6 tael / 700 *wen*	1700-1800 *wen*
Hangzhou Bureau	180	3 days	0.4 tael / 520 *wen*	800-900 *wen*

The third step was from Ningyuan Prefecture to Yazhou Prefecture 雅州府. This distance consisted in 910 "big *li*" and the transport duration was 13 days. Because in this transport one pack animal carried one hao of copper (128 *jin* [76.8 kg])[237], the transport cost was calculated per hao. The fund for this distance was 1.5525 tael per 100 *jin*.

[237] See chap. 2.4.3.1.

Map 4: Transport routes from Ningyuan to Chengdu, 1900[238]



[238] This map is based on the map of Sichuan compiled by the Mission Lyonnaise in 1898, see: Chambre de Commerce de Lyon (1898). It is very suitable for the reconstruction of the transport routes, because it reflects the situation of existing overland routes only two years before the time of the case study.

Although theoretically the fund per pack animal should be calculated by the unit of *hao*, i.e. 128 *jin*, in fact only 120 *jin* counted, which was an example of skimp by the government. Thus for every 120 *jin* the fund was 1.863 tael or ca. 2100 *wen*. However, the real cost of this distance was 4,500-4,600 *wen*, more than twice as much as the fund. Again, brokers were needed to solve the problem.

From Ningyuan to Yazhou, the transport needed to cross the Dadu River 大渡河. The brokers and their transport teams at both sides of the river did not cross it, thus the copper transport had to stop here, cross the river, and then hire a new broker at the other side. This process was called "changing the brokers" (*zhuanjiao* 轉腳). In order to organize the transport better, two "Copper Stations" (*tongzhan* 銅站) were set up at both banks of the river. At the south bank there was the Dashupu 大樹堡 (also pronounced as Dashubao) station, while to the opposite side there was Fulin post-station 富林驛, both were equipped with secretaries who were in charge of hiring brokers (*jiaogui shuban* 腳櫃書辦).

Sometimes it was difficult to hire enough brokers to carry on the transport immediately, so that waiting was necessary. Besides, to utilize all the brokers as much as possible, two routes for the convoys were distinguished. One was called "Long Convoy" (*changyun* 長運), which led directly from here to Yazhou Prefecture. The other one was called "Short Convoy" (*duanyun* 短運) and led via the Hanyuan 漢原(源) copper station, which was 60 *li* away from Fulin post-station. From there, new brokers were hired to forward the transport to Yazhou. Likewise, secretaries were installed in this station.

There was yet another copper bureau at Zidadi 子打地 also belonging to Ningyuan Prefecture but located in the north of it, thus the copper did not need to be transported from the bureau southwards to Ningyuan anymore, instead it was directly delivered northwards to Yazhou. The route led from Zidadi to Laoyatan 老鴉灘 (also pronounced as Laowatan) by carriers and onward by ship to Fulin post-station, where it met the one of the other convoys.

Further northward, copper was also produced in Yingjing District 滎經縣. The state part of this copper needed to be delivered to Yazhou by ships, while the merchant copper was directly transported overland to Chengdu. It only took five days and there was certainly no motivation to save cost since it could anyway be sold at a much higher price.

From the above-mentioned fund of 2,100 *wen*, actually only 1,900 were given out step by step at each station as shown in Table 19.

Table 19: Disbursement of transport funds, Ningyuan to Yazhou, ca. 1900

Station	Part of fund (*wen*)		Name
Ningyuan bureau	1,100		"Upwards transport money" (*shangjiaoqian* 上脚錢)
Dashupu station (way there)	500 for "Long Convoy"	200 for "Short Convoy"	"Changing transport money" (*zhuanjiaoqian* 轉脚錢)
Hanyuan station	–	300	
Yazhou bureau	200		"Downwards transport money" (xiajiaoqian 下脚錢)
Dashupu station (way back)	100		"Supplement" (*buhuan* 補還)
SUM	1,900		

The fourth step led from Yazhou Prefecture to Leshan District, where Jiading Prefecture's seat located in. In Leshan there was the General Bureau for Mint Metal Transportation (*tongqian zhuanyun zongju* 銅鉛轉運總局) and in Yazhou there was the Sub-bureau (*tongqian zhuanyun fenju* 銅鉛轉運分局). Their responsibilities were to receive, to check and to weigh the mint metal and forward the convoy on the waterway.

The task of Yazhou Sub-bureau was to hire bamboo rafts (*zhufa* 竹筏) for the transport downstream along the Ya River (which is also called Qingyi River 青衣江) to Leshan. The funds available for this were for each *hao* of copper 0.1446 tael. Licensed raft-brokers (*fahang* 筏行) were employed to manage the transport. According to the regulation, each bamboo raft was loaded with four *hao* of copper, in fact always 6 to 8 *hao* were loaded on one raft, but it was still given the same amount of fund, which was as much as ca. 700 *wen*.

Table 20: Disbursement of transport funds, Yazhou to Jiading, ca. 1900

Category of fund	Fund (*wen*)
Raft brokers charged "Paper and pen cost when receiving the written pledge" (*lingzhuang zhibi qian* 領狀紙筆錢)	70 per raft
From Yazhou Sub-bureau to the rafts, carrier cost (*jiaoliqian* 腳力錢)	24 per *hao*
From the rafts to the Leshan General Bureau, carrier cost	20 per *hao*
Weighing money (*chengshouqian* 秤收錢) at the Leshan General Bureau	12 per *hao*

If one raft was loaded with 6 *hao*, 294 *wen* were left; 8 *hao* then only 182 *wen*, which was really few to pay three to four boatmen sailing for two to three days.

However, the brokers were still willing to do this business, especially in the first half of the year, because that was the time they transported goods from the Leshan region upstream to Yazhou and returning with empty rafts was still not as profitable as bringing copper along. But during the summer and autumn seasons, the water was bigger and there were other goods to be brought downstream, then the employment of brokers was more difficult.

The fifth step was from the General Bureau in Leshan to Chengdu upstream along the Min River 岷江. Ship-brokers (*chuanhang* 船行) were employed to carry out this stretch of the transport. The ships were called "Half-head-ships" (*bantouchuan* 半頭船), among which the bigger ones could load 5,000-6,000 *jin* while the smaller ones 4,000-5,000 *jin*. The ship brokers lived on taking over the governmental services (*guolu dachai* 過路大差) and on transporting mint metal (*bangyun tongqian* 幫運銅鉛).

Table 21: Costs and funds for water transport, ca. 1900

Ship type	capacity	load copper	fund	real cost
Big ship	5,000-6,000 *jin*	40 *hao*	4,000 *wen*	6,000 *wen*
Small ship	4,000-5,000 *jin*	32 *hao*	3,200 *wen*	5,000 *wen*

Beside the transport itself, which was very difficult to carry out, overstocking was a problem especially in the General Bureau in Leshan.

The last step was the reception of the copper at the Baochuanju mint. From the harbour at the east gate of Chengdu, copper was carried to the mint. Each *hao* got the fund of 0.0324 tael, ca. 30 *wen*, which was again not sufficient.

2.5.5 *Transport conditions*

Regarding many practical aspects of the copper transport, Chinese sources remain silent. This is for example the case for the working conditions of porters and caravan guides but also for the actual structure and situation of the transport paths and the construction of transport ships and rafts.

Fortunately, the main transport route between Chengdu and Ningyuan (and further on to Huili) was at the same time an important part within the network of long-distance interregional and international travel routes and trade connections. The stretch from Chengdu through Jiading Prefecture and Yazhou Prefecture until Yingjing District 滎經縣 or the ferry crossing of the Tong River (i.e. Dadu River 大渡河) and further on towards Laowatan and Zidadi, was a stretch of the only walkable route from China proper into Tibet during the late Qing period. The entire stretch between Chengdu and Huili was used as a part of the land route from central China into Yunnan continuing towards Burma or Thailand. As a consequence of this situation, many western travellers passed the same routes as the porters and mule caravans transporting raw copper and provisions through the south of Sichuan and have left not only accurate accounts and vivid descriptions of various aspects of transport and travel, but also a great number of photos providing visual impressions about the transport conditions at the time under consideration. These travellers were missionaries, military officers, adventurers, engineers, envoys, businessmen, scientists, and of many more different professions and thus offer views with very different foci but also with very different personal attitudes and interests, which need to be taken critically into account.

2.5.5.1 Water transport

The portions of the main route involving water transport need to be divided into two parts: The Ya River 雅河 from Yazhou to Jiading and the Min River 岷江 from Jiading to Chengdu. Copper transports arriving on rafts or small ships from Yazhou were usually transhipped in Jiading onto larger junks in order to continue on them until the harbour at the East Gate of Chengdu.

Figure 2: Rafts on the Ya River (Fergusson)

The vessels employed for water transport on the Ya River were rafts made of large bamboo poles such as the ones described by W.N. Fergusson in his account on the travels of the British Lieutenant John Weston Brook through Western China in the years 1906-1908:

"The Ya is a very shallow and fast-flowing river, and on this account the Chinese have constructed some very ingenious rafts by which they navigate it, and carry on them quite large cargoes, both up the river and down as far as Yachowfu. These rafts are made of giant bamboos, which are from four to six inches [c. 10-15 cm] in diameter at the thick end. They taper off very gradually, and some of these poles reach a length of seventy to eighty feet [c. 21-24 m]. The bamboos are lashed together side by side; each pole is heated and turned up in front, and when the rafts are completed they look like giant Canadian toboggans, being about eighty feet long [c. 24 m] by fifteen feet [c. 5 m] broad. As these bamboos are hollow and full of air, a raft will carry several thousand pounds, and only draw a few inches of water. They are quite flexible, and glide over the rapids and even over shallows without injury. […] These rafts are not the most comfortable looking crafts, as the only shelter afforded is a bamboo mat hut, usually erected near the centre of the raft. A few boards are elevated about a foot above the bamboo to keep one's feet out of the water, though in crossing some of the rapids the spray will still insist on coming through. Yet even ordinary passengers, who are in a hurry to reach Chiating or some other port down the stream, do not hesitate to take passages on these rafts, and even the missionary ladies often take advantage of this quick and easy mode of travel."[239]

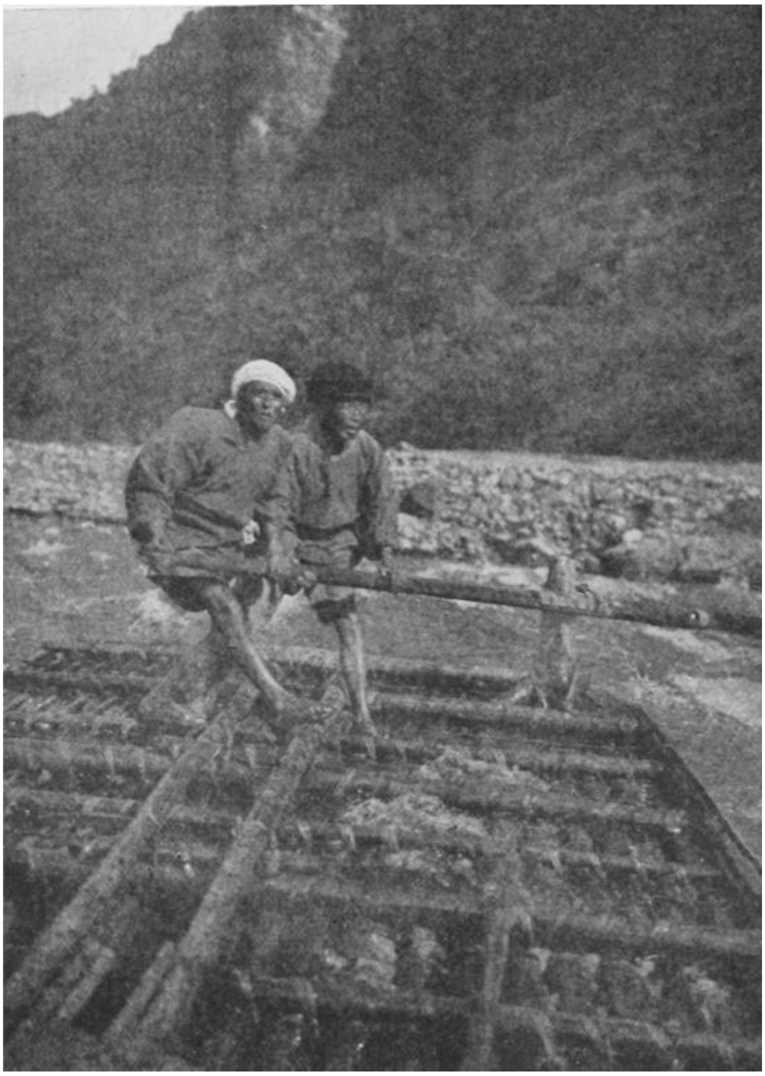
Fergusson also gives an overview over the commodities shipped on the respective portion of the Ya River, copper being only one of them:

"The principal traffic on the down journey is wool, hides and deer horns, which find their way from Tibet: also iron, copper, lead and coal, all of which are mined in considerable quantities in the neighbourhood of Yachow, and beyond. When returning,

[239] Fergusson (1911), p.175ff

they carry wine, sugar, cotton and piece goods, which are the chief articles of import. […] "[240]

Figure 3: Steering a raft on the Ya River (Fergusson)



Further information on the construction and navigation qualities of the Ya River rafts is provided by the British Botanist Earnest Henry Wilson, who travelled the southwest of China during the first decade of the 20th century in search for yet undescribed plants:

[240] ibid., p.176

“Although fragile-looking affairs, these rafts are quite unsinkable, and the best of their kind in existence. They are built entirely of the culms of a giant Bamboo, known as "Nan chu" [Dendrocalamus giganteus). Each raft is about 66 feet [c. 20 m] in length and 11 feet [c. 3.4 m] wide. The canes are laid side by side in one plane and securely lashed to numerous crossbeams, not a single nail being used in the whole construction. Several unequal lengths of bamboo are used so that the end-to-end joints occur at irregular intervals. The stern of the raft is square, the prow bent upwards to serve as a fender against rocks and shoals. The outer silicious "skin" of the canes is removed and the nodes hardened over a hot fire. The bending of the canes to form the upturned prow is done by heating and weighting with heavy stones. A narrow wicker staging is carried down the centre of the raft, and is raised about a foot above the floor; on this the merchandise is placed to keep it dry […].

These rafts are capable of yielding both transversely and laterally, and can thus pass over any slightly submerged obstruction. Fully loaded, one raft will carry a freight of about 30,000 lbs [c. 13605 kg[241]]. weight, and then draw only about 6 inches [c. 15 cm] of water, owing to the great buoyancy of the hollow cylinders of bamboo. Down-stream a crew of four men manipulates each craft, which is propelled by an oar on either side and steered by a scull aft and another forward, but the latter is only used in the more difficult places. The sculls and oars are fitted to Alder stumps, which serve as rowlocks. The rafts are hauled up-stream by men attached to bamboo lines, and several usually travel in company, in order that the crews may assist one another over the more difficult rapids.

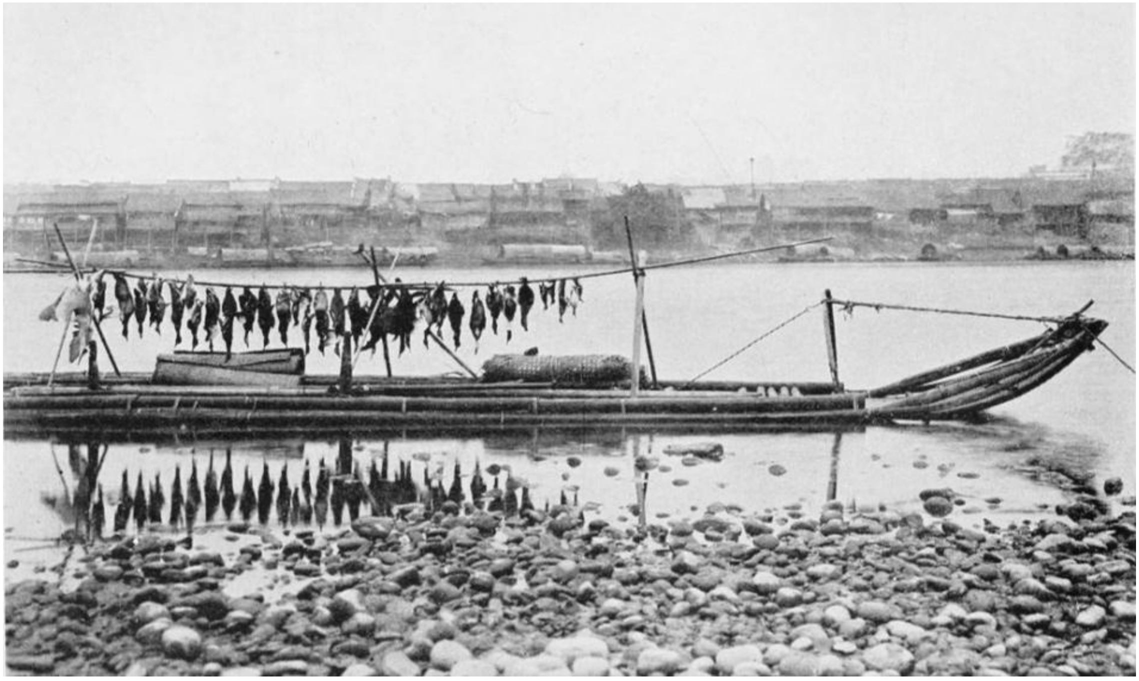
The Ya when not in flood is a clear-water stream, and from the raft the stony river-bottom is plainly visible; often the boulders look so dangerously near the bottom of the raft that the passenger expects a bump every few minutes. A curious hissing and crackling noise accompanies the raft's progress over the more shallow places. This noise is due to the movement of the boulders and stones in the bed of the stream, the hollow

[241] This number seems too high and does not persist when contrasted with Chinese sources (see chap. 2.5.4.). At most Fergusson’s “several thousand pounds” can be taken as realistic.

bamboo tubes acting as sounding boards. There are many angry and dangerous rapids and whirlpools on the Ya, and the current is very swift.'[242]

After his journey through Sichuan and Yunnan in order to inspect the cutback of local opium production in the years 1910 and 1911, the British Envoy Alexander Hosie describes the rafts of the Ya River, too, without adding considerable information to the accounts above.[243]

Figure 4: Raft with ducks on the Ya River (Fergusson)



Another short but much earlier account is given by the German geologist Ferdinand von Richthofen in his travel diaries about his expedition in the year 1871. He does not dwell on the construction of the rafts but mentions that ordinary boats must also have been able

[242] Wilson (1913), p.140f

[243] Hosie (1914), Vol. II p.7f.

to navigate the Ya River at times and furthermore provides some information on prices and travel time:

"Wir sahen uns hier [in Yazhou] nach einem Boot um: es gab zunächst nur Bambusflöße, und selbst von diesen konnte keins vor morgen früh abgehen. Wir mieteten eins von hier nach Kia ting fu (280 li) für den hohen Preis von 7400 cash, ließen aber dann die Anzahlung von 400 cash sitzen und mieteten ein Boot für 8000 cash. Die Leute kamen nachträglich in Streit um den Köder und teilten die Beute, indem die Bootsleute denen vom Floß 2000 cash zahlen mußten. Der Fluß ist wasserreich, reißend und voller Stromschnellen, hat aber wenig Untiefen. Die Fahrt nach Kia ting fu wird in 1 ½ Tagen gemacht, im Sommer in einem Tag; aufwärts nimmt sie vier Tage in Anspruch."[244]

Concerning the lower portion of the water transport route from Jiading to Chengdu, sources are less detailed, probably because of its less particular character in comparison to the fast-flowing, shallow Ya River. An early description is provided by the British consul Edward Colborne Baber, who in 1877 travelled downstream from Chengdu to Jiading and thus to the opposite direction than the mint metal transport ships:

"On the 26th of July we took ship outside the East Gate on a rapid narrow stream, apparently the city moat, which soon joins the main river a little below the An-shun Bridge […] The main river is a very disappointing waterway, about 80 yards [c. 73 m] broad in its wider reaches but often narrowing to 50 yards [c. 46 m] or less, full of small rapids and shoals, and navigable only by the smallest junks. Our own bark drew at most a foot and a half of water, but in many places the channel drew less, causing us to stick fast repeatedly. The stream being swift, between five and six knots – and the numerous bridges, though generally well built, having uncomfortably small arches, the navigation is not devoid of danger. […]

The limit of navigation for large junks is Su-ma-t'ou, a busy place in lat. 30°28' (by obs.). […] At Su-ma-t'ou the shore is a thick layer of roller-stones, five to ten inches [c. 13-25 cm] in longer diameter, so closely strewn that they make landing unpleasant. […] We […] were glad to land at Chia-ting Fu on the 28th, after a journey – not counting

[244] Richthofen (1907), Vol. II, p.311.

stoppages – of twenty-six hours and forty-two minutes from the capital. The distance may be estimated at a little more than 100 miles [c. 160 km].”[245]

When Baber remarks that only the smallest junks can navigate the Min River, this should be understood in comparison to the much larger junks on the Yangtze River below Chongqing, since, as shown in chap. 2.5.4., junks of different sizes were in use on the Min River and Baber himself mentions that until Sumatou 蘇碼頭 larger junks would be able to operate. Richthofen provides additional information concerning the travel upstream, which is more relevant for the copper transports to Chengdu:

> *“Der Min kiang wird erst unterhalb von Kiatingfu durch die Aufnahme des Yahö und des Tunghö ein bedeutender Fluß. Sein Lauf ist schnell, und man kann die Fahrt von Kiatingfu nach Suifu bei Hochwasser in einem Tag machen, während sie stromaufwärts 10 — 12 Tage erfordert; jetzt dauert sie zwei bezw. neun Tage.“*[246]

Also on this route there is a passage by Alexander Hosie adding little more to Baber than the remark, that the mouth of the Tong River in Jiading creates a dangerous whirlpool and form a dangerous obstacle for junks using this waterway upstream.[247]

2.5.5.2 Land transport

From all those mines which lay in the very south of Sichuan, especially in the prefecture of Ningyuan including the department of Huili, copper was transported on a common route through the Jianchang 建昌 valley, up the Xiaoxiangling 小相嶺 pass and down to the Tong River. After crossing it on a ferry it would be conveyed onward over the Daxiangling 大相嶺 pass to Yazhou in order to be loaded on the rafts described above there and to continue its journey on the waterway. Even more western travellers have

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245 Baber (1882), p. 28ff.

246 Richthofen (1907), p.316.

247 Hosie (1914), Vol. II, p.7f.

described this route than the waterway, because for many of them it was however more practical to continue on the land route from Yazhou to Chengdu with their light cargoes, which was clearly not an option for the heavy copper transports.

The transport means in Ningyuan Prefecture was mainly pack animals and porters. Pack animals were three types: mules, donkeys, and especially horses, because Xichang was famous for producing good horses. As to the porters, there were "slide poles" (*huagan* 滑竿), back carriers (*beizi* 揹子), and shoulder carriers (*tiaozi* 挑子).[248] Table 22 offers a list of loading capacity and speed of different transport means[249]:

Table 22: Transport means, loading capacities and transport speed

Transport means	**loading capacity (*jin*)**	**speed (*li* per hour)**
"slide poles"	130	10
back carriers	80-90	8-9
shoulder carriers	70-80	8-9
mules	130-170	9-10
horses	120-130	9-10
donkeys	60-80	7-8

The first portion of the route leading out of the Jianchang valley along the Anning River 安寧河 up to the Xiaoxiangling pass (3185 m) and down again to the ferry crossing over

248 Chang Long Qing (1939), *jiaotong men*, p. 32.

249 Chang Long Qing (1939), *jiaotong men*, pp. 35-37.

the Tong River is referred to by a number of travellers as particularly dangerous and difficult.

The earliest descriptions about the problems related with travel and transport on this way can be found again by Edward Colborne Baber who on his way from Ningyuan towards the Tong River passed the Xiaoxiangling northward:

"[The] Route is rendered dangerous by falling rocks. Many loosened masses lie on the hillsides ready to shoot suddenly down on the hollow way from slight disturbing cause. Near the village we passed the corpse of an unlucky pony which had been battered to death in this manner, and were told, that four mules, valued 70 dollars apiece, had lately been crushed near the same spot. After Ta-wan is passed, the precipices close in the stream leaving barely sufficient space for a narrow path which works along under a wall of rock. The more dangerous bluffs line the further brink of the torrent; where a glance into its bed is possible through the border of ferns and wild flowers one sees that it is crowded with blocks whose fresh angularity shows that they have toppled from the heights. In some places such stony cascades have cleared the stream an shot across upon the pathway. Here and there the bluffs under which the way winds not only overlean but hang down pendulous masses, not of honest limestone, but of a very coarse conglomerate of that rock with pebbles and earth full of spreading roots. […] The precipices are not high; the highest is perhaps 200 feet [c. 60 m]. But the inaccessible hill-tops above recede very slightly, and rise to not less than a thousand feet above the stream."[250]

Besides the dangers of difficult pathways and falling rocks, another issue was the recurring raids by Yi tribes from the surrounding mountains which were partly not subjects of the empire and which exacerbated an already weak security situation in the difficult to control mountain area. In order to protect the transport route, garrisons had been established all along the way and had been staffed with regular Chinese soldiers and loyal Yi warriors. Baber's report also contains a note on them:

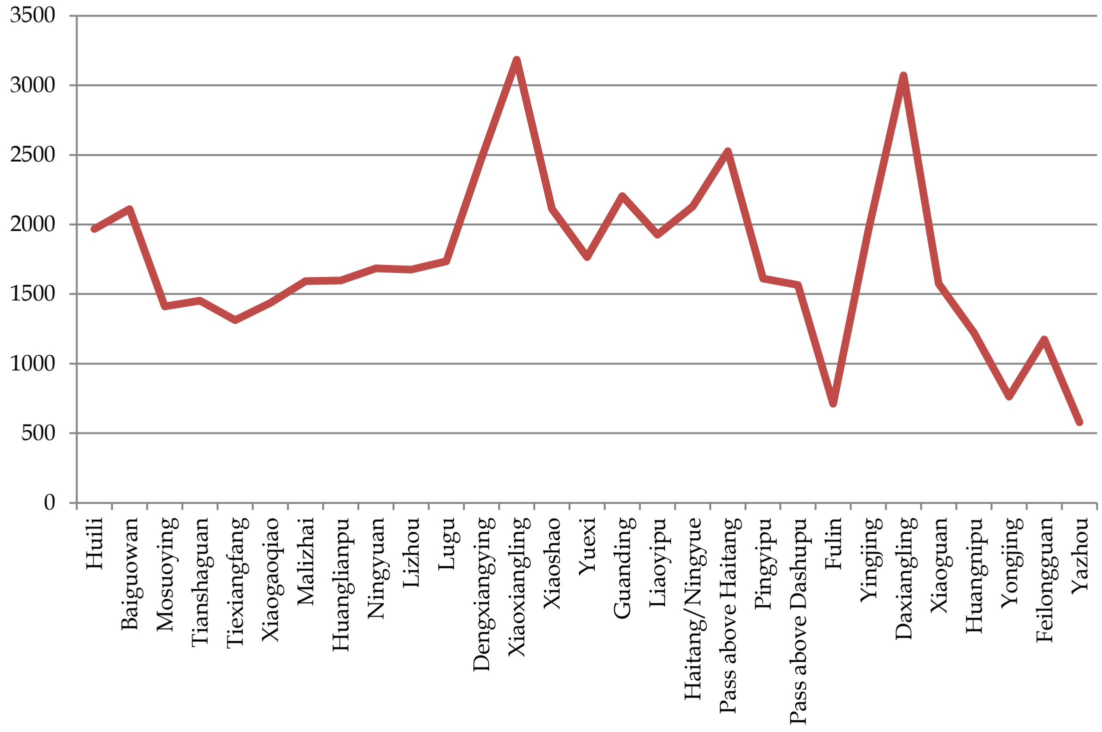
"We entered upon that part of the road which is considered to be most endangered by Lolo incursions. And in fact a few miles further on we reached a station occupied by a

[250] Baber (1882), p.58.

small garrison of Chinese and subject Lolos who keep constant watch against the marauding mountaineers. Spears and firelocks hang ready to hand under the eaves of the pine-built cabins all along the little street; vigilant communication is maintained with the sentinels on the hillcrests, and several of the garrisons carried the match for their firelocks coiled in readiness round their wrists."[251]

With the help of data collected by Baber on his journey it is also possible to gain an overview over the altitudes which needed to be mastered between the Jianchang Valley and the Tong River, see Graph 20. [252]

Graph 20: Huili-Ningyuan-Yazhou: Altitudes above sea level



[251] Ibid., p.59.

[252] Ibid., p.146. This chart does not reflect the actual geographical surface condition recorded with modern cartographical methods, since nowadays the old route cannot be retraced everywhere, but it relies on all the data provided by Baber and Hosie in their accounts. Thus the distances between the different values on the x-axis do not reflect actual distances either.

Alexander Hosie some twenty years later draws a similar picture complemented by his experience of climatic obstructions formed by the especially long periods of snowfall and frost in the high mountains:

"We left our comfortable quarters to face a snowstorm, and plodded all day through snow and slush half a foot in depth. Garrisons, each supposed to be thirty strong, lined the road at intervals of a mile with guard-houses between. This part of the country, skirting as it does the western border of independent Lolodom, is the scene of frequent Lolo raids, whole caravans — goods, animals, and men — being swept off, and carried into the inaccessible mountains to the east. Our escorts were now relieved at each garrison, and the men were armed with swords."[253]

Fergusson confirms Baber's and Hosie's information on the falling rocks as well as on the garrisons and on the dangers originating from the Yi tribes.[254]

After crossing the mountain range near the Village of Dashupu 大樹堡, the valley of the Tong River is reached, which in this place carries the name Dadu River 大渡河 meaning "Great Ferry River". According to its size it might have been possible to already ship the copper from here on downwards to Jiading, but the particular difficulties in the cause of the waterway must have impeded this, even following the river along its banks with pack animals seems to have been impossible. Baber records:

"The Ta-tu, or to adopt its more general name, the T'ung, should be regarded as the main upper stream of the Min river, since it brings down a much greater volume of water than either of the two confluents which join it near Chia-ting. At Lu-ting bridge, one of the narrowest points, its breadth is a little under 100 yards, but it is not navigable above Tzŭ-ta-ti; even below that town there are so many rapids and obstructions that the waterway is little used. Between Fulin and Sha-p'ing it is only practicable, for the whole distance, for timber-rafts which are floated down to Chia-ting for sale; but the danger of the transit is so imminent that the owners of the timber have to bind themselves to provide the raftsmen with coffins in case of fatal accidents. Below Sha-p'ing there is no difficulty.

[253] Hosie (1897), p.107.

[254] Fergusson (1911), p. 285

A wilder or more broken region than that which borders the T'ung can scarcely be conceived; there are few reaches which are not overhung by bare cliffs, often of immense height."[255]

Thus instead the river was crossed on boats between the settlements of Dashupu and Fulin. According to Alexander Hosie by the time of his passage in 1882 the ferry service over the Tong River was in the Hands of so called Xifan 西番 people, a mixed population of Yi and Tibetan tribes.[256] Besides copper, the most important goods shipped to the northern side of the river were pine boards, while on the return way to the south side the ships were loaded with cotton and salt.[257]

Figure 5: Crossing the Dadu River (Heim)

[255] Baber (1882), p.45.

[256] Hosie (1897), p.101.

[257] Ibid., p.102.

The last part of the journey which had to be carried out by means of overland transportation led over two mountain passes, the Daxiangling (3072 m) and the smaller Feilongguan (1174 m) down to the city of Yazhou. On the Daxiangling like in the highest mountains south of the Tong River, snow must have been a problem during a large part of the year. Alexander Hosie reports about his passage:

"We were only a day's journey from the foot of the Ta Hsiang Ling Pass, and carriers from Yün-nan, who came to our inn, were cramming them with the difficulties that had to be surmounted. Snow, so they said, was lying deep on the passes, and they had only just managed to get through with their lives. […]

When we awoke on the morning of the 7th of March, we found the whole mountain enveloped in a thick mist, which became denser as we ascended. When we reached the Hsiao Kuan, or Lower Pass (4800 feet), the snow lay thick by the roadside; but all around was buried in white gloom. Huge icicles hung from rocks projecting over the rugged path, and we frequently heard their crashing as they fell, amid the din of roaring torrents, into the depths below. As we ascended, the snow became deeper, increasing from two to three inches above the Lower Pass to a couple of feet. The pathway, which skirts the edges of ravines and precipices, was one continuous mass of slush, snow, and ice — higher up, dry and crisp ; and, starting from Huang-ni-p'u at half-past six in the morning, we stood on the summit (9366 feet) at half-past two in the afternoon, having indulged in two short intervals of rest. A stiff, north wind was blowing over the ridge, and I overheard one of the escort duly warning my followers that shouting on the summit would most certainly provoke a storm. For a time not a sound but that of our own footfalls on the crisp snow broke the stillness of the gloomy scene."[258]

Fergusson describes a similar situation and the porters' way to master those climatic conditions:

"The second day they reached the foot of Dahsiangling, and stopped for the night at Huangnipu, a street with about 100 families, where travellers generally rest before

[258] Hosie (1897), p.97f.

ascending the mountains, as the accommodation at the inns on the way up is very poor indeed. Half-way up the mountain they found it covered with snow and the path very slippery, being coated with ice; so, strapping iron plates with sharp spikes on the soles of their boots, they struggled on through the bitterly cold wind that was blowing, and were rewarded on reaching the top by a magnificent view of the Tibetan mountains, which from this pass opens out before the eyes of the traveller if it happens to be fine weather when the top is reached. On the east slope of the mountain it is nearly always raining or snowing and the foliage is very dense."[259]

Figure 6: Mule train between Ningyuan and Yazhou (Sun Mingjing)

[259] Fergusson (1911), p.280f.

Figure 7: Porters on the Daxiangling (Fergusson)

The other mountain pass did not pose a major geographical obstacle to transport due to its much lower altitude. Therefore Hosie gives one of the rare accounts of actual copper transports being conveyed on this route. Interestingly he points out, that the copper caravans did also transport other goods in order to make up for the insufficient funding by the government:

"We spent the greater part of the 5th of March struggling in a dense mist along the right bank of a small tributary of the Ya Ho. A pass, called the 'Flying Dragon', 3580 feet above the sea, lies between this and a larger tributary of the same river. A long pull over a frightful road brought us to the summit.[…] Up the west side of the pass scrambled about twenty ponies and mules, panting and blowing; not without sufficient cause, for

they were carrying heavy loads of copper from Ning-yuan, and, from Yün-nan, the bark of a species of Khamnus, which is used for making a green dye."[260]

Reaching Yazhou as the end of the long and hard march however must have been a strong contrast to the deprivations of the route, Ferdinand von Richthofen even compares it to the famous German spa town of Baden-Baden:

"Es hielt schwer, uns heute von Yatschöu fu loszueisen; die Stadt ist für die Bewohner von Kien tschang eine Art Baden-Baden: sie lustwandeln in den Straßen, gehen ins Theater, besuchen die Kaufläden und dünken sich im Vollgenuß von allem, was das Leben Bestes bietet. Ein Tag in Yatschöu fu! — das war die Bettelei meiner Leute den ganzen Weg über gewesen."[261]

To estimate the hardships of the work carried out by the porters is difficult due to the enormous loads they had to transport under the stiff conditions manifoldly described above. One Account given by Morrison concludes many of the still few western sources on this topic and complements them with the author's own observations from his travel through the region under concern:

"We, who live amid the advantages of Western civilisation, can hardly realise how enormous are the weights borne by those human beasts of burden, our brothers in China. The common fast-travelling coolie of Szechuen contracts to carry eighty catties (107 lbs.), forty miles a day over difficult country. But the weight-carrying coolie, travelling shorter distances, carries far heavier loads than that. There are porters, says Du Halde, who will carry 160 of our pounds, ten leagues a day. The coolies, engaged in carrying the compressed cakes of Szechuen tea into Thibet, travel over mountain passes 7000 feet above their starting place; yet there are those among them, says Von Richthofen, who carry 324 catties (432 lbs.). A package of tea is called a "pao" and varies in weight from eleven to eighteen catties, yet Baber has often seen coolies carrying eighteen of the eighteen-catty pao (the "Yachou pao") and on one occasion twenty-two, in other words

[260] Hosie (1897), p.95.

[261] Richthofen (1907), p.294.

Baber has often seen coolies with more than 400 lbs. on their backs. Under these enormous loads they travel from six to seven miles a day. The average load of the Thibetan tea-carrier is, says Gill, from 240 lbs. to 264 lbs. Gill constantly saw "little boys carrying 120 lbs." Bundles of calico weigh fifty-five catties each (73.5 lbs.), and three bundles are the average load. Salt is solid, hard, metallic, and of high specific gravity, yet I have seen men ambling along the road, under loads that a strong Englishman could with difficulty raise from the ground. The average load of salt, coal, copper, zinc, and tin is 200 lbs. Gill met coolies carrying logs, 200 lbs. in weight, ten miles a day; and 200 lbs., the Consul in Chungking told me, is the average weight carried by the cloth-porters between Wanhsien and Chen-tu, the capital. Mountain coolies, such as the tea-carriers, bear the weight of their burden on their shoulders, carrying it as we do a knapsack, not in the ordinary Chinese way, with a pliant carrying pole. They are all provided with a short staff, which has a transverse handle curved like a boomerang, and with this they ease the weight off the back, while standing at rest. “[262]

How these heavy loads could be lifted and carried and how energy could be saved to survive the task tells an old porter’s song:

> *Seven steps up, you have to rest.*
> *Eight steps down, you have to rest.*
> *Eleven steps flat, you have to rest.*
> *You are stupid, if you don't rest.*[263]

[262] Morrison (1902), 90f.

[263] Jenkins (2010). The author of this National Geographic article recorded this short song from two old men near Yazhou, nowadays Ya’an, Gan Shaoyu, 87 and Li Wenliang, 78, who worked as tea porters in their early ages.

Figure 8: Tea porters (Wilson)

2.6 *Problems, abuses and government reactions*

After discussing regulations, rules and expectations in the chapters above, the following chapter is addressed to those phenomena which violated regulations, disobeyed the rules and did not function according to the expectations. The first phenomenon is the one of officials being unable to execute the governmental policies due to a lack of personal quality or devotion and posing the question, if the entire system of mint metal procurement would be served better by officials or merchants. The problem of the merchant side was at the one hand a lack of capital available for investment into the mines, at the other hand the insufficient governmental funds provided for their work and costs. Especially this problem of chronical underfunding made new ways of operation necessary, which for the officials and runners often laid in various types of abuses to the disadvantage of the merchants, for the merchants in extensive contraband production and smuggling. These abuses from both sides created a system which, although not codified and thus very unstable, kept copper production and procurement functionable in spite of great conflicts and problems. Of special importance were those phenomena in the immediate border region between Yunnan and Sichuan, were the competitive and little cooperative attitude of the two governments at the one hand put great pressure on the local merchants, at the other hand provided them with various opportunities to evade taxation and to carry out contraband trade.

2.6.1 *Lax control and unable administration*

Governmental control over the mint metal industries was not close enough to ensure a satisfying efficiency of operation at any time. With this it was one example of the limited organizational capability the Qing state showed in many cases. To elucidate this, the situation in Sichuan needs to be compared with the one in the other two notable copper producing provinces, namely Yunnan and Hunan. In those two provinces, administration, judicial and police supervision, control as well as investments in money and kind by the state played an important role[264], while in Sichuan it was the merchants who took over the active functions with a state control which was rather loosen and passive.

[264] Vogel (1989), p. 296.

One very basic problem of copper administration in Sichuan, which had even more far-reaching consequences than the institutional looseness of the system, according to numerous reports must have been the one of unable officials. This inability can express itself in different ways: either officials were generally lacking organizational abilities or experience in dealing with questions related to copper management, or they theoretically would have had these abilities but only used them for their personal enrichment by deceiving the merchants, the state or both.

One example of the first category is the case of Mao Xuanhui 毛宣徽, who was the Prefect of Ningyuan in 1784 and could not organize the transport of mint metal successfully and thus got dismissed[265]. However, the case of the Mine Officials of the Laodonggou mine can be counted into the first or the second category is doubtful. Liu Dalu 劉大麓, the first mine official of the mine, decided unauthorized that merchants were charged the tax copper of 20 *jin* for producing every 130 *jin* instead of 100 *jin*, as regulated by the government, because merchants did not have sufficient capital when the mine was newly opened. The difference of the 30 *jin* of copper was called "concessionary copper" (*rangtong* 讓銅). Afterwards, his successor Shen Guoshi 沈國實 increased the concession to 40 *jin* under the excuse of "expensive food supply in the mine". The next Mine Official Zhang Juchuan 張巨川 repeated the same action that the amount of "concessionary copper" was raised to 50 *jin*, with the reason of "declining purity of copper ore and increasing difficulty of getting charcoal"[266]. In the end, the situation was so severe that the 20 *jin* of tax copper could only be charged when 200 *jin* of copper were produced[267]. The governmental procurement of copper was thus impaired.

As a matter of fact, not all officials in charge of copper administration were unable but positive exceptions must have been rather scarce. The example of the able official Zhou Wan 周琬 shows impressively, how the government used all means at its disposal to keep him in charge of copper administration and how he had the ability to bring mining areas to flourish, which were before surely administered by incompetent officials. Zhou

[265] GZDQL, vol. 59, pp. 566-567.

[266] ZPZZ-GY, Yinjishan 尹繼善.

[267] ZPZZ-GY, Celeng 策楞.

Wan served in Sichuan between QL 15 and QL 22 (1750-1757). When he was at the post of Circuit Intendant of Chuanbei 川北, he was promoted to be the Provincial Treasurer of Yunnan in 1751. Being the only son of his old mother, Zhou Wan applied to stay in Sichuan rather than to go to Yunnan, probably to avoid the long and difficult travel. That was a great advantage for Sichuan. Governor Celeng 策楞 suggested to the Qianlong Emperor to keep him in Sichuan, exchange him with the Circuit Intendant of Jianchang and "add the title of Copper Administrator" (*jia tongzheng xian* 加銅政銜) to let him especially deal with mining affairs[268]. Soon he was promoted to be the Provincial Judge (*anchashi* 按察使) of Sichuan. Although it was the responsibility of the Provincial Treasurer (*buzhengshi* 布政使) to deal with mining, one exception was made for Zhou Wan for his excellent ability and knowledge on this topic. The old existing mines were the tasks of the Provincial Treasurer, while the newly opened mines were taken care of by Zhou Wan.[269] Four years later, he was again promoted to be the Provincial Treasurer. According to the regulation, the new Provincial Judge Gongtai 公泰 should be in charge of the new mines. However, Zhou Wan was more skilled and familiar with the work, so finally this time all the mining affairs became the responsibility of him, i.e. the Provincial Treasurer again. Thus through all the changes of his offices he could never be replaced in his function as expert for copper production.

Other examples for competent officials were Wang Yujiang 王裕疆, Prefect of Jiading (1751), Li Shijie 李世傑, Governor of Sichuan (1783-1789) or Fu Zhaoxiong 符兆熊, Prefect of Ningyuan (1790), who worked efficiently on the mining affairs. Although the work of all these officials caused the successful operation of mines in Sichuan, their exceptionality shows the low quality of officials in general.

Even if no doubt had to be cast on the personal competence, the responsible Mine Officials' ability to exert efficient control was often impaired. They were chosen among petty officials, whose ranks were low and thus lack of authority. In Yunnan to the opposite, local and regional seal-holding officials (*zhengyin guan* 正印官) held

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[268] *Qing Gaozong shilu*, chap. 400, QL 16/10/*jiachen*.

[269] *Qing Gaozong shilu*, chap. 489, QL 20/5/*renyin*; chap. 549, QL 22/10/*wuzi*.

responsibilities for all mining affairs and for the upkeeping of law and order in the mining areas. These mining officials were to a much higher extent experts in their field and thus through their personal competence as well as through their institutional authority much better able to execute their administrative tasks efficiently. [270] As introduced in the chapter 2.2.4.2, Sichuan also shortly switched to the Yunnan mode, that the magistrates should take over the responsibility of mines. However, this mode turned out to be unsuitable for Sichuan. A memorial from E'hui 鄂輝, the Governor-general of Sichuan in 1791 compared the different functions of officials and merchants concerning mining in Sichuan and Yunnan and then drew the conclusion that Sichuan had to stay with the old method, which means, depending on merchants rather than on officials.

2.6.2 *Merchant capital: little, scattered, and unstable*

One risk for a stable mining operation and mint metal procurement was the origin of the mining capital, which in Sichuan needed to be provided by the merchants themselves instead of the government. In most cases at the beginning of a mining enterprise, this capital was often very limited. In the case of Yunnan, governmental funding was offered before miners started their work.[271] Merchants operating mines there should be given "official capital" (*guanben* 官本) by the local government. In return they would pay 20 percent of the produced copper as tax and sell the rest to the government. To the contrast, in Sichuan merchants needed to first totally depend on their own investment and only the production they obtained after that they could sell to the government or on the free market according to the regulations. Thus the dependency of merchants on the government but also the support of merchants by the government were in Sichuan were both much less than in Yunnan.

It was repeatedly reported that mine merchants in Sichuan were lack of capital, and thus operation could not be continued. For example, Zhou Wan stated the following in his memorial to the Qianlong Emperor in 1752:

[270] Vogel (1989), p. 238.

[271] GZZL, chap. 4, p. 85.

"Before one can get the 'pond ore' [tangkuang 塘礦, which means the broad and massive ores with a sunken cavity], the expenses of labour and food are about several thousand tael of silver. Now Sichuan's mining does not receive public funds but only depends on merchant capital. Since there are no rich merchants in our province, the capital they bring is no more than two hundred to five hundred tael. Thus they always run out of capital shortly after the [beginning of the] operation. Then they have to stop and their mine workers disperse."[272]

Mark Elvin in contrast to this statement argues very convincingly based on examples predominantly from the textile industries that there was no capital shortage in China at all during the Qing period[273] and capital thus may have been available in vast amounts for promising copper mining enterprises. In spite of this, special obstacles like the remoteness and the high risk of investment may have been the predominant reason for the apparent capital shortage. Huang Tinggui, the Governor of Sichuan confirms this problem accordingly in 1755 noting that

"In Yunnan the mines are operated by the state fund while in Sichuan the mine merchants need to prepare capital by themselves. [Because the mining areas are located in] remote and poor regions, no rich and big merchant would bring large amounts of capital here. The investments are all scattered and need to be assembled. Still, they are not much and always used off. The merchants all count on selling the copper they can obtain, change it into capital, then again use this capital to mine copper. That is how the whole process is running."[274]

When facing these difficulties, the reaction from the government was to gather the merchants as well as their investment to concentrate first on the most promising mines. Zhou Wan suggested to make those merchants wanting to invest separately on mines with poor mineral quality withdraw, in order to let them cooperate with and invest at those

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[272] GZDQL, vol. 6, pp. 265-267.

[273] Elvin (1973), p. 286f.

[274] See also GZDQL, vol. 11, pp. 350-351.

mines which were of rich mineral deposits and already operating for a longer. After that, if the merchants still had spare capital and the intention to invest, they could do this at other mines.[275] By this means, Zhou Wan wanted to join the limited forces and capital in the mining business to pull increase Sichuan's copper production output as soon and efficiently as possible.

When investing in a copper mine, capital sharing seems to have been a common situation. Colborne Baber met a miner in Huili in 1877, who introduced himself as being in such an investment partnership. He describes the situation in the following way:

"Copper is […] mostly worked by unmoneyed adventurers with a capital of a few hundred taels, who just manage to make a living out of the investment, and that only by hard labour. I met one such projector coming in with his ore from the Huang-sha valley, who informed me that he was in partnership with five others, their united capital amounting to a little more than 1000 taels, say 300l. His own contribution was 400 taels. They went prospecting on the 8th of August and struck ore on the 10th.They employ twenty to twenty-five men, who both excavate the mineral and smelt it. During rather less than a month he had smelted about 50 tons, yielding 30 per cent. of metal.".[276]

The poor supply of merchant capital lead to serious conflicts. In most cases it was a conflict between merchants who operated one excavation (*cao* 硔) in succession. The merchant who originally had started the excavation invested his capital and operated the mine for several months, before reaching the "pond ore" he already ran out of his capital thus had to stop. The new merchant came and continued with the same mine. When he was so lucky to obtain the "pond ore", the original merchant would come to either obstruct the operation or fight for the profit[277]. To solve this conflict, a regulation was made that only three months after the original merchant had withdrawn the new merchant was allowed to start[278]. If the original merchant dared to create disturbance, he would be punished in the same way with those "who went back to their hometown and occupied too

[275] GZDQL, vol. 6, pp. 265-267.

[276] Baber (1882), p. 91.

[277] QDDKY, p. 220.

[278] QDDKY, p. 219.

much farmland but let it uncultivated", that he would get flogged for eighty times, wear cangue for one month, and be forbidden to stay in the mine[279].

2.6.3 *Low funds and high costs*

In addition to the problem of acquiring capital for investment into copper mines, also their actual operation and maintenance needed to be taken into consideration. The funds given by the government for copper mining in the form of governmental copper purchase from merchants at a fixed price were originally meant to cover the cost of mining and transporting the mint metals. In fact, it was never enough for either of them.

Ever since the beginning of large scale mining, during the three phases of negotiations between the merchants and the government described in chap. 2.2, it already becomes evident that the state tried to limit its fund as much as possible. In the end in the final regulations in 1743, the governmental purchase price of 9 or 10 tael per 100 *jin* of copper was fixed, and did not change in spite of general inflation and increasing production costs in reality. For example in 1751 in the Laodonggou mine, according to an investigation made by Wang Yujiang 王裕疆, Prefect of Jiading, producing every 100 *jin* refined copper cost more than 13 tael of silver[280], 30% more than the governmental fund. Another example was that in 1804, the market price for copper was above 10 tael if purchased directly at the mines and 16-17 tael if purchased in Chengdu including transport costs.[281]

The governmental funds for copper were so low that merchants could not get profit through this business. Mines closed down and no merchants were willing to invest. In 1806 the prefect of Ningyuan reported that merchants resolutely refused to operate the mine of Tuojiaoshan&Baiguoshan. In the end, the local government in fact had to invest by itself. During this process, it turned out that in order to obtain 100 *jin* of copper, 13 tael needed to be invested.[282]

279 ZPZZ-GY, QL 24/10/2, Wu Shiduan 吳世端.

280 ZPZZ-GY, QL 16/4/20, Yinjishan 尹繼善.

281 ZPZZ-CZ, 1351-026.

282 ZPZZ-CZ 1354-010.

One example for the actual breakdown of a mine due to insufficient governmental funding is given by Wilson regarding Tongchang, where copper mining was replaced by iron mining which was of minor interest for the state and thus not tied to fixed governmental purchase prices and funds:

"Formerly [copper] was worked and smelted here, the name Tung-ch'ang signifying "copper-shop" or factory. From what I could learn the industry was abandoned some ten years or more ago when copper mining became a government monopoly controlled by the officials. The people told me that they could not produce copper on paying lines under Tls. 3500 to Tls. 3600 per picul. The officials would only pay Tls. 2800, consequently copper smelting was given up and replaced by that of iron."[283]

As to the financing of copper transports, governmental funds were also too low. From the case study on transport introduced in chap. 2.5.4., it can be seen that the funds for each step from the mines in Ningyuan Prefecture to Chengdu were necessarily insufficient. The regulations set up by the Board of Revenue calculated the whole cost for copper transport from the three mines in Ningyuan Prefecture to Chengdu with 2.1 to 2.7 tael of silver, while the actual transport cost amounted to as much as around six tael[284]. Compensation for this financing gap could be found through the employment of brokers and through contributions from governmental institutions (*fenren juanpei* 分認捐賠)[285].

2.6.4 *Officials' and clerks' abuses*

"Not far from these said mines copper ore abounds, but is not much exploited, as it requires a very venturesome spirit to embark in copper, that metal being a government monopoly. Private parties who may have struck ore are compelled to sell the produce at a fixed rate to the official of the district, who then disposes of it much as his own advantage directs. It is notorious in the neighbourhood that the Chinese government, central or provincial, does not receive a tenth part of the output. In consequence of such abuses,

[283] Wilson (1913), vol. I, p. 233.

[284] ZPZZ-CZ, 1351-026.

[285] ZPZZ-CZ, 1351-026.

capitalists are shy of mining ventures, knowing that the lion's share must fall into the pockets of the local functionaries […] The copper has to be conveyed to the Prefect of Ning-yuan, who allows him 9.2 taels per yao, a yao being nominally 138 catties; but the officials demand brimming measures which raises it to 142 catties. … The officials can easily dispose of it privately at 22 taels per yao, but on the improbable assumption that they send it to head-quarters they still get 14 taels from the provincial treasurer."[286]

The above description reflects what E. Colborne Baber was told by a miner he met in Huili in 1877. The same abuses were also observed by an unknown official who investigated the copper administration in Ningyuan Prefecture in 1899. In his account *Ningyuan fu shu tongkuang qingxing qingce* 寧遠府屬銅礦情形清冊, he even included a whole chapter on "Long-standing abuses by clerks in the copper bureaus" (*Geju shun xun jibi* 各局書巡積弊). In this chapter he described the following situation:

"Among the several twenty hao of copper purchased by the state every month, the bureau clerks only deliver half. The other half is sold by them at a high price. They hire transporters who just live in the house to the face of the bureau and let them carry the copper away in small litters (jiao 轎). Then the copper is sold according to the 'commoner's price' (minjia 民價) in the market, which is 24 to 25 tael [per hao] to the copper utensil shops nearby, or to dishonest salesmen who smuggle it and practice counterfeiting. [By selling] each hao [of copper] they can get profit of 14-15 tael of silver […] However, the mine merchants know about the abuse but do not dare to accuse them, because they themselves also evade the tax and have fear of the risk that the bureau clerks would suppress [their own] smuggling due to grudge; likewise, the clerks are aware of the illegal selling by the mine merchants but do not dare to get involved, because they themselves also steal and sell copper and are afraid of the risk that the merchants might expose their crime. Both sides have something to cover, thus the copper administration becomes worse every day."[287]

[286] Baber (1882), p. 91.

[287] NYFS, chap. „各局書巡積弊".

Besides the abuses of selling copper illegally, clerks also took advantage of merchants in every step from the producing of copper in the mines until the receiving of copper in the bureaus whenever they could. For example, under the control of the copper bureau of Hangzhou, when the merchants smelted ore once (*chehuo* 扯火), the clerks asked for the "frozen copper on the surface" (*fumian bingtong* 浮面冰銅) as charge for their working; clerks who "controlled the work shift" (*guanban* 管班) asked for the "copper sink at the bottom of the wok" (*baguo diting* 巴鍋底銅) as customary fees (*lougui* 陋規); When the merchant delivered the copper to the copper bureau, the clerks there charged an extra 6 to 7 *jin* of copper per *hao* on the pretext of different weights and scales (*xujia chengpan* 虛加秤盤); When giving silver to the merchants, clerks either paid them with silver pieces lighter than the treasury standard (*kuping* 庫平) or underhand substituted the original silver with a lower purity one; When paying the transport fund, they again tried to always embezzle a part of it, which was a common phenomenon. Clerks created difficulties not only for the merchants but also for the brokers. For instance, in the transport bureau of Ya'an, the raft brokers had to pay a clerk whose name was Zhou a certain amount of so-called "Good-behaviour-money" (*guijuqian* 規矩錢), otherwise he would not let the copper be weighed still on the same day but wait for the next day. During the night he would replace big copper pieces with ones of a smaller size and in the following accuse the brokers of having stolen the state copper. In another copper bureau in Yanjing, clerks even made their surcharge of copper into a regulation: for every *hao* of "quota delivered copper" (*zhengjietong* 正解銅), which was 128 *jin*, the bureau charged another 10 *jin* of "wastage for the tax in Yanyuan District" (*Yanyuan xian kehao* 鹽源縣課耗), 1 *jin* for paying the "family servant of the magistrate of Yanyuan District" (*Yanyuan xian jiading* 鹽源縣家丁), 1 *jin* for the "Department of Works in the District administration" (*gongfang* 工房), 1 *jin* for local Yi chieftain (*tusi* 土司), 1 *jin* for worshipping (*shengong* 神工), and another 5 or 6 *jin* again for the compensation of differences in scales and weights. Thus for getting the fund for 100 *jin* of copper, merchants actually had to hand in 147 to 148 *jin*, which led to a situation which was even worse than the one described by Baber. As a consequence, the merchants had to consider other ways to obtain profits, since this type of collaboration with clerks and the acceptance of their abuses could not be avoided.

One case displaying a conflict between an official and a merchant himself involved with abuses happened in the eighth year of the Xianfeng reign-period (1858). Through this example the firm establishment of several abuses in the actual execution of the copper administration and merchants' business becomes evident.

It is briefly recorded in the *Qing shilu* 清實錄 (Veritable records of the Qing Dynasty) that the bandit Luo Sheng 罗升, a copper mine merchant from Huili Department in Sichuan, was punished because of selling copper produced by his mine illegally and ordered to pay compensation for it. However, his reaction was to gather a number of people to rob and to resist being arrested by the governmental troops. In the end unsurprisingly he and his fellows were beaten down by the soldiers and he himself got beheaded in the fight. His fellows were arrested but still tried to escape by which they injured soldiers. The result was, that all the bandits were ordered to be beheaded by the Xianfeng Emperor.[288]

The case was simple but caused much attention. The execution of death penalty to Luo Sheng and his fellows was not due to their smuggling of copper but to their later revolt. The question is thus, where the reasons for their fierce resistance need to be seen and if they were mere "bandits" used to behave in this way or if they much more perceived the punishment as unjustified because they had followed a balanced system of abuses they were accustomed to.

After having gained an overview over the variety and extent of abuses especially involved in the collaboration between officials and merchants in the copper business, we can assume that the latter reason was closer to the truth. Further prove for this assumption can be obtained in the following from an imperial edict concerning this case:

"Wang Xizhi 王錫之, who is the magistrate of Zhangming District acting concurrent as the prefect of Huili prefecture, punished [the merchant] in a way which violated the precedents and thus incited the disturbance. Bring him to the Board [of Personnel] and let it be discussed how to punish him."[289]

[288] *Qing Wenzong shilu*, XF 8/8/*xinhai*.

[289] Ibid.

It remains unclear which "precedents" the edict is referring to but the Emperor's reaction on the case is indeed highly interesting because it reveals the attitude towards an official who would like to fight against abuses, namely to consider him as the origin of the whole disturbance and thus as the one to be punished.

This leads to the assumption that after a long practice of copper administration, a certain balance of "unwritten rules" had been established that was obeyed by both the merchants and the officials. Part of this may have been that smuggling and contraband were tolerated within a certain range so that merchants' profits would be granted and cooperation between them and the officials in charge could be maintained. However, Wang Xizhi obviously was not aware of these "unwritten rules" or at least not willing to respect them. His judgement thus broke the established balance and led to the outbreak of unrest.

2.6.5 *Between Sichuan and Yunnan: case study of the Kang family*

A special situation under the aspect of problems and abuses could be found in the border region between Sichuan and Yunnan. The two provinces both had an interest in the mines of Huili Department in Sichuan during the Guangxu reign-period (1875-1908). These mines were locate very close to the border between the two provinces and geographically closer to the capital of Yunnan in Kunming than to Chengdu in Sichuan. From chap. 2.4.1.2., it can be seen that according to the regulations the copper production of the Jiangjunshi mine was distributed between Sichuan and Yunnan. The fact, however, that two provinces and thus two institutions at the same time involved with one mining area became the origin of numerous abuses.

Firstly, conflicts arose about the opening of new mines along the border. From Sichuan's perspective, everything was in its territory, thus allowing Yunnan take its share of the profits could already be regarded as "making personal sacrifices for other people's benefits" (*sheji yunren* 舍己芸人), further attempts of the Yunnan copper bureau like enlarging branch mines or exploring new galleries should be strictly forbidden. From Yunnan's perspective, much was justified by the fact that it had the benefit of better transport connections and the argument of the priority for the metropolitan copper supply[290].

Secondly, Sichuan was not able to procure sufficient amounts of copper. Although according to the regulation of the entire copper production, 40% should be purchased by Sichuan and 60% should be purchased by Yunnan, in fact what the Sichuan mint could procure was only 1/15 of it, which was about 20,000 *jin* per year and Yunnan could also only get 1/10, which was 30,000 *jin* per year. The question, what happened with the remaining above 83% is certainly related to contraband activities. As the reason for this crime was assumed that "Sichuan merchants could use the Yunnan copper bureau as a periapt while Yunnan officials could regard Sichuan copper as a habitat of profit" (*Chuanshang ji jie Dianju wei hufu er Dianyuan fu yi Chuantong wei lisou* 川商既藉滇局為護符而滇員復以川銅為利藪). This means that the merchants in Huili made arrangements with the officials of the Yunnan copper bureaus and sold copper illegally to Yunnan. Once the contraband copper reached the south side of Jinsha River, which was the territory of Yunnan, the authorities of Sichuan could not deal with it any more.[291] It seems that the merchants in the mines of Huili succeeded in manipulating the regulation very well and thus gained much profit by selling more than 83% of their production on the private market at very attractive prices rather than to the state.

The reaction from the side of the Sichuan government was to set up another agreement that both governments should offer funds separately to the merchants. In 1904 the "Agreed regulations between the [copper] bureaus of Sichuan and Yunnan" (*Chuan Dian liangju yiding zhangcheng* 川滇兩局議定章程) came into being. They ordered that a newly opened mine should be at least 30 *zhang* (ca. 96 m) away from an old one; if merchants accepted capital from Sichuan, their entire production belonged to Sichuan and the same for Yunnan; when distributing copper both sides should be present; when raising purchase prices both bureaus should inform each other and ask for mutual permission.[292]

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[290] NQSBSC, „會川銅廠".

[291] NYFS, chap. „各局書巡積弊"

[292] *Niqing shiban Sichuan kuangwu beilan*, „川滇兩局議定章程".

The following case study and introduces a merchant from Huili, who got accused and even prosecuted by the Sichuan government but had a very special cooperation with the Yunnanese side.

Because of the location of his mine Jiangjunshi 將軍石 – at the border between Sichuan and Yunnan, the copper merchant Kang Shouyong 康受鏞 needed to cope with political pressures from both sides. What this meant for him can be traced from three perspectives.

At first from the perspective of a Sichuan official[293]:

"In the Jiangjunshi region, there are more than ten mines and eight to nine furnaces. Most of the merchants there are quite rich. The reason is that big profit is made with contraband copper. Among all the merchants, the Kang family runs [its enterprise] the longest and has the most people in business. Thus they have the most abuses. Years ago, Kang Shouyong even dared to forge a license from the Yunnan Mining Affairs Administration, sold openly one or two hundred hao 號 *(1 hao is 128 jin, so 12800-25600 jin) of contraband copper and beat up an official of the Sichuan copper administration. After his crime was reported, the Minister of Yunnan Mining Affairs Tang* 唐 *ordered Huili Department to arrest him and to punish him strictly. However, Kang Shouyong fled and could not be found to bring to justice. He took a false name, bought himself a title of "registrar of a prefecture" (fu jingli* 府經歷*) as an expectant Appointee (houbu* 候補*). These are only the abuses that have happened before. Now there is a government student Kang Shouxu* 康受煦*. Together with other people, he controls the mining business and uses public offices for private benefit. Since the year Guangxu 16 [1890], they lied that the mines of Bajiaojing* 芭蕉箐 *and Hongya* 紅崖 *which are actually theirs would belong to Yunnan. They even lent the ores to the Yunnan administration so that Yunnan could cover their abuses. The small amount of low quality copper is secretly sold to the local copper shops to cast utensils or to counterfeit coins. The good quality ones is sold to the Dongchuan Mint or to private merchants. They never hand in copper according to the regulation of 40% Sichuan and 60% Yunnan purchasing.*

[293] NYFS.

Thus, although their yearly output can be 200,000 to 300,000 jin, they only hand in 10-20 hao [1280 - 2560 jin] to the Sichuan mint per month."[294]

Secondly, the events can be followed from the Yunnan officials' perspective[295].There are overall 86 pieces of documents preserved in the provincial archives of Yunnan which are concerned with the topic of Kang Shouyong and his Jiangjunshi mine. All these documents date from the years 1907-1911 and draw an interesting picture of the person of Kang as well as of his fateful involvement with the Yunnan authorities:

Besides the administration of his family's mine, Kang had also been forced to take over the post of a commissioner for copper mining of the provincial government of Yunnan for his region. In this way, Yunnan wanted to participate more efficiently in his flourishing business. Because Kang did not cooperate in the way the Yunnan authorities wished, he was then removed from his "post" and accused of defalcation and corruption. Although he asserted his innocence and begged for mercy, he was arrested and sent to Yunnan for his punishment. But in Yunnan his excellent talent and knowledge on copper mining was considered as useful, too. So he did not end up in an ordinary prison or penal labour camp but instead was entrusted with the operation of the Luoxue 落雪 mine. To atone for his crime, he had to hand in 3000 tael of silver to invest into the Luoxue mine as a monetary fine. Kang operated Luoxue very successfully and worked in the following for several mines in Tangdan 湯丹 and Dongchuan 東川, where he was required again to invest his capital but without income and served there until the mines began to earn profits. After this, Kang appealed to the authorities to annul his crime. His initially enormous fortune was completely lost and he returned to his hometown in Sichuan, where he still needed to continue paying back his debts to the Yunnan government.

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[294] Which is 7-10% of the actual output. Baber also pointed out that Chinese government does not receive a tenth part of the output.

[295] Archives Bureau of Yunnan, Nr. 1077-4-515, 1106-4-1706, 1106-4-3021, 1106-4-3024, 1106-4-3074, 1106-4-3104, 1106-4-3105, 1106-4-3180, 1106-4-3193, 1106-4-3195, 1106-4-3203, 1106-4-3268, 1106-4-3269, 1106-4-3270, 1106-4-3271.

Thirdly, in the 1990s Kang Bingkun 康秉琨, the grandson of Kang Shouyong wrote down the history of his family as he knew it from his own memories and from the stories, his relatives had told him. From this perspective the events presented themselves like this:

"Since 1905, the government of the Huili Prefecture began to meddle in the copper mining industry. They took their share of the profit of the Kang family, established a copper bureau in Tong' an 通安 *and appointed my grandfather as copper official. The bureau was established in the nowadays southwest corner of the Sifang* 四方 *Street of Tong' an. Later on, quarrels concerning mining broke out within the big family. My grandfather quit the business, the mines closed down and the copper bureau was cancelled, too."*[296]

From the story of Kang Shouyong, it can firstly be see that the relative closeness to the border of Yunnan repeatedly constituted a problem. The two provinces of Yunnan and Sichuan generally did not establish their mining policies under consideration of each other's interests. They rather acted as rivals while Yunnan had the benefit of better transport connections to several of Sichuan's mines for example along the Jinsha River and the argument of the priority for the metropolitan copper supply, which always granted favourable conditions like in the case of the 40 – 60 distribution in Huili. Secondly, the reaction of the government towards the contraband activities of merchants is shown. As already reported by Baber:

"now and then a speculator of exceptional temerity opens works on a large scale, but the moment his success seems assured he is either accused of contraband mining, or appointed sub-receiver of copper for the locality. In either case his vision of wealth vanishes, and he slinks out of connection with all decorous alacrity."[297]

As a conclusion it can be stated that at the one hand, the lax controls of the governmental administration and its dependency on private structures like copper merchants and brokers caused many problems and abuses; at the other hand while contraband trade,

[296] Kang Bingkun (1997), p. 145.

[297] Baber (1882), p. 91.

smuggling and other malpractices were surely existing to a wide extent, they seem to have formed a balance again und not have undermined the system as a whole to an intolerable extent. To the opposite, these abuses became the condition of cooperation between the two sides of actors.

2.7 *Other mint metals: lead and zinc*

Besides copper, zinc and lead were also important as mint metals and Sichuan produced them for the supply of its provincial mint as well.

The administrative organization and the regulations concerning lead and zinc mining were set up after the example of copper mining and thus do not need to be discussed separately. The treatment of these minor mint metals in this chapter thus remains confined to the introduction of names and locations of lead and zinc mines in Sichuan as well as the main transport routes from the most important mines to the Baochuanju.

2.7.1 *Lead mines*

2.7.1.1 Important lead mines

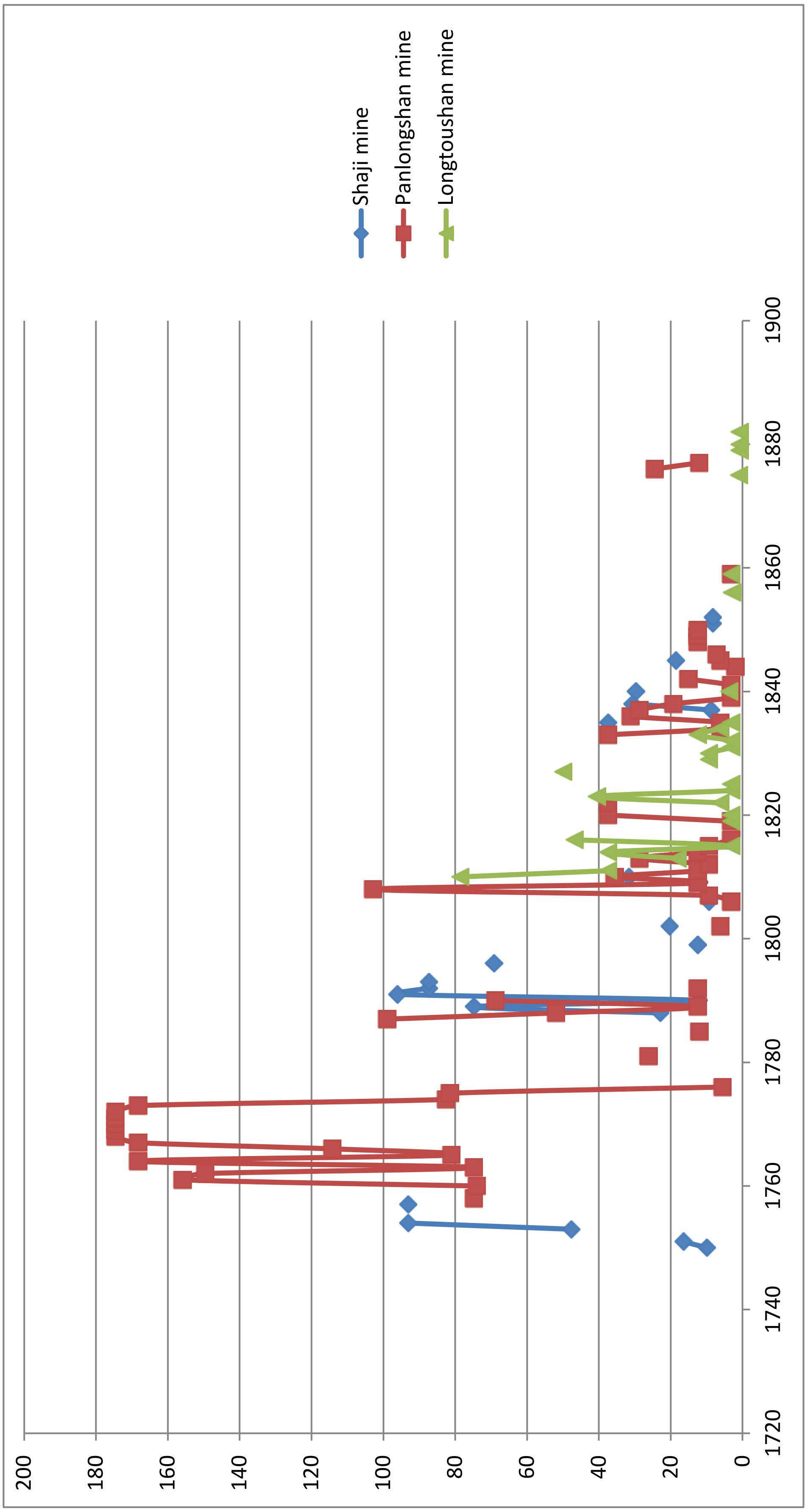
Only three lead mines appeared to be regular contributors to the mint metal procurement of the Sichuan mint:

Table 23: Major lead mines in Sichuan, 1750-1882

Lead mines	**Jurisdiction**		**State purchase price (tael per 100 *jin*)**	**Operating time**
Shaji 沙雞	Mianning District	Ningyuan Prefecture	1.45, 1.6	1750-1852
Panlongshan 盤隴山	Yingjing District	Ningyuan Prefecture	1.6, 2	1758-1877
Longtoushan 龍頭山	Leibo Subprefecture	Xuzhou Prefecture	2	1810-1882

Map 5: Major lead mines in Sichuan, 1750-1882

Graph 21: Yearly output of the most important lead mines, 1750-1882 (in tons)



The funds for the transport of lead to the provincial mint were given in the same way as described for the transport of copper. The transport routes used for the most important lead mines were the following:

- **Route1**. Shaji mine landway 25 station/2000 *li* (2.5 tael) Chengdu Prefecture[298]. The fund was 2.5 tael per 100 *jin*.
- **Route2**. Panlongshan mine carrier 150 *li* (0.5325 tael) Yingjing District landway 520 *li* (0.65 tael) Chengdu Prefecture[299]. The fund was 1.1823 tael of silver per 100 *jin*.
- **Route3**. Longtoushan mine carrier 260 *li* (0.923 tael) Xiaowuji 小霧基 waterway 680 *li* Xuzhou Prefecture waterway 450 *li* Jiading Prefecture waterway 640 *li* (together 0.531 tael) Chengdu Prefecture[300]. The fund was 1.454 tael of silver per 100 *jin*.

2.7.1.2 Minor lead mines

Table 24: Minor lead mines in Sichuan, 1750-1882

Lead mines	Jurisdictions		Sources
Changning 長寧	Changning District	Xuzhou Prefecture	RM
Waziping 瓦子坪	Guan District	Chengdu Prefecture	RM
Shizishan 獅子山	Huili Department	Ningyuan Prefecture	RM
Jiuxingsi Qiankuangping 九姓司鉛礦坪		Luzhou Independent Department	RM
Tiantaishan 天臺山	Pingwu District	Long'an Prefecture	RM

[298] GZZL, p. 129.

[299] RM 2.209.18650.7. See also GZZL, pp. 127-128.

[300] RM 2.215.19265.12. See also TZBL, chap. “四川鉛廠運腳雜費”.

Huajiaoyuan 花椒園		Shizhu Independent Subprefecture	RM
Sanshan 三山	Tianquan Department	Yazhou Prefecture	RM
Kuhaogou 苦蒿溝	Yingjing District	Ningyuan Prefecture	RM
Qianwanggai 鉛旺蓋		Youyang Independent Department	RM
Yuehualou 月花樓	Yanyuan District	Ningyuan Prefecture	GZZL, p. 123.
Chashangou 茶山溝	Changning District	Xuzhou Prefecture	JQ-SCTZ, chap. 70, opened in QL 7
Gumixiang 穀米鄉	Leibo Subprefecture	Xuzhou Prefecture	*Leibo tingzhi*, chap. 30, pp. 2-3
Gaojiashan 高家山	Leibo Subprefecture	Xuzhou Prefecture	*Leibo tingzhi*, chap. 30, pp. 2-3
Shawantang 沙灣塘	Leibo Subprefecture	Xuzhou Prefecture	*Leibo tingzhi*, chap. 30, pp. 2-3
Meizigang 梅子岡	Leibo Subprefecture	Xuzhou Prefecture	*Leibo tingzhi*, chap. 30, pp. 2-3
Dawanzi 大灣子	Leibo Subprefecture	Xuzhou Prefecture	*Leibo tingzhi*, chap. 30, pp. 2-3
Dabaoding 大寶鼎	Leibo Subprefecture	Xuzhou Prefecture	*Leibo tingzhi*, chap. 30, pp. 2-3
Erpingzi 二坪子	Leibo Subprefecture	Xuzhou Prefecture	*Leibo tingzhi*, chap. 30, pp. 2-3
Tubazi, Chunshuping & Laomayuan 兔壩子椿樹坪老馬園	An District	Mianzhou Independent Department	*Shu gu*, chap. 4.
Milachuan Boligou 密蠟川玻璃溝	Buping tusi	Yazhou Prefecture	*Shu gu*, chap. 4.
Longdong Ganyanglouzigang 隴東趕羊樓子崗	Buping tusi	Yazhou Prefecture	*Shu gu*, chap. 4.
Loujianba 樓見壩	Chongqing Department	Chengdu Prefecture	*Shu gu*, chap. 4.
Tuantuozi 團沱子	E'mei	Jiading Prefecture	*Shu gu*, chap. 4.

Zhongzui Wuziping 中嘴無子坪	Emei District	Jiading Prefecture	*Shu gu*, chap. 4.
Lianghekou Changdigou & Shuiduixi 兩河口即長梯溝水碓溪	Emei District	Jiading Prefecture	*Shu gu*, chap. 4.
Xiaoshuigou Laoheyan 消水溝老鶴岩	E'mei District	Jiading Prefecture	*Shu gu*, chap. 4.
Dongzigou 硐子溝	Guan District	Chengdu Prefecture	*Shu gu*, chap. 4.
Daqiangou & Xiaolinggang 大乾溝小嶺崗	Guan District	Chengdu Prefecture	*Shu gu*, chap. 4.
Dayan, Donggou & Erbao 大沿東溝二堡	Guangyuan District	Baoding Prefecture	*Shu gu*, chap. 4.
Chaotianma, Linxiangshan & Yunbanya 朝天馬麟象山雲板崖	Hongya District	Jiading Prefecture	*Shu gu*, chap. 4.
Wawudang, Mugouya & Yuyanshan 瓦屋黨母狗崖玉沿山	Hongya District	Jiading Prefecture	*Shu gu*, chap. 4.
Shibanjing 石板箐		Luzhou Independent Department	*Shu gu*, chap. 4.
Luobu 羅卜		Luzhou Independent Department	*Shu gu*, chap. 4.
Yanbangou & Qingshangou 岩板溝青山溝		Maozhou Independent Department	*Shu gu*, chap. 4.
Cengyanzi & Huapi 層岩子化皮黑鉛廠	Pingshan District	Xuzhou Prefecture	*Shu gu*, chap. 4.
Laoxi 老溪	Pingwu District	Long'an Prefecture	*Shu gu*, chap. 4.
Yaozipo 鷂子坡	Qingxi District	Yazhou Prefecture	*Shu gu*, chap. 4.
Dalinggou Shanping 大嶺溝杉坪	Qingxi District	Yazhou Prefecture	*Shu gu*, chap. 4.
Malaoxi 馬老溪	Taiping District	Suiding Prefecture	*Shu gu*, chap. 4.
Dongla, Lianghezui & Longchi 東蠟兩河嘴龍池	Tianquan Department	Yazhou Prefecture	*Shu gu*, chap. 4.
Lengzhen 冷鎮	Tianquan Department	Yazhou Prefecture	*Shu gu*, chap. 4.

Dongla & Shibangou 東蠟石板溝	Tianquan Department	Yazhou Prefecture	*Shu gu*, chap. 4.
Laolongshan 老龍山	Yingjing District	Yazhou Prefecture	*Shu gu*, chap. 4.
Tuzhuba 土箸壩	Wan District	Kuizhou Prefecture	*Shu gu*, chap. 4.
Baishaling 白沙嶺	Wan District	Kuizhou Prefecture	*Shu gu*, chap. 4.
Guoluya 過路崖	Wan District	Kuizhou Prefecture	*Shu gu*, chap. 4.
Huajiaoyuan 花椒園	Wan District	Kuizhou Prefecture	*Shu gu*, chap. 4.
Youxiyou, Huangcaoping & Mushiping 尤溪溝黄草坪木石坪	Wenchuan District	Maozhou Independent Department	*Shu gu*, chap. 4.
Ninggangshan Dishuiya 寧崗山滴水崖	Xichang District	Ningyuan Prefecture	*Shu gu*, chap. 4.
Caoli 草里	Xiushan District	Youyang Independent Department	*Shu gu*, chap. 4.
Shizishan 獅子山		Youyang Independent Department	*Shu gu*, chap. 4.
Sanchaba 三岔壩		Youyang Independent Department	*Shu gu*, chap. 4.
Xiaogaishan 小蓋山		Youyang Independent Department	*Shu gu*, chap. 4.
Qianxi, Xiaoba, Yingzuiya & Tongcaogou 乾溪小壩鸚嘴崖銅漕溝		Youyang Independent Department	*Shu gu*, chap. 4.
Jizi 麂子	Yuexi Subprefecture	Ningyuan Prefecture	*Shu gu*, chap. 4.

Map 6: Zinc mines in Sichuan, 1755-1877

2.7.2 *Zinc mines*

There were altogether only five zinc mines recorded in Sichuan. namely the following:

Table 25: Zinc mines in Sichuan, 1755-1877

Mine name	**Jurisdiction**		**State purchase price (tael per 100 *jin*)**	**Operating time**
Qianwanggai 鉛旺蓋	Youyang Independent Department		2.2	1755-1785
Baishaling 白沙嶺	Shizhu Independent Subprefecture		1.8	1770-1877
Dabagou[301] 大壩溝	Yingjing District	Yazhou Prefecture	2.2	1774
Waziping[302] 瓦子坪	Guan District	Chengdu Prefecture	2.2	1774
Xianglushan[303] 香爐山	Yingjing District	Yazhou Prefecture		

Among these five mines, only the first two contributed enduringly to the mint with their zinc production. The transport funds were given in the same way as described for the transport of copper:

- **Route1**. Qianwanggai mine, Mumushan 木馬山[carrier 55 *li* (0.195 tael)] Siqu Xiatuo 思渠下沱 [waterway 2980 *li* (0.894 tael)] Chengdu Prefecture[304]. Fund was 1.089 tael per 100 *jin*.
- **Route2.** Baishaling mine [carrier] Shizhu Independent Subprefecture 石砫直隸廳 to Xiatuo 下沱[waterway] Chengdu Prefecture.
- **Route3.** Baishaling mine [carrier] Shizhu Independent Subprefecture 石砫直隸廳[waterway] Yangduxi 洋渡溪[waterway] Chengdu Prefecture[305]. Fund was 1.23 tael per 100 *jin*.

[301] Only once contributed to the Baochuanju with 12850.5 *jin* of zinc, see RM, 2.193.16864.2.

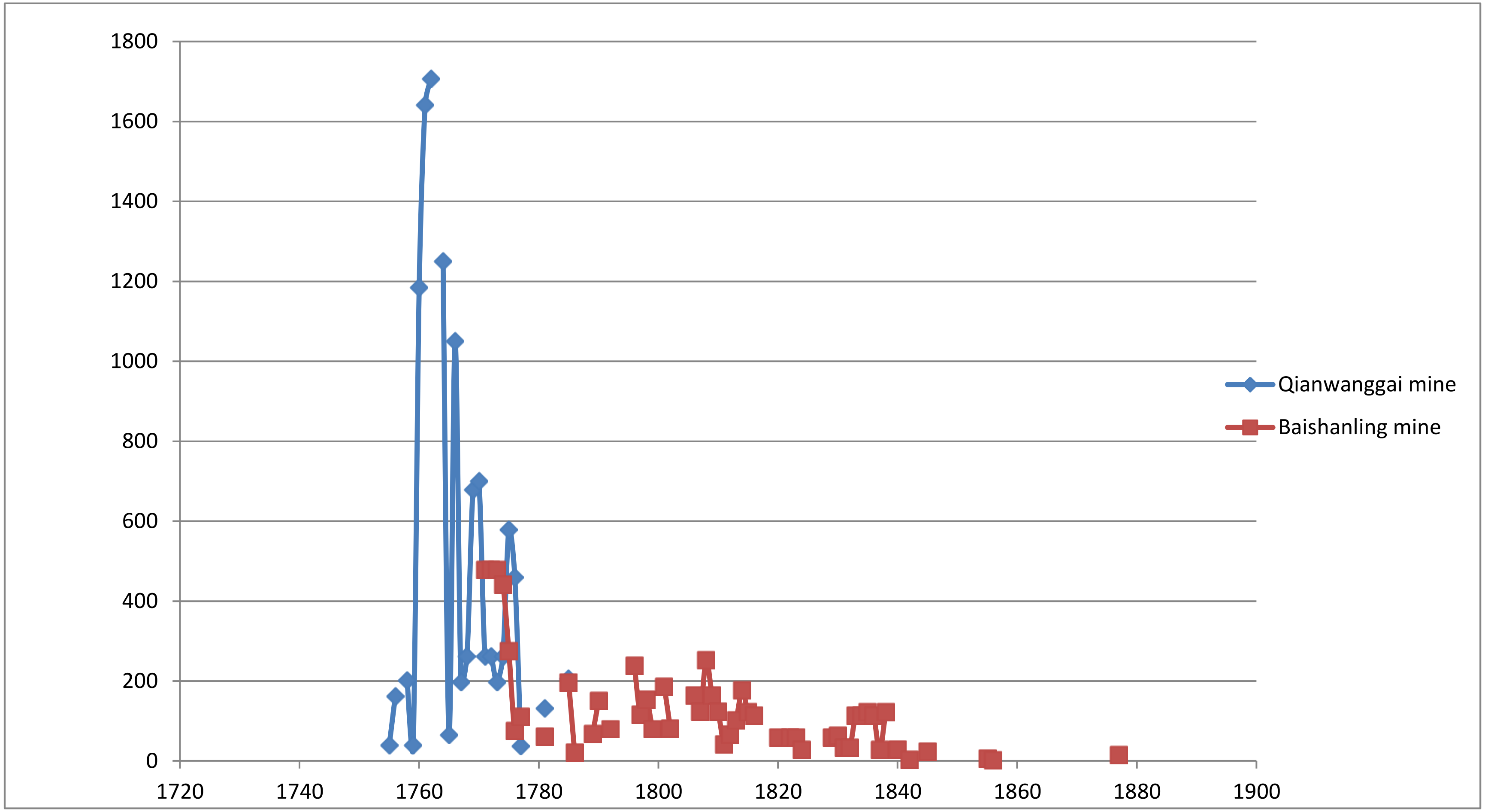
[302] Also only once contributed to the Baochuanju, with 187 *jin* of zinc, see RM, 2.193.16864.2.

[303] *Shu gu*.

[304] GZZL, p. 131.

[305] TZBL, chap. “四川鉛廠運腳雜費”.

Graph 22: Yearly output of the most important zinc mines, 1755-1877 (in tons)



3 MINING AND REGIONAL DEVELOPMENT

3.1 *Mining, immigration and agriculture*

3.1.1 *Sichuan after the Ming-Qing transition*

After the time of the Ming-Qing Transition and the Rebellion of the Three Feudatories 三藩之亂, most of Sichuan was completely devastated and depopulated. Not only endless warfare with a high death toll on the battlefield but also massacres against civilians brought the formerly well-off province into chaos. Epidemics like the bubonic plague or Meningitis moved together with the armies and infested surviving population parts.[1] With the large scale retreat of human settlement, wild animals, especially tigers multiplied enormously and took their share, too. It is for instance reported in a memorial to the Shunzhi Emperor in 1653 that from the 506 inhabitants of a newly founded settlement 228 were eaten by tigers.[2] Under these conditions, Sichuan, a province by natural condition largely apt to intensive agriculture, became an almost empty wilderness. Although the negative effects of the above mentioned historical events were enormously far-reaching, it seems that not all areas have been involved to the same level. There is a record by Fei Mi 費密 from the year 1669, in which it becomes evident, that the regions to the south of Chengdu, especially the lands around the Dadu River, the towns of Yazhou and Yuexi and the Small Cool Mountains most have preserved at least a minimum of agricultural activity and population structure.

"In the first month of the year dinghai (1647) there was a great famine in Sichuan and people ate each other. Since the year jiashen (1644) when the rebellion [Zhang Xianzhong] started it had been going on for three years. People in the departments and districts were all killed except one or two left who escaped. Soldiers only concentrate on

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[1] Entenmann (1982), p. 49.

[2] Memorial by Zhang Chun 張春 dated SZ 7/3/24, in: *Ming Qing shiliao*, first serious (jia).

*warfare and battle. There is nobody to plant and plough on the fields. The rice in store is decayed, which leads to a terrible famine. At that time all the rice came from the barbarian districts (*土司*). Thanks to the supplies from the Dadu River Sub-section (*大渡河所*) and from the Yuexi Command (*越巂衛*), the rice price in Yazhou Prefecture is only [little] above 10 tael of silver per dou [10.35 litre]. In Jiading it is already 30 tael, in Chengdu and Chongqing it is 40 to 50 tael. […] Most of the survivors of Chengdu escaped to Yazhou feasting on wild plants. Others flew into the barbarian districts."*[3]

Fei Mi's information on the rice price is here particularly interesting because it shows its increase along the later copper transport route from Yuexi and the Dadu River region, where it is produced through Yazhou Prefecture (10 tael per *dou*) down the Ya River to Jiading Prefecture (30 tael per *dou*) and again up the Min River to Chengdu (40-50 tael per *dou*). It can furthermore be seen from Fei Mi's record *Huang shu* 荒書 (Book of devastation) as a whole, that at least during the time of the Ming-Qing transition the most catastrophic events must have taken place north of the prefectures of Yazhou and Jiading, probably leaving the later copper mining regions in a situation of relative stability, though far away from being densely populated or economically flourishing.

China's Southwest in general and Sichuan itself in particular during the decades to come developed into China's most favoured immigration province. During the end of the seventeenth and the beginning of the eighteenth century high overpopulation especially in the Southeast forced many farmers into emigration, with plenty of them choosing Sichuan as their new home. This development was largely supported by the Qing government by providing seeds, ploughing oxen and long-term tax incentives in order to attract new settlers.[4]

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[3] Fei Mi, Huangshu: Zhang Xianzhong jiao Sichuan shilu p.436 f.

[4] Entenmann 78 ff.

3.1.2 *Immigrants and their occupations*

The vast majority of Sichuan's early immigrants were peasants which could not be nourished by their small patches of land in other parts of China any more or had become landless for economic reasons. These immigrants aimed at establishing themselves as farmers by occupying abandoned arable land or by clearing new land. If they managed to overcome the difficulties of the wilderness and the lacking infrastructure they were confronted with, they could develop successfully. Later immigrants could not find suitable patches of arable land at an affordable price anymore and many of them had to become day labourers or tenants before after many years probably being able to settle down. With this development occupations of immigrants also began to diversify. Instead of practicing rice-based subsistence agriculture, now cash crop farming with plants like indigo or tobacco increased. The building up of new cities and market towns lead to urbanisation and a higher level of commercialisation even in Sichuan's rural economy offering a series of new occupations such as artisans or merchants to people.[5] Right at this time during the Yongzheng reign-period the first large mining enterprises opened up in China's Southwest providing within a few years a source of income for hundreds of thousands of workers, mostly from the lowest, completely fundless layers of the immigrant society. While in Yunnan this development took place somewhat faster and more immediate, Sichuan's mining industry evolved slower nonetheless became a very important source of employment, too.[6]

This employment did not only concern the miners themselves but also a large number of occupations related to the mining industries like merchants providing food and supplies to the mines, metal craftsmen like blacksmiths or mint workers, transport coolies and a great number of people finding other types of outcome in the newly appearing mining towns, flourishing and declining with their mine's profit.

[5] Entenmann 133 ff

[6] The reasons for this difference in development are among others the much more successful execution of the *gaitu guiliu* policy (see chap. 2.1.3) as well as a closer financial involvement of the state in Yunnan (see chap. 2.6.3).

3.1.3 *Conflicts between miners and peasants: a case study*

The fact that in some of Sichuan's mining areas, especially in the lower regions of the Small Cool Mountains agriculture played an important role too and peasants tended to be already longer established on the spot than miners, inevitably lead to interest conflicts between the two groups. One conflict like this, which did not only involve peasants and miners themselves but also officials of two adjacent districts will be introduced in the following as an example[7]

The case under consideration took place in the year Jiaqing 9 (1804) in Mabian Subprefecture 馬邊廳 in the north-eastern foothills of Liangshan. Different copper mines run by different merchants had been operated in this region for more than forty years. As a yearly average they could hand in 38,000 *jin* of copper to the provincial mint. The local economy could benefit from the successful mining enterprises, too, and the place could be called wealthy. From 1790 onwards mining began to decline. During the Yi rebellion which had taken place two years earlier, the biggest mines had been burnt down and copper taxation quotas were very difficult to fulfil.

Under these circumstances the merchant Xu Zhenglong 徐正龍 applied to open a copper mine. Before he did so, he had already invested some capital, had hired some charburners and had successfully smelted ore on a trial base. His enterprise was ready to start.

The landlord Zhu Xianghou 朱相侯 attempted to stop him because he saw his own agricultural investments in danger, but he did not succeed. So he incited the magistrate of Pingshan District 屏山縣 to send out his runners in order to lead more than twenty villagers to the mining site and to let them destroy the charcoal stacks and arrest the five charburners. Miner Xu complained about this again to the magistrate of Pingshan. The magistrate's answer was, that the burning of charcoal for mining purposes should be strictly controlled. Trees for burning charcoal should be bought within the budget of the governmental purchasing price, which was 9 tael of silver per 100 *jin*. Xu refused to

[7] *Mabian ting zhilue*, chap. 4, Copper Affairs.

accept the judgment and went to the neighbour jurisdiction in Mabian Subprefecture to seek the magistrate's support against this judgement.

Zhou Sinian 周斯年, the magistrate of Mabian Subprefecture, was holding the opposite opinion. He suggested to either transfer Landlord Zhu and his followers to the superior government, the Xuzhou Prefecture 敘州府, or to his own jurisdiction and let them be punished there. He also suggested to make the order that all the forest around the mines should be reserved for their use only, which means for charcoal production.

His arguments were the following:

a) Copper production was already declining and the Yi rebellion had exacerbated the situation. The local government could not acquire enough tax copper for minting so that the deficit grew increasingly. Thus the mine merchant should be supported, not the landlord indulged.
b) Governmental purchasing prices were fixed forty years ago and were already very low at this time. Since then the costs of mining had increased enormously. How could the magistrate of Pingshan still ask a merchant to buy trees from this money?
c) The treatment of this case would make all other mine-owners insecure in a time in which it was particularly important for the government to give the right orientation.

Magistrate Zhou's report reached the provincial treasurer and his reply was, to let the prefect in Xuzhou take over the law suit. However, the prefect decided to keep the old judgement of the Pingshan magistrate valid and to let the miner pay for his wood, so no one would need to bother to bring all the parties involved to the prefecture.

Through the reasons leading to this conflict between a landlord and a mine merchant as well as through the attitudes of the government officials, several aspects of the crisis affecting Sichuan's copper industry at this time, can be seen:

a) Increasing costs already made the mining business decline. In 1790 the costs to produce 100 *jin* of copper in the Tongda 銅大 Mine in Mabian were 9.466 tael of silver[8], which exceeded the governmental purchasing price 9 tael fixed half a century ago by almost 0.5 tael per 100 *jin*. From the local gazetteers it can be see why the costs increased. In 1762-1763 "oil, rice and food, everything was cheap; in the mountains, trees could be cut and charred anywhere, so the necessary capital was few but the profit was much"[9]. Now after 1790-1791 "oil, rice and food, the prices for everything increased rapidly; mountains, forests and trees all have their owners. Charcoal stacks are getting further and further away day by day. Supply and transport are not easy; smelting is more and more difficult."[10] Consequently, "mining declined and the commoners cleared more [land]. Steep mountains and old forests were all turned into arable land. People occupied the mountains and forests and quarrelled with the miners."[11]

b) Acquisition of fuel was a crucial question of running a copper mine. Price inflation and the expansion of agriculture resulted in higher costs for the production of charcoal, which again directly affected the entire mining enterprise.

c) The population increased rapidly. As mentioned before, at the beginning of Qing Dynasty, in order to solve the problem of depopulation in Sichuan during the Ming-Qing transition, the Qing government took a series of measures to increase its population. Resettlement allowed Sichuan to recover its lost population within a few decades[12]. The arable land per capita in Sichuan decreased rapidly from 33.58 *mu* (=0.0667 hectares) in Qianlong reign to 2.17 *mu* in Jiaqing reign-period.[13]

d) There were two opposed opinions among local officials, which reflected the conflict between mining merchants and government. In order to encourage mining on the one hand or to ignore or even hamper it on the other one, they followed different policies.

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8 Peng Zeyi (1962), p. 352.

9 *Mabian ting zhilue,* chap. 4, Copper Affairs.

10 Ibid.

11 Ibid.

12 Entenmann (1982).

13 Wei Yingtao (1990), p. 12.

3.2 *Mining, environment and deforestation*

As can be seen from this case study, fuel supply was of crucial importance for the successful operation of a copper mine and its smelter. If no mineral coal was available in a fairly close distance to the mine,[14] this meant that for the smelting of the ore trees had to be cut down and processed into charcoal in order to provide fuel. Regardless of the availability of mineral coal, uncharred firewood needed to be used for the roasting of most copper ores before the actual smelting process could begin. While these uses doubtlessly accounted for the by far largest share of a mine's wood consumption, in addition to fuel remarkable amounts of wood were usually also used for the timbering of the galleries,[15] the construction of the worker's dwellings, for heating, cooking and the making of all types of tools.

In order to satisfy a mine's enormous wood demand, workers and charburners would usually first start to cut down the trees in the immediate neighbourhood of the mine and later in increasingly big distances mainly along the walkable paths.[16] By doing so, larger and larger areas around the mine would be deforested with its continuous exploitation and at the same time acquisition of fuel would become more and more difficult and expensive.[17] As a side effect, often land erosion along the steep ridges or on more loosen soils sometimes lead to the situation, that even after a mine would be abandoned and wood cutting would be stopped, the bare land surrounding it could still not be reforested again.

While much doubt needs to be cast neither on these basic assumptions nor on the fact that these phenomena[18] constituted a major problem for the mines, it is to the contrary much more difficult to estimate, how influential they were to the mining region and its ecological system as a whole. It can be seen from some western accounts that towards the

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[14] In Sichuan copper smelting with mineral coal is only reported from several mines in the Huili region, see chap. 2.3.4. of this thesis.

[15] *Mianning xianzhi*, chap. 5, Mine Affairs.

[16] *Mabian ting zhilue,* chap. 4, Copper Affairs.

[17] Vogel (2008), p. 144.

[18] Valuable and detailed research on the relation between deforestation and the fuel consumption of copper mines on the example of northern Yunnan has been carried out within the framework of the research group "Monies, Markets and Finance in China and East Asia, 1600-1900" by Hans Joachim Rosner, Stefan Dieball, Andreas Braun and Ron Hagensieker. See e.g. the forthcoming conference proceedings of the research group.

end of the Qing period in some places in the mining regions deforestation had in fact become a general problem, which did not remain confined to the immediate environment of the smelters.

Fergusson relates to the region around Ningyuan, which although originally rich of water and gentle in climate, and describes that it

"[...] at the present time is very bleak, and only near the waterways or on an occasional hill small trees are to be found, and there is very little shrubbery about. Fuel is very expensive, as it has to be carried a long way."[19]

The Austrian Botanist Heinrich Handel-Mazzetti confirms his description in various places of his account:

"The surrounding hills and mountains were totally bare, the red of the sandstone being the predominant colour, though it was still sparsely covered by dry yellow steppe vegetation. The only exception was Lu Shan, the temple mountain on the west bank, where the light green pine forest had not been felled."[20]

While this passage describes the situation in the surroundings of Ningyuan itself, he reports a similar image from formerly wooded areas further inside the mountainous regions of Liangshan:

"A small pinewood and higher up a few scattered firs and broad-leaved trees were all that remained of the mountain forests which, to judge from the huge rotting trunks half buried in leaf mould, must once have stood here. The shady woodland and the damp forest floor carpeted with moss and shade-loving plants were now only a dream [...]."[21]

When passing through Tong'an, where still at the time of his travel fairly intensive copper production was carried out, Handel-Mazzetti observed vast deforestation, too, and relates it directly to the demand of the mines and smelters:

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[19] Fergusson (1911). The Descriptions of Fergusson are based on the observations of John Weston Brooke, who travelled in China between 1880 and 1908.

[20] Handel-Mazzetti / Winstanley (1927 / 1996), p. 15.

[21] Ibid. p.18.

"Everything was dried up, a landscape in shades of brown. On either side we saw steep slopes laid bare by landslides with broad outflows of sand and mud beneath them. Only on the left, where the landslides terminated at the end of the plateau itself, did the rock display any variation in colour. The summits of the mountain range superimposed on the plateau were also totally barren, like those of Mount Dienshan in the north-east; all the trees had presumably been cut down to fuel the copper mines. […] The track continued northwards through bleak barren country over a low ridge and then crossed the valley of the Yangzhu He which flowed towards us in broad meanders."[22]

Forest destruction by intensive woodcutting is mentioned still in several other places of his report:

"Botanically, the track over the sandstone ridge was of some interest, even though nearly all the forest had been felled"[23]

"Since the summit region of Mount Longzhu Shan (3675m) was unforested — whether because of its volcanic rock, its exposure to wind or more probably because the trees had been felled — it seemed higher than it really was."[24]

"Travelling north east we climbed over a little ridge, pausing to collect plants among the scanty remnants of a mercilessly destroyed forest along the valley bottom of a little stream and on the slopes on either side. The presence of Epimedium acuminatum confirmed that the spot had once been forested."[25]

In the region of Zhaojue, Handel-Mazzetti serves a rather anecdotal indication for the deforestation of the formerly wooded area:

"[…] one of the officials came to complain that our horses had smashed the wood-framed window at the rear of the temple. Of course it was not the horses that had

[22] Ibid. p. 11.

[23] Ibid. p. 46.

[24] Ibid. p. 47.

[25] Ibid. p.19.

done this but the mafus, who claimed that they had been unable to find any other wood for their cooking fire."[26]

These many descriptions show that deforestation in general must have been an issue in the Liangshan region already during the time under consideration. Although at least in one place Handel-Mazzetti directly attributes the deforestation to the copper mining himself, it is necessary to consider other factors that may have contributed to deforestation alike and to estimate their extent and influence in the whole picture. Again Handel-Mazzetti names another reason for the destruction of forest land, namely to offer a better pasture for cattle and to extirpate possibly poisonous reptiles:

"[...] ridges were bare, every tree and bush having been cut down and the grass which replaced them having been burnt, allegedly to improve the grazing and kill reptiles."[27]

In another place he speaks about a forest destroyed by fire, although it is not clear, if in this case the reason for destruction were the same ones as above and if it was actually destroyed by people:

"Westwards these gorges led back to the Yalong, but on this side they were sadly disfigured by burnt forests."[28]

Other reasons for forest destruction beside the acquisition of fuel for purposes of copper mining that need to be surely taken into account are the clearing of land for the purpose of agriculture, the cutting of trees as firewood for the growing population and of course also the fuel supply for metal smelters other than copper, like iron, gold, tin or lead, which were all found and produced in the Liangshan region, too.

In the investigation undertaken by Chang Longqing and his colleagues in the 1930s, they categorized the reasons for deforestation as the following[29]:

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[26] Ibid. p. 20.

[27] Ibid. p.16.

[28] Ibid. P.26.

[29] Chang Longqing (1939), nongmu men, pp. 52-53.

a) Mountain fire. In order to avoid Yi and drive wild animals from harming crops, or to produce fertilizer for agricultural use. Accidental forest fires were also common.
b) Daily use for cooking and heating.
c) Producing charcoal for mining. Especially in the region of Zhaojue 昭覺 where the Wupo mine and Jinma mine were operated, the forest was all gone.
d) Making pine candles.

From the above mentioned observation and investigation, it can thus be concluded that mining activities in Sichuan was indeed one of the many reasons for the local deforestation.

3.3 Mining, economy and stability

3.3.1 *Capital investment*

While the occupation of land for agricultural purposes, the use of forests by peasants and the population increase in general usually lead to higher prices of the commodities necessary for a mine – most importantly charcoal – some positive effect came along with immigration, too. Settlers brought external capital into a region that had not much of an economic base for large scale investment into mining, immigrant capital was an important foundation of the introduction of large-scale copper mining in Sichuan during the first half of the 18th century.[30] Furthermore, with immigration, mining knowledge and people in search of mine work from all over China entered Sichuan and furthered the development of the industry. Special attention should be paid to the migration of knowledge from Yunnan. Specialists from Yunnan brought in more advanced techniques in mining, for example, during the smelting process[31]. This could also be seen from the case study of Kang family, who originally came from Yunnan and operated mines in Huili successfully over generations[32].

3.3.2 *Mining towns and mining profits*

One place that greatly benefitted from this inflow of human and material capital into Sichuan's copper mining was the small rural outpost of Mabian, which within short rose to a wealth which earned it the nickname of "Little Chengdu"[33]. Like capital investment and sufficient workforce were necessary conditions to make a promising copper mine flourish, flourishing copper mines and the profits gained by them could obviously also contribute to the general weal of a settlement and its region.

Besides the example of Mabian, this also becomes obvious from a number of remarks western travellers have made about Huili, a town whose wealth according to

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[30] Lin Chengxi 林成西 (2006), pp. 187-190.

[31] *Mianning xianzhi*, chap. 5, Mine Affairs.

[32] See chap. 2.6.5.

[33] Gazetteer of Mabian Subprefecture.

Baber is purely due to its mines and the traffic route that leads through it[34] Likewise, Baber describes Baiguowan, the place where most of Huili's coal for smelting the copper was mined as a "flourishing village"[35], while the biggest part of the surrounding places is evaluated rather poorly.

Still before Baber the French traveller Louis de Carné passed Huili and compares it to what he witnessed in Yunnan, which at this time he must have found plague-struck and with the wounds of the devastating Panthay Rebellion still open:

"This valley is full of villages; the houses are new or freshly built; and every now and then one is reminded, by some group of buildings of the well-cared-for villas of our retired merchants. This part of Setchuen seems to breathe freely, and profit by the sad condition of the neighbouring province, depopulated by war, pestilence, and famine. With these consoling symptoms of calm prosperity are combined, round Houeili-Tcheou, signs of animation and commercial activity. This village is surrounded with a strong enclosure; bastions are being completed, and other fortifications are in course of erection. Beyond this, the inhabitants of Houeili-Tcheou seem very little troubled by passing events."[36]

Similar judgements are given by Elizabeth Kendall-Kimball, who dedicates a long passage to the beauty of the small town she passed in 1911 [37] and also by Heinrich-Handel-Manzetti, who still several years later calls Huili "more neat than Kunming".[38]

If this was the case for Huili then even more for the smaller town of Tong'an which according to Chang Longqing entirely relied on profits from copper mining with practically all its wealthy citizens investing into this business.[39]

These observations, however only hold true for these places during the time when mining activities took place on a high level, as e.g. a visit of Henri d'Ollone to the area

[34] Baber (1882), p.92

[35] Ibid.

[36] De Carné (1872), p.307

[37] Kendall-Kimball (1913), p.68

[38] Handel-Manzetti (1927), p.10

[39] Chang Longqing (1939), p. 61.

around the formerly flourishing Wupo mine shows.[40] When mining yields decreased especially in the rather remote mountain areas, miners left the region, in the worst case may have turned to banditry as often feared by the authorities. Accordingly, in spite of existing copper mining activities on a modest scale, Liangshan at present is one of China's poorest and least developed regions.[41] The reason, that in the eyes of contemporary western travellers as well as from a present perspective the town of Huili has been spared from a steep decline may be seen in the fact that its prosperity did not solely rely on mining but also to a certain extent on trade and agriculture. It can thus be preliminarily concluded that although copper mining had importance for the province's economy at large, could not offer sustainable benefits to the mining regions on the local level.

[40] D'Ollone (1911), p. 86.

[41] For more information on the present economic situation see e.g. Heberer (2007).

3.4 *Mining, ethnic proportions and conflicts*

3.4.1 *Yi and mining*

As has been described in chap. 2.1.3., vast parts of Sichuan's copper mining area were situated within the realms of the Yi. Although the political influence of the Yi as well as the methods of control and confrontation between them and the Qing government changed very much over time, they remained an important factor.

It is unclear, until which extent Yi people were already involved into copper mining before large scale mining operations with the support of the state began. It was told in an investigation during the 1950s by the Yi people that ten generations ago, which was around beginning of 18th century, their ancestors moved to the Xiacun region in Huili to smelt copper by using pine charcoal[42]. Some place names show that the Yi were at least aware of certain copper deposits. For example, in the name pronounced as "Zi-du-laola" 子堵老拉 in Huili, "zi" refers to copper, "du" means "producing", and "laola" deep valley[43]. According to Alexandre François Legendre, who travelled the region at the beginning of the 20th century and referred to oral information from a local chieftain, the Yi were not able to mine and extract copper by themselves before the advent of Han miners but bought it from Xifan tribes of the neighbouring regions:

"Ce metal [copper] abonde au Kien Tch'ang, non seulement a l'etat de sulfures très riches, comme l'érubescite, mais encore à 1'état natif. Malgré cela, les Lolos n'auraient appris à utiliser le cuivre qu'a l'arrivée des Chinois, dit-on generalement. I1 était plus logique de penser que le Si-Fan, maître de ces Territoires avant la venue du Chinois et, d'une si grande habileté à travailler tous les métaux, avait été l'initiateur. Cette hypothèse a trouvé confirmation: un chef de tribu fort intelligent, duquel je tiens d'autres précieux renseignemeuts m'a dit textuellement: 'Nos ancêtres ne savaient pas extraire le Cuivre: ils l'achetaient des Si Fan et déjà transformé en ustensiles. Il en était, de même, du fer.'"[44]

[42] *Sichuan yizu lishi diaocha ziliao, dang'an ziliao xuanbian*, p. 94.

[43] Zhu Shengzhong (2005), p. 98.

[44] Legendre (1909), p. 619.

While preparing for his expedition into Yi territory, Henri-Marie Gustave d'Ollone, too, met with objections of an Yi chieftain against mining. These objections, however, were obviously not only due to traditional believes but rather to experiences the Yi had had with mining activities before:

"Ma [the Yi chieftain] déclare répondre de nous, au nom de sa tribu: si nous promettons solennellement que notre but n'est point de découvrir des mines, — ce que les Lolos redoutent par dessus tout, car les métaux précieux appellent les invasions — nous n'avons qu'à venir, tous les siens nous feront bon accueil, et s'emploieront à nous en ménager un pareil chez leurs voisins."[45]

A similar attitude is reflected in the report by Zeng Zhaolun 曾昭掄, a professor of chemistry at National Southwestern Associated University, who visited the region around the former Wupo mine in 1941:

"From the copper mine I took a shortcut back. The first stretch lead through a field where Yi people were working. They all stood up one after another and questioned me about the ore's quality. I answered with 'not bad' and expressed the wish that the copper should be mined by the Yi people themselves. When I said so, they were all quite happy. Later I said the same words to Wupowuda [Zeng's Yi host], he was also very excited. I understand their mind: it is absolutely forbidden for outsiders to lay hands on the copper ore here."[46]

In spite of this attitude, the Yi around Wupo did not carry out any copper mining themselves. Instead, they directly took the natural copper which could be found and easily obtained here and traded it with Han Chinese in the market[47]. In praxi, however, attitudes of Yi people towards the mining activities varied much in respect to situation, time and places.

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[45] D'Ollone (1911), p. 24f.

[46] Zeng Zhaolun (1947), p. 216.

[47] *Xuzhou fuzhi*, chap. 20, p. 11b-12a.

3.4.2 *Yi and Han: confrontation and cooperation*

One source from the early establishment phase of large scale copper mining refers to an event which took place during Yongzheng 10 (1732) at the Ziguba mine in Mianning District. It is recorded, that Yi people attacked the mine and killed the miners. The reason for this is not clear. It may have been hate against the Han and their mining activities but just as well also desire for pillaging goods and obtaining slaves.[48]

During the Daoguang and Xianfeng reign-periods (1820-1861) numerous mines in Leibo Subprefecture had to be completely closed down due to recurring disturbances by the Yi, who set fire to the buildings and destroyed the mines. This did not remain confined to Leibo, also the famous thriving Wupo mine, which belonged to Xichang District, was destroyed in Daoguang 12 (1832) by an Yi attack under the leadership of a *tusi,* a local Yi chieftain which was officially enfeoffed his title by the Qing government and should thus rather be regarded as "adapted Yi".[49] In 1882 Baber reports that near Yuexi there were "mines of silver, copper and iron, which until lately were worked by the Chinese, but are now in the possession of the free Lolos"[50] Whether these mines continued operation after being conquered by the Yi remains unclear.

In spite of these above mentioned examples of disturbances of mining activities by the Yi, which could be continued to become a much longer list, various reports also show a very fruitful cooperation of the local Yi population with miners and investors. In the Ziguba mine in Yongzheng 4 (1725) it was recorded that the Yi provided the mine workers with oil and rice. These provisions were treated like a capital investment into the mine by the merchants and thus a share of three tael of silver was paid to them every month. This was called "mountain fee" (*shanqian* 山錢)[51].

In some mines, cooperation between Han and Yi was even further developed. For example in the Wupo mine, most of the mine workers digging ore underground were

[48] MNYZ, pp. 355-356.

[49] MQDA, DG12/3/2.

[50] Baber (1882), p.65.

[51] MNYZ, p. 355.

actually Yi themselves while Han people were mainly in charge of smelting the metal.[52] In a lead mine in Mabian Subprefecture which employed more than 100 workers altogether, also a big number of them were Yi[53].

Another very interesting example of arrangement between Han miners and Yi landowners took place in Huili Department at the Jiangjunshi mine near Tong'an. A Han mine merchant Kang Shouyong 康受鏞 began to carry out mining on land belonging to a local Yi nobleman. For this he had to pay a high "protection fee" to the Yi in order to avoid troubles during mining. After several years, a marriage was arranged between Kang and the Yi nobleman's daughter. Henceforth Kang would not have to pay any protection fee anymore and the Yi nobleman would become an investor into the mine, providing more land for the enterprise and support for the construction of facilities and buildings.[54]

In regard to this, actions and reactions from two sides need to be taken into consideration: from the miners and from the government. In general, both miners and government pursued a situation of peace and cooperation with the Yi as long as they could protect their own interests. Not only were the miners willing to pay rent and protection fees and make gifts, but also the government used its influence on the *tusi* or other local chiefs they were on good terms with to function as an intermediary between the Yi and the miners. For example, before the above-mentioned Ziguba mine began operating, two officials went together with a respected local old Yi and brought gifts, a red waistband and a bolt of cloth, to the Yi who controlled the mine area and asked him for good cooperation[55]. In a proposal of re-opening the Wupao (i.e. Wupo) mine in the late Qing period, the government hoped to reach its aim by on the one hand convincing the Yi with the "principle of righteousness" (*xiao yi dayi* 曉以大義) and on the other by promising them to share the profit (*liyi tongzhan* 利益同霑)[56].

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[52] "Jiefang qian de yi han guanxi" 解放前的彝漢關係 (Relation between Yi and Han before Liberation), in: *Yijiuwujiu nian zonghe diaocha ziliao* 一九五九年綜合調查資料 (Material of a comprehensive survey made in 1959), N. 28. Quoted in Hu Qingjun (1981), p. 183.

[53] Fang Guoyu (1984), p. 587.

[54] Kang Bingkun (1997), p. 145.

[55] MNYZ, p. 356.

[56] NQSBSC, "四川總督錫良飭烏抛廠事".

However, outbreaks of hostility could still not be avoided on a long term. If this happened, the miners were in general in a weak position. They usually had no other way than to give up their mine and to flee. One exception was a mine in Leibo Subprefecture in 1850 where miners organized their own military force. They gathered money and hired 60 able-bodied men to resist attacks from the Yi. This could help for a while as long the Yi did not make any bigger moves[57].

The fact that the miners usually needed to stand alone against the Yi people's assault was a feature of the loosen control by the government. The general attitude of the government towards this problem was to tolerate and to remain patient until it became impossible either because the rebellion of the Yi already developed into a threat for the adjacent Han regions or because the mines they destroyed were of a truly significant importance for the government, like in the case of Wupo mine, where after the attack of an Yi force governmental troops were dispatched[58].

3.4.3 *State control in the mining region*

The Development of Sichuan's copper mining industry as a whole appears to be largely related to the level of control exercised by the Qing state. In spite of the predominance of private structures in matters of investment and operation, periods of strong state control seem to have resulted in a more continuous exploitation and higher yields, while during times of weaker state control and a stronger influence of local structures, especially the Yi constituted a problem for the mining enterprises and lead to decline. Following this assumption, three phases of state control and mining development can be identified: Before 1742, from 1742 to the break-out of the White Lotus Rebellion in 1796, and thereafter.

During the *first phase*, before 1742, while Yunnan's big copper mines began to expand, Sichuan was not ready for such a development yet. This was mainly due to the fact that the above mentioned *gaitu guiliu* policy[59] in Sichuan was not carried out with

[57] *Leibo tingzhi*, chap. 31, p. 5.

[58] *Qing Xuanzong shilu*, DG12/4/*wuyin*.

[59] See chap. 2.1.3.

the same resoluteness as Yunnan. Yi groups migrating over the Jinsha River into Sichuan's Liangshan even strengthened tribal structures and Yi influence in the mining region. Thus the first mines which attempted to open during this period were frequently attacked and destroyed by the Yi.

During the *second phase,* from 1742 until 1795, the end of the Qianlong reign-period, Garrisons were established to enlarge control over the Liangshan region. Although this did not automatically coincide with a complete sinisation as it may have been the case in many places in Northern Yunnan, the general security situation for the Han miners increased remarkably, only few records about Yi's disturbances can be found in the historical sources from this time.

During the *third phase,* the White Lotus Rebellion broke out in 1796 among impoverished settlers in the mountainous region that separates Sichuan from the Hubei and Shaanxi provinces. The Green Banner Army usually stationed in the marginal area of the Cool Mountains was transferred to suppress the rebellion which resulted in a weakened defending ability against Yi raids[60]. By this safety for the miners declined again and mines were destroyed again. Sichuan's copper industry was so severely damaged during this period[61] that it could not recover until the advent of modern mining technologies during the republican period.

[60] Hu Qingjun (1981), p. 171.

[61] *Leibo tingzhi*, chap. 31, pp. 1-5.

3.5 *Mining, administration and spatial aspects*

The area under consideration in this study and its immediate surroundings encompassing the southern edge of the Chengdu basin, the mountain regions at both sides of the Jinsha River in Sichuan and Yunnan as well a part of the Sino-Tibetan borderlands may belong to the same strata as far as certain aspects of its geological history and its ore deposit structures are concerned but under various aspects of human geography it is more difficult to regard them as one regional entity. This includes aspects like administration, markets, transport routes, ethnic distribution or agriculture. It is thus understandable that during most attempts of spatial organization division lines were drawn through this region. It is worthwhile to observe, how these division lines at the one hand joined shaping the history of Sichuan's copper mining and at the other hand how for the reason of copper production these lines were transgressed.

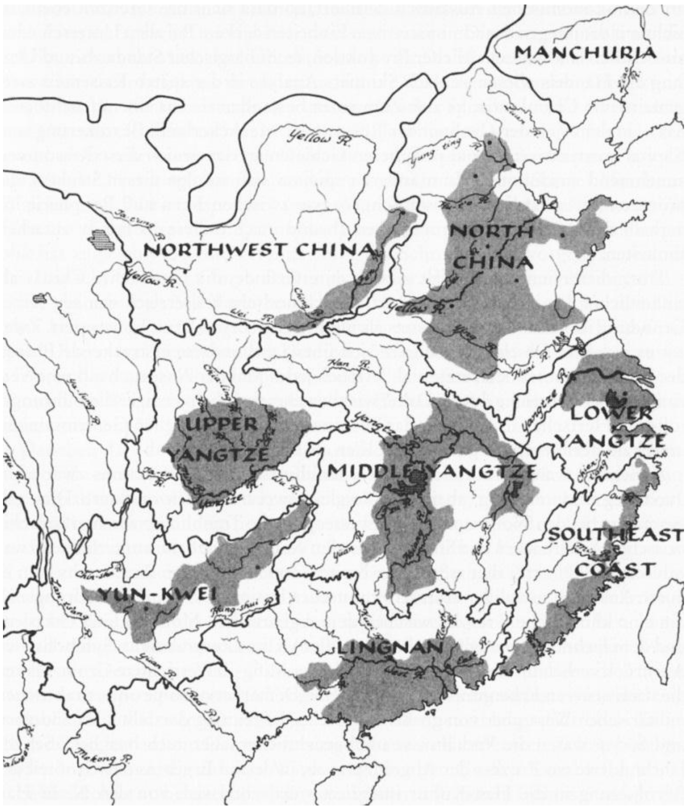
3.5.1 *Macroregional view*

One of the largest spatial divisions usually applied to the area of China proper are the so-called physiographic macroregions as defined by G. William Skinner.[62] Besides actual administrative division lines this model considers aspects of physical surface geography like water sheds and river drainage basins as well as market and transport structures on the local level and core-periphery relations. It aims at providing a tool to regionalize certain aspects of Chinese history and to improve the understanding of regional developments in general.

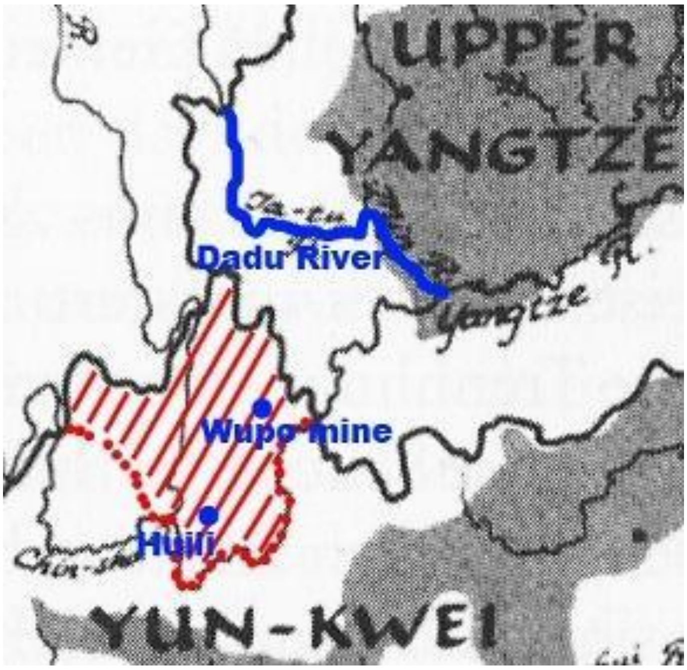
Following Skinner's understanding, Sichuan's mining region is divided between the southern peripheral part of the "Upper Yangtze" macroregion with its core in the Chengdu basin and the northern peripheral part of the "Yun-Kwei" macroregion whose core is located on the Yun-Gui Plateau around the provincial capitals of Guiyang and Kunming. Interestingly Skinner does not draw the division line according to the traditional provincial borders between the provinces of Sichuan and Yunnan but instead already declares the biggest part of the Liangshan region south of the Xiaoxiangling

[62] For the fundamental information on this model see: Skinner (1977)

Map 7: China's physiographic macroregions as defined by Skinner



Map 8: Close-up of the border between two macroregions



小相嶺 as part of the Yun-Kwei macroregion. The important mining areas around Ningyuan and Huili would thus rather be regarded as the periphery of Kunming than of Chengdu while mines like Laodonggou 老洞溝 in the prefecture of Jiading would still belong to Chengdu. This would make a large part of the copper transports from southern Sichuan to the mint in Chengdu achieve the status of supra-regional transports providing the Upper Yangtze core with commodities originally belonging to the periphery of the Yun-Kwei macroregion.

3.5.2 *Inter-provincial view*

From the border changes during the governor-generalship of E'ertai in Yunnan in 1725[63] until the establishment of the special administrative zone Xikang after 1905, the border between Sichuan and Yunnan remained untouched. However, Skinner draws the division line of the two above-mentioned macroregions to the north of the actual provincial border. The reasons which must have led Skinner to do so can be understood from several aspects of copper administration and transportation.

That the areas around Ningyuan and Huili were generally regarded as ruled from Chengdu is not in doubt. Nonetheless a far-reaching influence of the Yunnanese government and the core part of the Yun-Kwei macroregion can be identified.

When the Wupo mine began to operate in 1818, Yunnan was experiencing a copper supply crisis. In order to still carry on the delivery to Beijing, its officials all tried to find other solutions for copper procurement, thus noticed the situation of the Wupo mine immediately and came to purchase. Using the high priority of the supply for the metropolitan mints and the relatively convenient transport conditions through the valley of the Jinsha River to Yunnan's copper transport bureau at Huangcaoping 黄草坪 as an argument, Yunnan's officials convinced the Jiaqing Emperor to allocate virtually the entire production of Wupo to their domain. Due to the enormously difficult transport over the entire Liangshan mountain range to Chengdu, thus only a smaller part of copper reached Sichuan's provincial capital from Wupo. Before the agreement with

[63] See chap. 2.1.3.

Yunnan most of Wupo's copper production was instead just piled up in the storage houses of the mine[64].

This example and the case study of the Kang family show that under various aspects at least the southernmost region of Sichuan around Huili but to a lesser extent also Liangshan and the areas around Ningyuan stood under Yunnanese influence and occasionally preferred to orient themselves for reasons of convenience towards Kunming rather than towards Chengdu.

3.5.3 *Intra-provincial view*

As it has been shown, in fact various connections and activities transgressing the provincial border between Sichuan and Yunnan around the Liangshan region can be seen, which can probably offer some supporting arguments for Skinner to move his macroregional border northward. However, another examination has to be undertaken at the line suggested by Skinner, which runs south of the Dadu River 大渡河 or Tong River 銅河 presumably over the mountain range of the Xiaoxiangling.

Among the descriptions of the activities along the copper transport route from Ningyuan to Yazhou[65], except the general quality of a mountain range to divide the valleys at both sides of it from each other, there is no indication that the Xiaoxiangling was a major macroregional division line. The place, which qualifies more for this consideration, is the Dadu River. From its nature it is usually described as wild, unnavigable and thus surely difficult to cross.[66] Additionally it can be seen from the case study introduced above[67], that the dividing character of the Dadu River was reflected in the established practices and regulations of the copper transports. Both the brokers and their porters did not cross it together with their loads but only delivered it to a specially established copper station (*tongzhan* 銅站). Accordingly, two main copper stations had been established, one in Dashupu 大樹堡 on the south side and one in Fulin post-station 富林驛 on the north side of the river. After the arrival of the copper at this copper station

64 ZPZZ, 1359-010, 1359-017, 1359-024.

65 See chap. 2.5.5.2 (Land transport)

66 See e.g. Baber (1882), p.45.

67 See chap. 2.5.4.

a new team of brokers and porters picked up the loads and carried it onward over the Daxiangling 大相嶺 pass to Yazhou. Alexander Hosie reports that the ferry service over the river was carried out by Xifan 西番 tribesmen,[68] an ethnic group consisting in a mixture of Yi, Han and Tibetans and thus probably predestined to take over a ferryman's role at an unofficial border. That the lands south of the Dadu River were at least at times under a much stronger influence of the Yi than the ones north of it can consequently be seen from the reports of Baber[69] and Hosie[70].

At least from the information that the course of Sichuan's copper transport provides, it needs to be stated that the crossing of the Dadu River had much more the character of a border crossing, which was also reflected in the establishment of two copper stations, than the Xiaoxiangling pass would have had. From this perspective Skinner's argument to draw a macroregional division line north of the Jinsha River and the established Sichuan-Yunnan border can be supported, but the location of this division line probably needs to be adjusted.

Towards the end of the nineteenth century with the further decline of Qing state control in the south of Sichuan, Yi influence grew to an extent that in various western maps and travel accounts the name "Independent Lololand" to the opposite of the clearly centrally controlled provinces of Sichuan and Yunnan can be found, which displayed if not the actual nominal independence of the area, then still the particular position between the two provinces it was holding. Since 1905 the administrative landscape was adjusted to this situation by integrating it into the newly created special administrative region of Xikang 西康, which from 1927 onwards achieved the status of a regular province. In 1955 this province, which probably never reached any administrative efficiency, was dissolved again and the People's Republic of China returned to the borders valid during most of the Qing period.

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[68] Hosie (1897), p.101.

[69] Baber (1882), p.59.

[70] Hosie (1897), p.107.

4 MINTING

At least according to the regulation, the biggest part of mined copper, lead and zinc in Sichuan served the purpose of minting and thus were consumed by the mints. In this chapter, minting in Sichuan will be examined, including its institutional history, applied techniques, and organization. The situation of mint metal procurement, cash development, cash distribution and disposal will be shown based on the main source, the *tiben* 題本 (routine memorials). In the end, a special evaluation of this source will be given.

4.1 *Institutional history*

4.1.1 *Minting in China – an introduction*

"Minting" in general refers to the process of producing coins. In the special case of this research, only the production of coins consisting in copper or any alloy containing major proportions of copper by the method of casting (*zhiqian* 製錢) is considered. Silver coins and any kind of struck or pressed copper (*tongbi* 銅幣) coins as they appear towards the very end of the Qing period are not included.

The history of cast copper coins in China reaches back at least until the Spring and Autumn period (770-476 BC), when copper pieces in the shape of spades and knives circulated with monetary functions. From ca. 350 BC onward, round coins with a square hole appeared for the first time, the shape which was supposed to remain the standard for virtually all Chinese copper coins for more than two millennia to come.

For the techniques of casting three different phases can be distinguished: "Upright Casting" with piece moulds (*pingban fan shushi jiaozhu* 平板范豎式澆鑄), "Stack Casting" (*diezhu* 疊鑄) and "Sand Casting" (*fanshafa* 翻砂法). The casting technique during the Qing period belonged to the last phase, which from the Song period onwards had become the standard. Details about this technique in particular will be explained in later chapters.

While after the Manchu conquest at the beginning of the Qing period mints mainly recast old Ming coins, after the rule became more consolidated and China's economy entered a phase of growth, the minting of new coins based on copper from the mines became increasingly important as a source of state revenue but as a necessity of the more and more commercialised society. While the two largest mints with the highest output numbers in newly cast coins were usually the two metropolitan mints, namely the Baoquanju 寶泉局, which belonged to Board of Revenue, and the Baoyuanju 寶源局, which belonged to the Board of Works, the by far biggest part of coins was cast in the provincial mints spread over the whole country.

4.1.2 *Importance of the Baochuanju inside of China*

The Mint of Sichuan was called Baochuanju 寶川局. In order to estimate its role among all Chinese mints operating during the Qing period, two sets of data can be consulted: the first one concerns the production of China's mints in 1769 and is based on the *Qinding Hubu guzhu zeli* 欽定戶部鼓鑄則例 (Imperially endorsed regulations and precedents for minting of the ministry of revenue); the other one originates from the *Duzhi jilue* 度支輯略 (A record of Board of Revenue) and offers information for the time between 1806 and 1810.

According to the first source, in 1769, the production numbers of each mint are listed in Table 26 in a descending order:

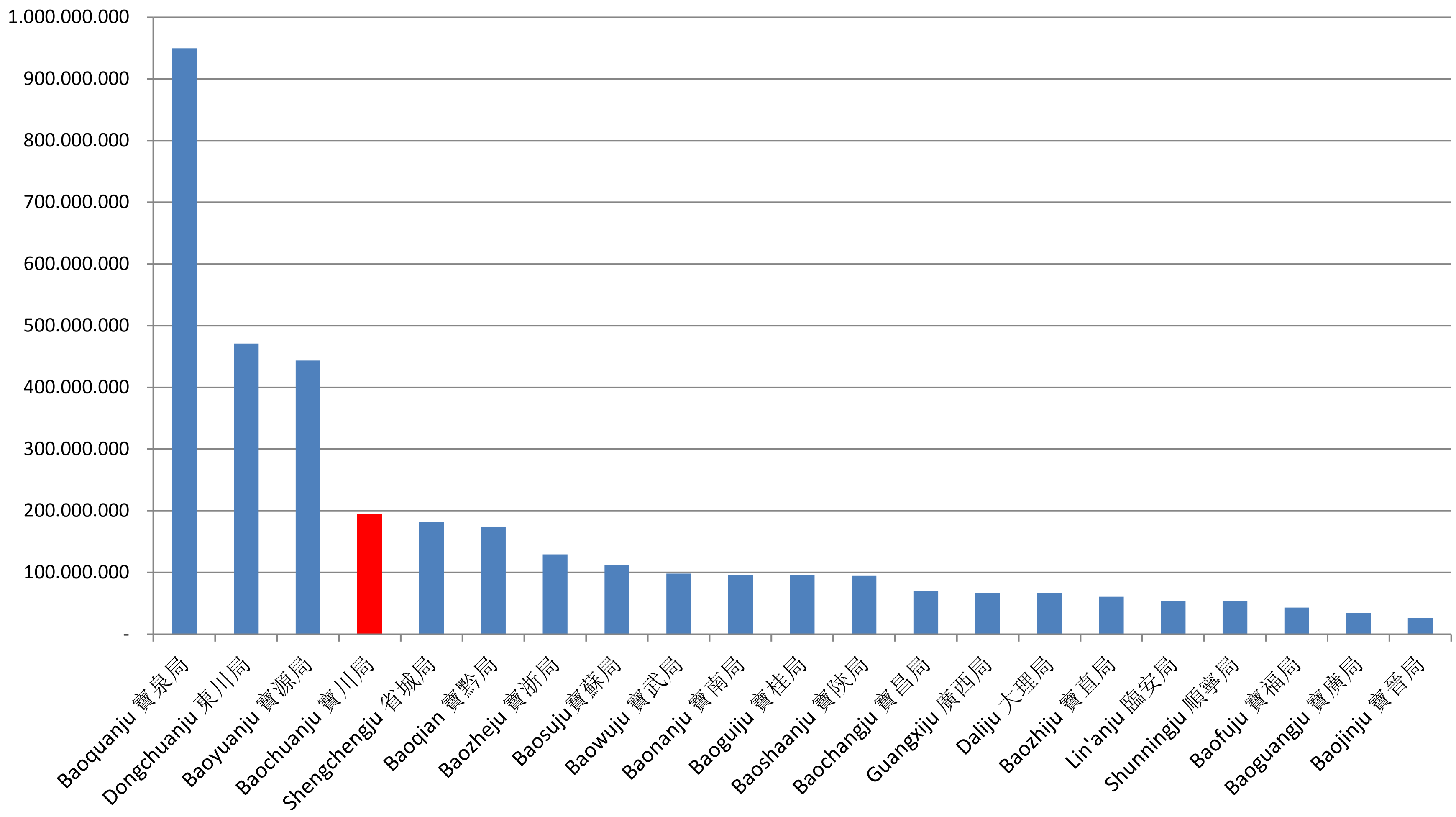
Table 26: Coin production numbers of Chinese mints in 1769

Jurisdiction	Mint name	Number of furnaces	Annual Coin production	Percentage of the whole country
Board of Revenue	Baoquanju 寶泉局	60	949,848,000	26.99%
Yunnan	Dongchuanju 東川局	70	471,311,946	13.39%
Board of Works	Baoyuanju 寶源局	?	443,679,000	12.61%
Sichuan	Baochuanju 寶川局	40	194,133,332	5.52%
Yunnan	Shengchengju 省城局	25	182,352,836	5.18%
Guizhou	Baoqianju 寶黔局	20	174,627,118	4.96%

Zhejiang	Baozheju 寶浙局	10	129,600,000	3.68%
Jiangsu	Baosuju 寶蘇局	16	111,982,080	3.18%
Hubei	Baowuju 寶武局	20	98,348,623	2.79%
Hunan	Baonanju 寶南局	20	96,108,000	2.73%
Guangxi	Baoguiju 寶桂局	20	96,000,000	2.73%
Shaanxi	Baoshaanju 寶陝局	20	94,589,004	2.69%
Jiangxi	Baochangju 寶昌局	10	70,063,360	1.99%
Yunnan	Guangxiju 廣西局	15	67,330,278	1.91%
Yunnan	Daliju 大理局	15	67,330,278	1.91%
Zhili	Baozhiju 寶直局	5	60,756,839	1.73%
Yunnan	Lin'anju 臨安局	8	53,864,221	1.53%
Yunnan	Shunningju 順寧局	8	53,864,221	1.53%
Fujian	Baofuju 寶福局	4	43,200,000	1.23%
Guangdong	Baoguangju 寶廣局	6	34,560,000	0.98%
Shanxi	Baojinju 寶晉局	6	26,208,000	0.74%

This table shows that the Baochuanju was at least around the year 1769 not only by number of furnaces but also by its coin output the second most productive one throughout the country.

Graph 23: Coin production by Chinese mints in 1769 (in *wen*)



The second set of data: according to Dai Jianbing's 戴建兵 research on the *Duzhi jilue* 度支輯略 (A record of Board of Revenue) written by Xu Zi 徐鼒, between 1806 and 1810 the Baochuanju was even the biggest of all provincial mint in China, ranking only behind the two metropolitan mints, namely the Baoquanju and the Baoyuanju in Beijing. By producing 194,133,332 coins annually, the Baochuanju accounted for 7.79% of all Chinese mints' coin production together.[1]

Table 27: Coin production numbers of Chinese mints, 1806-1810

Jurisdiction	Mint name	Number of furnaces	Annual Coin production	Percentage of the whole country
Board of Revenue	Baoquanju 寶泉局	60	899,856,000	36.11%
Board of Works	Baoyuanju 寶泉局	16	437,448,000	17.56%
Sichuan	Baochuanju 寶川局	40	194,133,332	7.79%
Zhejiang	Baozheju 寶浙局	10	129,600,000	5.20%
Yunnan	Baoyunju 寶雲局	28	125,683,186	5.04%
Jiangsu	Baosuju 寶蘇局	16	111,982,080	4.49%
Hubei	Baowuju 寶武局	10	86,288,623	3.463%
Hunan	Baonanju 寶南局	10	72,081,000	2.893%
Guizhou	Baoqianju 寶黔局	15	67,329,900	2.70%
Shaanxi	Baoshaanju 寶陝局	20	65,469,040	2.63%
Zhili	Baozhiju 寶直局	5	60,756,839	2.44%

[1] Dai Jianbing 戴建兵 (2009), pp. 1-21.

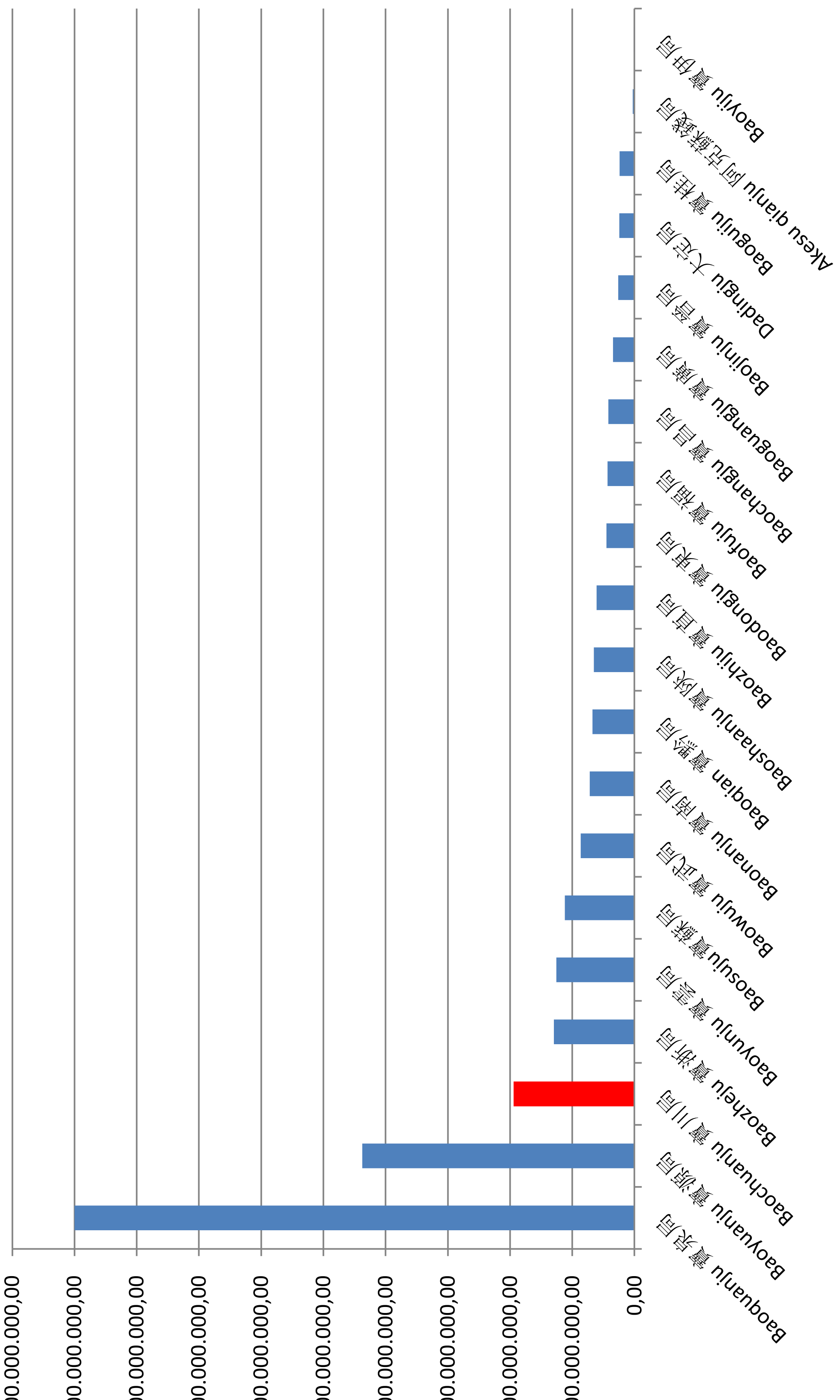
Yunnan	Baodongju 寶東局	10	44,886,852	1.80%
Fujian	Baofuju 寶福局	4	43,200,000	1.73376
Jiangxi	Baochangju 寶昌局	6	42,038,016	1.69%
Guangdong	Baoguangju 寶廣局	6	34,560,000	1.39%
Shanxi	Baojinju 寶晉局	4	26,208,000	1.05%
Guizhou	Dadingju 大定局	5	24,443,300	0.98%
Guangxi	Baoguiju 寶桂局	5	24,000,000	0.96%
Xinjiang	Baoyiju 寶伊局	2	1,722,000	0.07%
Xinjiang	Akesu qianju 阿克蘇錢局	6	普尔钱 2841176	

Through the analysis of these two sets of data it can be proved that when copper production as well as coinage in Yunnan declined, the Baochuanju mint began to play an increasingly important role within the coin production of China as a whole, becoming the biggest provincial coin producer.

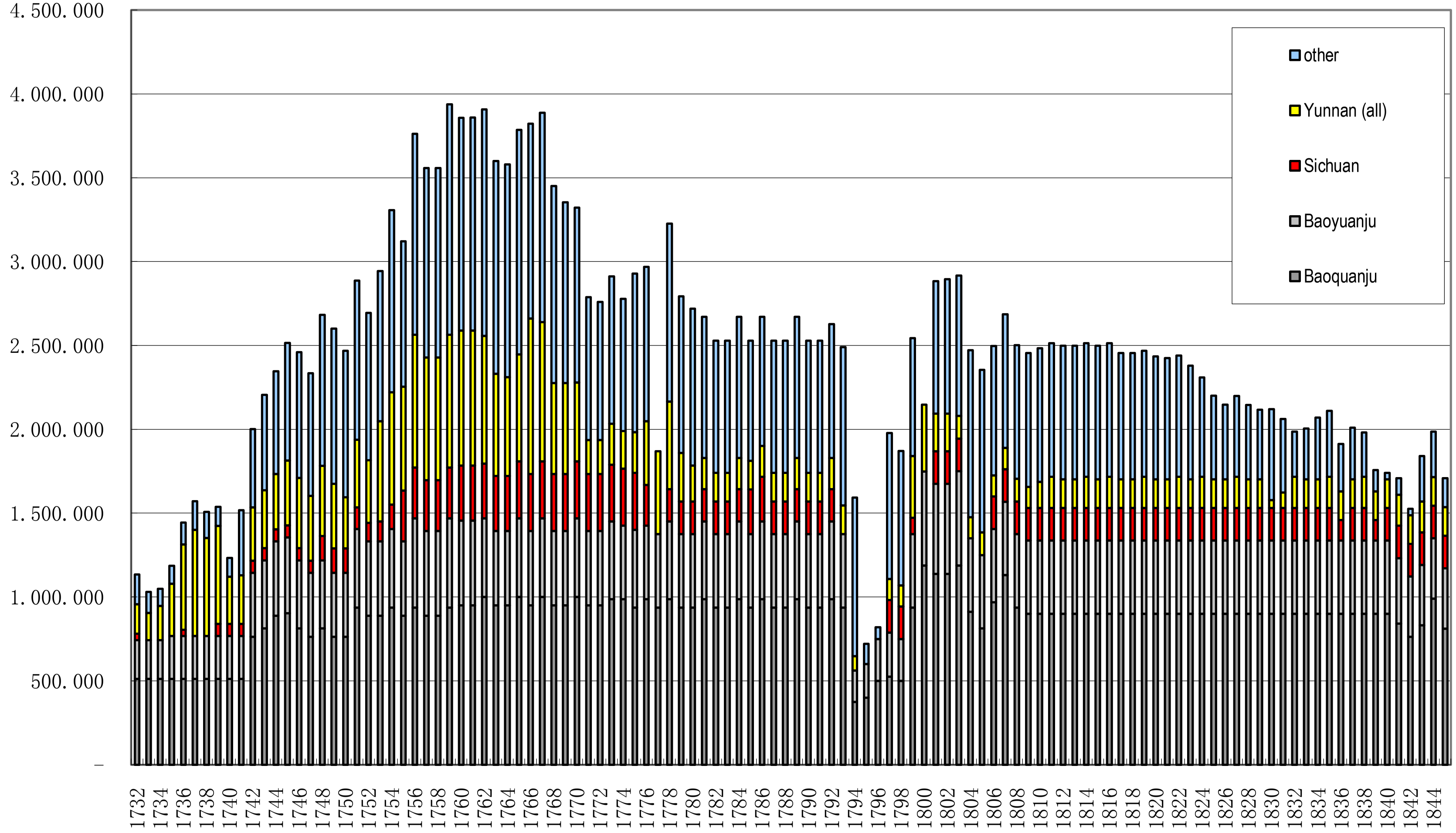
Combining the data of mint statistics compiled by Vogel[2] with the Baochuanju data from the Routine Memorials, we can gain a very clear image of the development of the Baochuanju's position during the entire time period under consideration. This is displayed in Graph 25.

[2] Vogel (1989)

Graph 24: Coin production by Chinese mints, 1806-1810 (in *wen*)



Graph 25: Coin production by Chinese mints, 1732-1845 (in *wen*)



4.1.3 *The Baochuanju between 1668 and 1755: establishment and extension*

The long period of time, which had to pass until a provincial mint for Sichuan was opened, firmly established and enlarged to its final size, reflects the development of the province's population and economy.

In the year Kangxi 7 (1668), Sichuan province was ordered to open a mint in its provincial capital in Chengdu to cast coins with the word *chuan* in Manchu script on the legend as a short form for the name of the province.[3]

Two years later, however, this mint already stopped to cast coins again upon a suggestion by Sichuan's Governor Zhang Dedi 張德地. He argued that population numbers as well as the tax yields in Sichuan were low, the province was rather remote and transportation was inconvenient, thus it was not necessary to maintain a currency system including both silver and coins[4]. It is unclear, how many coins were cast within these two years.

At this time, Sichuan depended on other provinces', mainly Yunnan's support for their supply of coins. Since Yongzheng 4 (1726), Yunnan offered and delivered forty thousand strings of coins every year for distribution within Sichuan, Huguang and Guangxi[5]. Since Sichuan's silver-coin exchange rate became steadily balanced, these provisions from Yunnan were cancelled in Yongzheng 10 (1732)[6].

This provincial mint operating during the Kangxi reign-period (1662-1722), was only of small scale and little importance. For the two years that it was existing, it was just installed inside of the Provincial Treasurer's (*buzhengshi* 布政使) office[7].

In Yongzheng 10 (1732), under the condition of the increasingly flourishing production of its copper mines, a re-opening of the Sichuan mint was again brought into discussion.

After Governor Xiande's 憲德 suggestion, the following actions and regulations were arranged: The mint started operating again, eight furnaces were built up, the back

[3] JQ-SCTZ, chap. 70, p. 11a.

[4] JQ-SCTZ, chap. 70, p. 11a. See also QL-SCTZ, chap. 15, pp. 7-8.

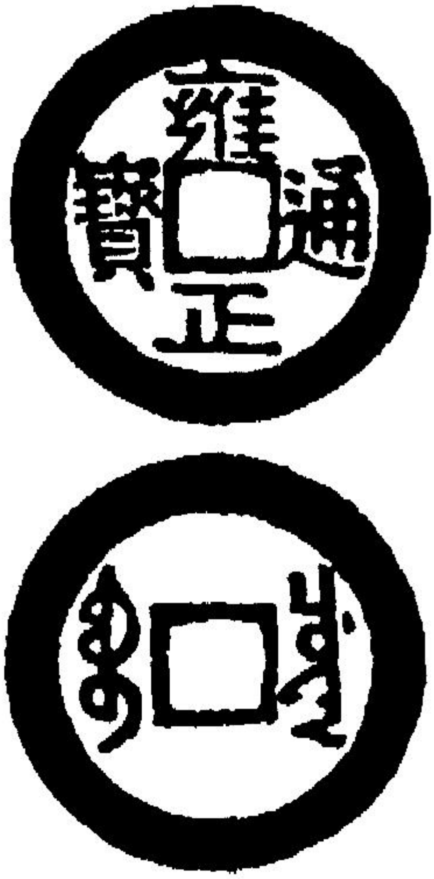
[5] QCWXTK, chap. 15, p. 15.

[6] QCWXTK, chap. 15, p. 21. See also: JQ-SCTZ, chap. 70, pp. 11b-12a.

[7] JQ-SCTZ, vol. 25, p. 2a.

side of the coins were casted with the two writings in Manchu (*boo chuan*, imitating the Chinese *bao chuan* 寶川, literally "treasure [of] [Si]*chuan*").

Figure 10: Coin from the Yongzheng reign-period cast in the Baochuanju[8]



Every year there were altogether 24 casting periods carried out, which were called *mao* 卯 and consumed 320,000 *jin* of mint metal consisting in copper purchased from Yunnan and zinc bought from Guizhou. The produced coins were be paid as soldiers' salary and officials' Yanglian 養廉 allowance (lit., [payment] for keeping honesty). Since now on minting activities were about to start on a larger scale, a much bigger area was required. Thus the Baochuanju was located in the north-western part of the former Palace of the

[8] Hartill (2005), p. 294

Prince of Shu 蜀王府 from Ming Dynasty, which under the Qing had become Sichuan's Imperial Examination Centre (*gongyuan* 貢院). The Circuit Intendant Zheng Qichu 鄭其儲, who was in charge of the project of building up a mint, remarked that the chosen area was so spacious and rigorous that it was very appropriate to establish the mint here. After his calculation one hundred and thirteen of the palace's rooms should be configured for the use by the mint[9].

In the Qianlong reign-period (1736-1795), because of the prosperous development of Sichuan's copper mining and thus the metal provisions for the mint, the Baochuanju continuously increased the number of furnaces in operation and experienced several expansions. After opening the mint in Yongzheng 10 (1732) with eight furnaces, in Qianlong 4 (1739) first seven new furnaces were set up[10]. The next expansion was carried out in 1747, when Shaanxi Province needed to be supplied with coins cast in Sichuan. At that time fifteen furnaces were added and the mint extended its production facilities towards the east now encompassing one chief gate (*zongmen* 總門), six "duty rooms" (*banfang* 班房) at its both sides, one "furnace-room-gate" (*lufangmen* 爐房門), thirty "furnace rooms" (*lufang* 爐房), thirty "polishing and filing rooms" (*cuomofang* 銼磨房), fifteen "supply rooms" (*gongyingfang* 供應房) as well as another six storerooms (*kufang* 庫房)[11]. By then, there were altogether thirty furnaces. They were in later times always referred to as "the old furnaces".

Another enlargement took place in Qianlong 20 (1755), when the city wall of Chengdu collapsed and needed to be repaired. Since the payments necessary for this project should be paid by newly cast cash, ten new furnaces, 20 more "duty rooms", 20 more "polishing and filing rooms" and four more storerooms were built[12].

The Baochuanju at this time was operating 342 days a year with only few resting days.[13]

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[9] JQ-SCTZ, vol. 70, p. 12b.

[10] SCBZL, p. 149.

[11] JQ-SCTZ, vol. 70, p. 13b.

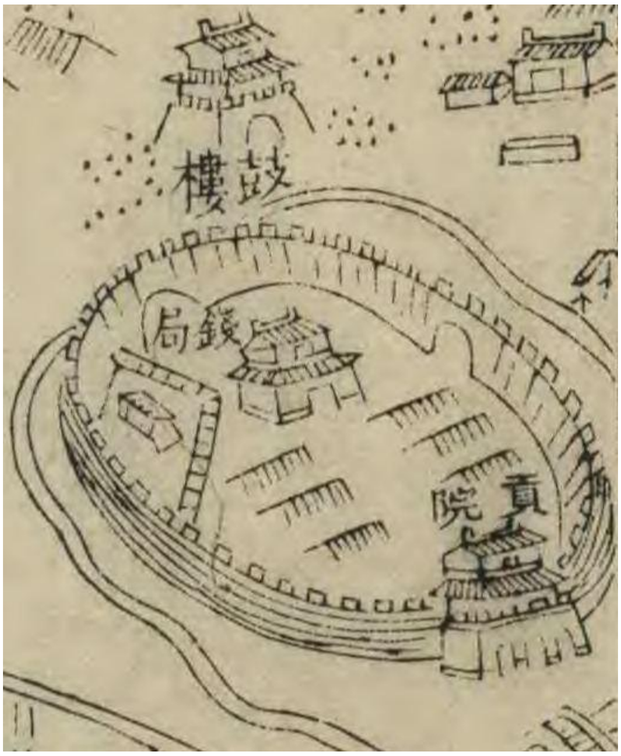
[12] JQ-SCTZ, vol. 70, p. 14.

[13] TZBL, chap. 5, „各省錢局鼓鑄章程"

Table 28: Number of furnaces in the Baochuanju, 1732-1904

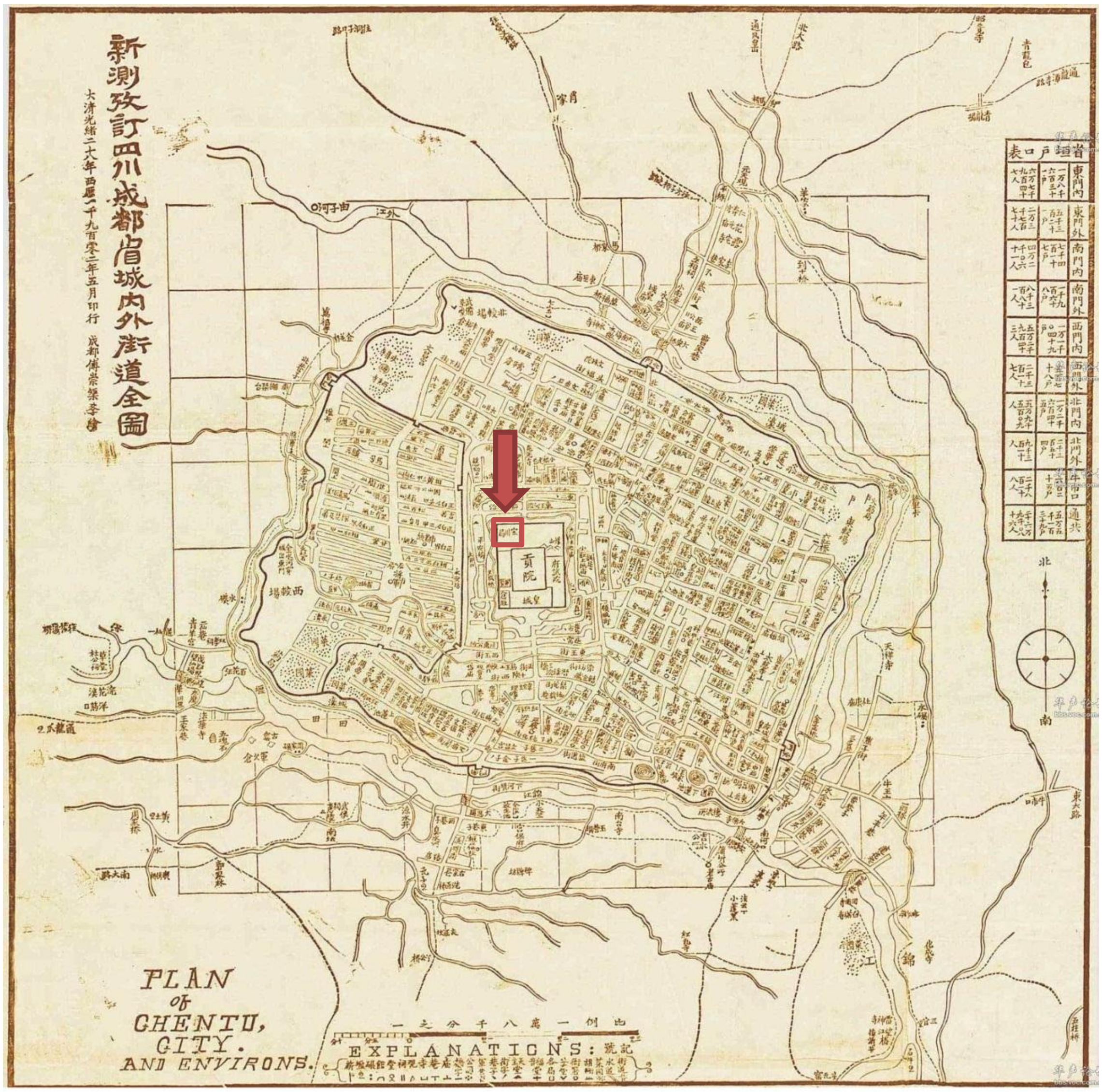
Year	Number of the furnaces
1732-1738	8
1739-1747	15
1748-1751	30
1752-1753	23
1754	30
1755-1904	40

Figure 11: Simplified depiction of the surroundings of the Baochuanju[14]



[14] *Chengdu xianzhi*, chap. 1, p. 17a.

Map 9: City map of Chengdu with location of the Baochuanju[15]



4.1.4 *The Baochuanju between 1755 and 1904: operation routine*

From 1755 until 1904[16], the Baochuanju had always owned altogether forty furnaces. The minting activity and thus the mint’s output was divided into different categories. Firstly, the main task for the mint was the so-called “standard casting” (*zhengzhu* 正鑄)

15 *Chengdu tonglan*.

16 Baochuanju mint closed in 1903, see Zhang Shanxi; Xue Yushu (2001), p. 71.

or “quota casting” (*e’zhu* 額鑄), for which only the thirty old furnaces were employed. Every year under the name of standard casting 12 mao 卯 [17] were carried out, which were called “standard casting periods” (*zhengmao* 正卯) [18]. Secondly, to increase the coin production, more furnaces and thus higher production capacities were established from 1756-1776, thus the casting carried out by using the ten new furnaces was called “added casting” (*jiazhu* 加鑄). There were also 12 mao per year, which were accordingly named “added casting periods” (*jiamao* 加卯) and at that time served the purpose of repairing the city walls. The fact that these two categories of casting produced the same amount of coins leads to the assumption that the new furnaces must have been operating more productively or at least must have been bigger. Beyond these two categories, there were still another three types of so-called “attached castings” (*daizhu* 帶鑄), which were set up by different origins of the mint funds and served various purposes. There was one mao, which was called “awarding barbarians” (*shangfan* 賞番), its casting output was used to reward barbarian garrison troops (*fantun* 番屯); two *mao* called “awarding [soldiers] by borrowed [fund]” (*shangjie* 賞借), their funds originated from the official pawn-office of the Chongqing Brigade 重慶鎮; another one *mao* shared the name with the one before but was cast with funds originating from the official pawn-office of the Chongkui Brigade 重夔鎮. These three types of “attached casting” were operated by the forty furnaces together, including old and new ones. Additionally, every three years it was required to check the slag which still contained usable metal and the dropped and broken metal pieces and to utilize them to cast coins. This process was called “overall check” (*pancha* 盤查) [19] and lead to a type of extra casting which was not counted into any of the above mentioned categories.

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[17] Unit of casting period, a name for the period of time in a mint, during which the furnaces were burning. After everything was prepared, the furnaces were ignited (*kailu* 開爐) and kept burning until all the ready weighed copper was used up. See Burger (1976), p. 13; Li Qiang (2007), pp. 46-48.

[18] SCBZL, p. 153.

[19] See Chapter 4.6. The categories and their names were called differently in different sources. Here we use the terminologies from SCBZL, because they were more clearly defined then.

Like this, every year the Baochuanju produced 12 *mao* of standard casting and 4 to 16 *mao* of other categories. The annual production was up to about 340,000 strings of coins. With only short interruption during 1793-1795, the operating was rather stable until 1860s, when the Qing government started to cast "large coins" (*daqian* 大錢) due to the silver crisis and to the deterioration of the copper coin[20]. After that, with two interruptions 1860-1861 and 1868-1874, the Baochuanju mint struggled to maintain its production until 1901. In this year it began to adopt the western technique and to produce struck instead of cast coins. In 1905 however, because the production at that time was too low, Governor Xiliang 錫良 suggested to establish the bureau of Agriculture Administration (*Nongzhengju* 農政局) in the place of the Baochuanju mint. This marked the end of the history of the Baochuanju.

After centuries of operating, the Baochuanju left behind a big amount of slags and ashes and piled them up to the east of the mint, where they formed a mountain which was called the "Coal Mountain" (*meishan* 煤山) by the people of Chengdu. This mountain was more than 20 m high, stretched 300 m from east to west dimension and 400 m from north to south[21]. It is said that at the beginning of the Republican time (1911-1949), when different warlords fought for the control over the city centre of Chengdu, the Coal Mountain used to be the commanding point they strived to get under their control[22]. However, the mountain was removed in 1952 and the biggest stadium of southwest China at that time, the "People's Stadium" 人民體育場 was built in its place[23].

4.1.5 *The Ningyuan mint*

Besides the provincial mint in Chengdu, there was another temporary mint in Ningyuan Prefecture, which operated for two short periods during Qing time only.

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[20] See Lin, Man-houng (2007).

[21] http://www.ynzb.com/bbs/dispbbs.asp?boardid=105&Id=43336.

[22] Li Jieren (1980), pp. 141-148.

[23] Wu Shixian (ed.) (1995).

The first time was from Qianlong 60 to Jiaqing 1 (1795-1796). The reason was that "small coins" flooded and severely hampered the normal currency circulation. Because of the long distance and the difficult transport conditions between Ningyuan and Chengdu, the problem was, that "the coins cast by the provincial mint could not reach Ningyuan, while the small coins in Ningyuan could not be delivered" [24] back to the Baochuanju for recasting , as described in the Gazetteer of Xichang District. Hence, in order to stop the further development of the small coins, Fukang'an, Governor General of Sichuan, ordered to suspend the casting in the Baochuanju mint and instead, to purchase small coins in Ningyuan Prefecture and to recast them into regular coins. 40,000 tael of silver were allocated to purchase the small coins in Ningyuan and the Provincial Judge Lin Jun 林儁 was ordered to stay in Ningyuan to concentrate on organizing the small coins purchasing. Four furnaces were established and small coins were bought by the government at a price of 60 *wen* per *jin*[25]. Altogether 958,948 *jin* of small coins were purchased that way[26]. The casting followed the regulation of alloy of the metropolitan mints, which was 60% copper and 40% zinc. The casting began on the 25th day of the fifth month in Qianlong 60 (1795) and lasted until 17th day of the third month of Jiaqing 1 (1796). Then the Prefect of Ningyuan reported that all the small coins available in his territory were cleaned away, thus the recasting furnaces could be removed[27].

The second time during which a mint was established in Ningyuan was towards the end of the Qing period. In 1900, in order to save the transportation cost of copper and following the precedent of Dongchuan Prefecture in Yunnan, Ningyuan Prefecture was allowed to cast coins. The front legend of the coins the Ningyuan mint cast was inscribed with the characters "Guangxu tongbao" 光緒通寶, and on the back side it was written "Ningyuan" 寧遠[28]. The colour was reddish; the size was equal to those cast by Dongchuan Prefecture. Although each coin also had the face value of one *wen*, its size

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[24] *Xichang xianzhi*, 1942, chap. 3, p. 8b.

[25] *Xichang xianzhi*, chap. 3, p. 8b.

[26] *Qiongxi yelu*, chap. 34, p. 1a.

[27] *Xichang xianzhi*, chap. 3, pp. 8b and 9a.

[28] *Xichang xianzhi*, chap. 3, p. 9a, the back legend was supposedly inscribed in Manchu script as usual for Qing coins but no coins cast in the Ningyuan mint are founded.

and weight were both only half compared to the standards of former reign-periods. Soon the casting was cancelled because of the unclear writings on the coins[29]. These short-lived coins were distinguished in the Gazetteer of Xichang District from the "white copper coins" of earlier periods and had an obviously stronger red colour.

The existence of a mint in Ningyuan was, however, only a temporary event and information on it in the sources is very limited. The further discussion of questions related to minting will thus solely concentrate on the Baochuanju in Chengdu.

[29] *Xichang xianzhi*, chap. 3, p. 9a.

4.2 *Introduction to the source: Tiben* 題本 *(Routine Memorials)*

The mint statistics presented in this context are based on mint reports preserved as a part of the Routine Memorials. Thus before a detailed discussion of the contained data can be undertaken, it is necessary to introduce this source.

After one year's minting, the Supervising Minting Officials needed to write accounting books and report their content to the Sichuan Treasurer, who would then hand these reports over to the Grand Secretariat (*neige* 內閣) in the form of Routine Memorials. Upon that, the Grand Secretariat replied and gave instructions or criticisms. Both types of documents, i.e. the reports and replies, are partly preserved. Due to historical reasons, these preserved documents are now possessed by mainland China and Taiwan. The former keeps them in the First Archive Museum in Beijing and organizes them under the category of *Neige hanwen tiben, huke huobi lei* 內閣漢文題本·戶科貨幣類 (Routine Memorials of the Grand Secretariat: Material on Monetary Matters) in the form of microfilms. 278 among 2,838 documents are concerning the Baochuanju. The latter includes them in the *Neige daku* 內閣大庫 (Archives of the Grand Secretariat) as an online version, among which 15 non-repetitive pieces are related to the Baochuanju mint.

Table 29: Categories of mint reports in the Routine Memorials

Category of reports	Years
Standard casting (*zhengzhu* 正鑄)	1732-1882
Added casting (*jiazhu* 加鑄), for repairing the city wall of Chengdu	1756-1776
Attached casting (*daizhu* 帶鑄), type 1, for awarding the barbarian garrison troops (*shangfan* 賞番)	1755-1882
Attached casting, type 2, with the fund from the official pawn-office of the Chongqing Brigade 重慶鎮	1760-1882
Attached casting, type 3, with the fund from the official pawn-office of the Chongkui Brigade 重夔鎮	1765-1882
Overall checking (*pancha* 盤查)	1753-1882

There are six types of reports altogether. From 1755 onward, it is always necessary to obtain several reports to gain a complete view of the yearly metal procurement and consumption and other related aspects. Unfortunately the reports from this period are not preserved completely.

For the years in which all the reports are preserved, the statistic is simply consisting in the sum of all relevant related numbers. As to the years in which some reports are missing, it is necessary to consult other sources to see, whether not existing reports were actually lost or just indicated that a certain type of casting had not been carried out in a certain year. If a record is actually missing, it needs to be reconstructed by using the general regulations and other memorials in order to complete the statistics. This way most of the years with incomplete reports can still be reconstructed.

Except for small amounts of individual information, the Routine Memorials mainly consist in numbers. These numbers stand for amounts of three subjects: silver, mint metal and coin. Each subject and its numbers are constructed in the same system or method, which is called *sizhu* 四柱 (lit., "four columns"). These "Four columns" stand for four categories: *jiuguan* 舊管 (stored), *xinshou* 新收 (received), *kaichu* 開除 (spent/used) and *shizai* 實在 (remaining).

Table 30: The calculation system of the "four columns" (*sizhu* 四柱)

	***jiuguan* 舊管 (stored)**	***xinshou* 新收 (received)**	***kaichu* 開除 (spent/used)**	***shizai* 實在 (remaining)**
Silver	fund left from last year	fund from this year	metal procurement, including metal type, origin, price, transport price and transport cost	fund left from this year
Metal	metal left from last casting	newly procured metal	metal consumption	metal left from this casting
Coin	coins left from last distribution	newly cast coins	distribution of the newly cast coins	saved coins

When read under consideration of this calculation system, the mint accounting books included in the Routine Memorials can provide abundant information about the operation of the mints. With such rich information, the situation of many mints can be reconstructed. This research offering a quantitative analysis of the data concerning the mint of Sichuan can thus very well serve as an example for possible future analyses of other mints.

Two remarks concerning the graphs which will be shown in the later chapters as well as quoting routine memorials need to be mentioned here. Firstly in all related chapters, the unit of weight will stay *jin* instead of converting it into kg or ton, because not the actual number of mint metal's weight but the trend of changes is the topic of particular importance in this chapter. Secondly, a citation within the corpus of the *tiben* is normally given as a serial number, for example, 2.170.13362.13. This means this routine memorial is in the archival fond (*quanzong* 全宗) 2, catalogue (*mulu* 目錄) 170, volume (*juan* 卷) 13362, and number (*hao* 號) 13. Some routine memorials, however, have no serial number, thus only the reporting date can be given. Together with the reports' origin (in this case Sichuan), the report can be located. When there are more than one report from Sichuan on the same day, they will be arranged in order with letter "a", "b", etc. For those routine memorials from the *Neige daku*, their entry-numbers will be given to identify them.

4.3 *Mint metal procurement*

Mint metals, which were used for casting coins in Qing period, were of four types, namely copper, lead, zinc and tin. One important principle of mint metal procurement was, that, in order to low down the cost of mint metal, the Baochuanju on the one hand preferred to buy metal from Sichuan rather than from other provinces and on the other hand also preferred metal handed over by the mines directly in the form of taxes or governmental purchases to those purchased from market. For the metal which was produced by its own mines in Sichuan, three categories of metal were distinguished, namely tax (*ke* 課), wastage (*hao* 耗), and surplus (*yu* 餘). Among these categories, the Baochuanju did not need to pay for the tax and the wastage parts, while it still needed to provide funds for the acquisition of the surplus part. Certainly, all three categories required funds for transport.

4.3.1 *Copper*

4.3.1.1 Demand and supply of copper

In the first decade of minting, i.e. from 1732 to 1742, because the mining business in Sichuan was not yet established, the mint metal supply entirely depended on its neighbouring provinces. The copper was purchased from Yunnan. Since from 1743 onwards, Sichuan provided the Baochuanju with the copper from its own mines, too. From 1746 onward until the end of the Qing period, copper purchases from Yunnan did not occur any more.

Sichuan's mines supplied its provincial mint with a sufficient amount of copper every year until 1790 when the mint's copper supply faced a crisis for the first time. The copper handed over by the mines was not enough for the casting so that the mint had to buy 800,000 *jin* copper from market (*shangtong* 商銅), which was so much that it covered the entire yearly demand of the mint. Although within the Qianlong reign-period this remained a singular case, the situation deteriorated soon and from the Jiaqing

Graph 26: Copper demand and market copper purchase of Baochuanju, 1732-1882

reign-period (1796-1820) onwards, every year the mint had to supplement the copper obtained from the mines directly with a certain share which had to be purchased from market at higher prices. The average amount of market copper purchased by the mint during these years which was 795,229 *jin*, shows that no later than Jiaqing 15 (1810), market copper accounted for about 92% of the mint's copper supply[30]. It is difficult to identify the origin of market copper from case to case, but there is in fact information about how the copper flew into market instead of being handed over to the mint. (see chap. 2.6). The funds which had to be invested for buying market copper were 12 tael per 100 *jin*, and thus much higher than those for the direct purchase from the mines. They were, however, still insufficient to pay for the real market prices (see chap. 2.4.2.2).

Beside the procurement of copper from the mines, in some special cases copper was obtained by the mint through such methods as the purchase and melting down of small coins[31], copper utensils[32] and confiscated contraband copper.

4.3.1.2 Copper purchase from Yunnan

In QL 3 (1738) Shuose 碩色, the governor of Sichuan, sent a request to the Emperor to purchase copper from Yunnan for his provincial mint, which initiated the provincial purchase of Yunnan cooper[33]. In a report by Zhang Yunsui 張允隨 in 1740, the governor of Yunnan, it was recorded that the annual purchase amount was 300,000 *jin*[34]. This activity did not last long due to the difficult transport conditions and because Sichuan started its own copper mining soon. Officially copper purchase from Yunnan ended in

[30] 23 examples of market copper are chosen to calculate the average. The reason is that among them, 21 are from the year when the reports were completed. The rest two, first QL 55 (1790) with the market copper supply equalling the total copper demand and, second XF 8 (1858) with the market copper much more than the copper demand, can thus also be used for calculating average number. The result 795,229 *jin* accounts for 92% of the yearly demand 864,000 *jin*.

[31] See Ningyuan mint, chap. 4.1.5. See also: RM, 2.199.17543.3.

[32] Twice reported that brass utensils were handed over to the Chengdu mint. In 1736 it was 272 *jin* (RM, 2.168.13407.1) and in 1739 it was 1,884 *jin* (RM, 2.170.13362.13).

[33] *Yunnan tongzhi gao*, chap. 77, p. 1a.

[34] *Yunnan tongzhi gao*, chap. 77, p. 1a.

1748,[35] the information provided by the Routine Memorials, however, shows that the last copper convoy from Yunnan that reached the Chengdu mint was received only in 1745[36].

Because Sichuan only purchased copper from Yunnan for a short period of time and because source on this operations are very limited, not more than the following is known: Yunnan sold its copper to Sichuan at a price of 11 tael of silver per *jin*[37]; the copper convoys took off from Dongchuan Prefecture 東川府 in Yunnan. By land the copper was delivered to Yongning 永寧, from there it continued on the water way to Chengdu; the fund for the former distance was 1.8 tael per 100 *jin*, and 0.48 tael for the latter[38]. Compared with the transport funds given to mines in Ningyuan later[39], it does not appear to be more expensive.

4.3.2 *Zinc*

4.3.2.1 Demand and supply of zinc

The procurement of zinc can also be divided into three parts: Zinc purchased from Guizhou province, zinc produced by Sichuan's own zinc mines, and market zinc.

As the biggest zinc producer in China during the Qing period, Guizhou also supplied the major part of Sichuan's zinc demand. Throughout the whole operating of the Baochuanju, zinc from Guizhou arrived constantly with only a few small interruptions. The most important zinc mines in Sichuan were the Qianwanggai mine (1755-1785) and the Baishaling mine (1772-1887).

The remaining part was purchased from markets mainly in Xuyong Subprefecture 敘永廳, which is located close to the boarder of Guizhou. In other places such as Chengdu and Chongqing, market zinc could also be purchased, sometimes in abundant

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[35] *Yunnan tongzhi gao*, chap. 77, p. 1a.

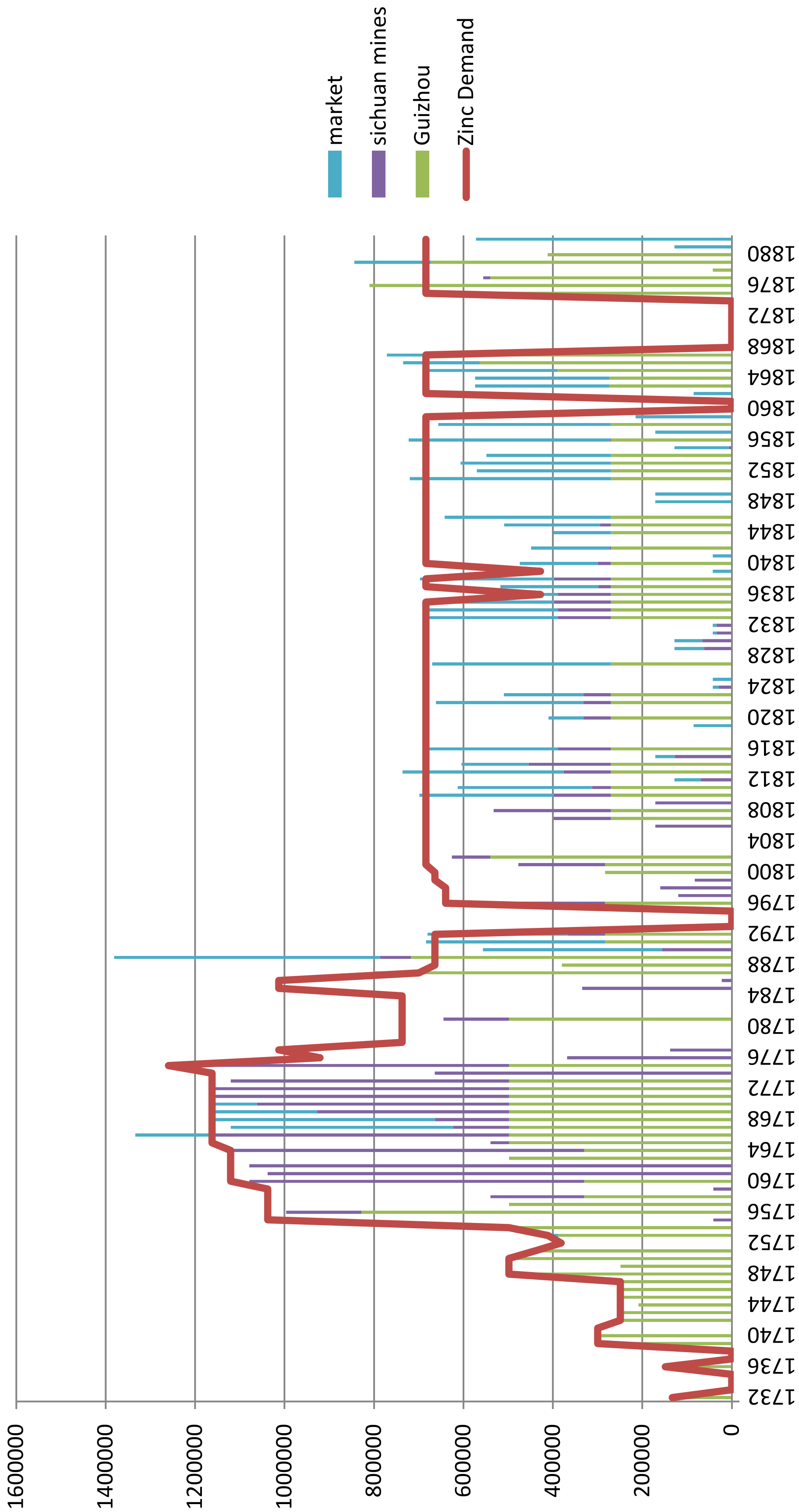
[36] RM, 2.175.14227.16.

[37] RM, 2.168.13407.1.

[38] RM, 2.173.13867.4.

[39] See chap. 2.4.5.

Graph 27: Zinc demand and zinc procurement of Baochuanju, 1732-1882 (in *jin*)



amounts and even cheaper than then the one from Guizhou. This supply, however, was unreliable[40]. As in the case of copper, small amounts of zinc could also be procured by the melting down of small coins, e.g., in Ningyuan prefecture in 1801, 1468 *jin* of zinc were procured in this way[41].

Market zinc could be purchased in various places, at different prices. Together with the fund for Guizhou zinc as well as zinc produced by Sichuan's own mines, the prices are displayed in this Graph 27.

From the above chart of funds for zinc from different origins, it can be seen that except for the market zinc, the price of Guizhou zinc was the highest. Thus as long as zinc from Sichuan's own mines or even markets was available, purchasing from Guizhou was the most expensive choice[42]. Zinc production in Sichuan was, however, not satisfying; Help from Guizhou could thus not be avoided.

The fund of market zinc shows a tendency to increase, e.g. for the zinc purchased in Xuyong Subprefecture it increased from 2.73 tael in 1767 to 3.787 tael in 1789 and then again up to 4.3 tael of silver for 100 *jin* in 1812. The raising of funds reflects the increase of the zinc price on the market.

4.3.2.2 Purchase of zinc from Guizhou

The purchase of zinc from Guizhou was taken over by selected officials from Sichuan. The official took off from Chengdu and brought silver to Guiyang, the provincial capital of Guizhou, to pay for the zinc. Then he returned to Yongning 永寧 District, and waited for the zinc there. When he received the zinc he delivered it back to Chengdu. The governmental purchase price, i.e., the fund for every *jin* of zinc was 3.9 tael. The regulations concerning the transport funds were the same like for copper transportation in Sichuan. It was twenty post stations by water to transport zinc from Yongning to Chengdu. Since for every station 0.024 tael per 100 *jin* were funded, thus for the entire route 0.48 tael. For every 10,000 *jin* of zinc, one clerk was employed to escort the convoy,

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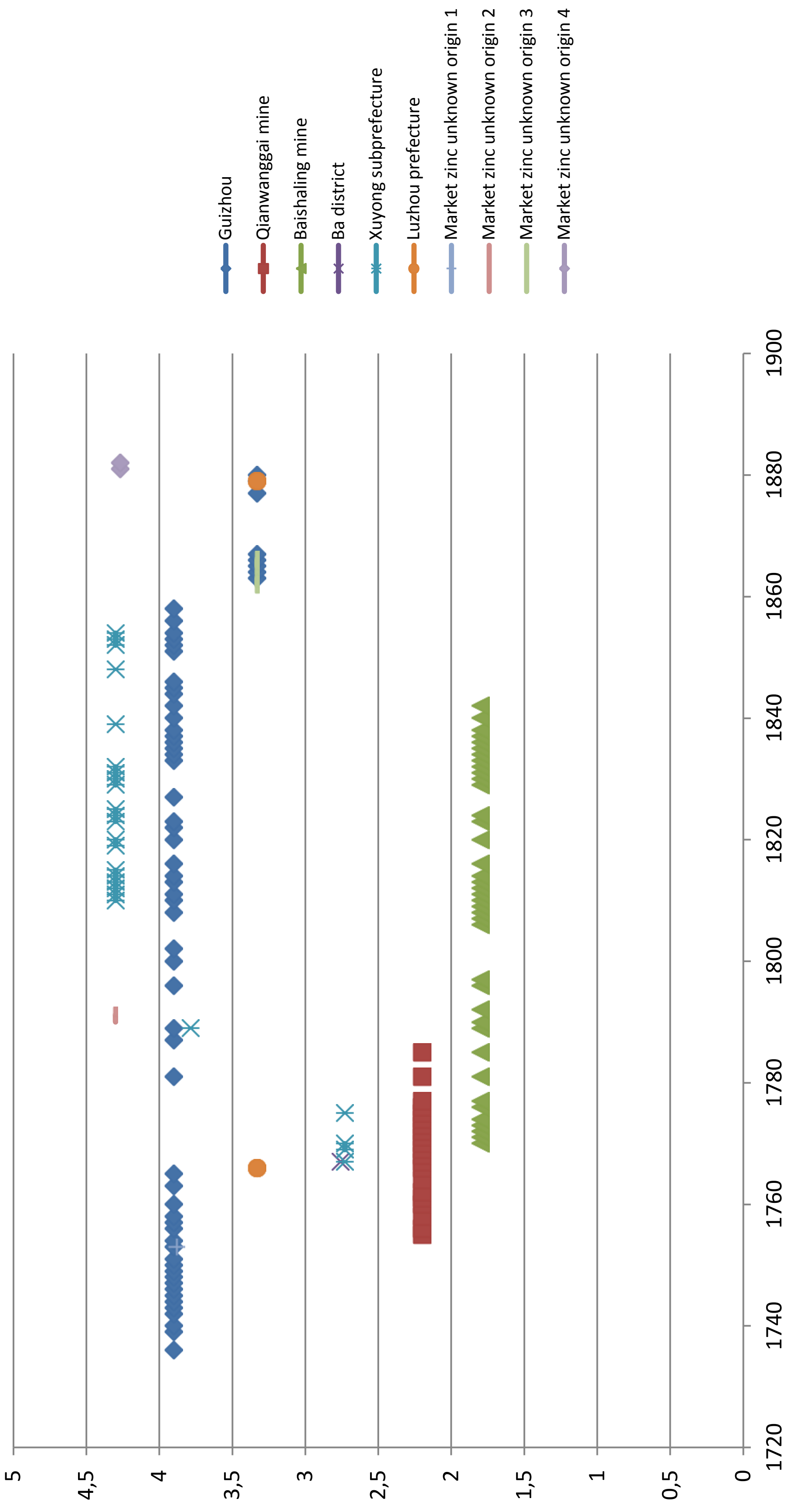
[40] GZDQL, vol. 13, pp. 505-506, 。四川总督开泰，乾隆二十一年正月十九日

[41] Neige daku, JQ9/4/2.

[42] GZDQL, vol. 13, pp. 505-506.

Graph 28: Prices for Zinc procured by the Baochuanju from different origins, 1736-1880 (in tael per 100 *jin*)



he received a compensation for food of 0.04 tael per day. To deliver the "zinc-purchasing-silver" from Chengdu to Guiyang, for every 2,000 tael one mule was required. For each mule for the entire journey, funds of 7 tael were provided. Furthermore 0.26 tael per bolt of cloth for packing the silver ingots as well as 0.05 tael for the oil-basket for storing the silver and 0,08 tael for packing paper, hemp rope and painting work (*qigong* 漆工) were still added.

The silver required for the transport of the zinc from Yongning to Chengdu was directly delivered there from Chengdu. For this purpose, every 2,000 tael transported by one mule was given funds of 5 tael for the journey. Again, packing cloth, paper, rope and painting work were paid in the same amounts as for the silver transport to Guiyang. The transport official received a monthly payment of 5 tael over the entire course of the journey.[43] The whole purchase mission was supposed to be carried out within six months[44]. As in the case of copper, the actual cost including buying and transporting 100 *jin* of zinc was more than the 4.4 tael provided by the governmental funds.[45]

Due to difference between the weight units in use in the two provinces, which meant that the weights in Guizhou were heavier than those in Sichuan, extra zinc needed to be added in order to supplement the resulting deficiency in comparison to the Sichuan weights. For every 100 *jin* of zinc bought from Guizhou according to Guizhou's weights thus another 1.25% had to be added[46].

4.3.3 *Lead*

From the chart below it can be seen, that the provincial mint of Sichuan over a long time period relied on its own lead mines' production. Purchasing lead from Guizhou only took place before 1747. After that, Sichuan supplied the provincial mint with lead from its own mines and lead from the market. From 1747 to 1751, the mint was shortly supplied by market lead. However, the lead mines could not meet the demand any more after 1840, from then on market lead played the most important role.

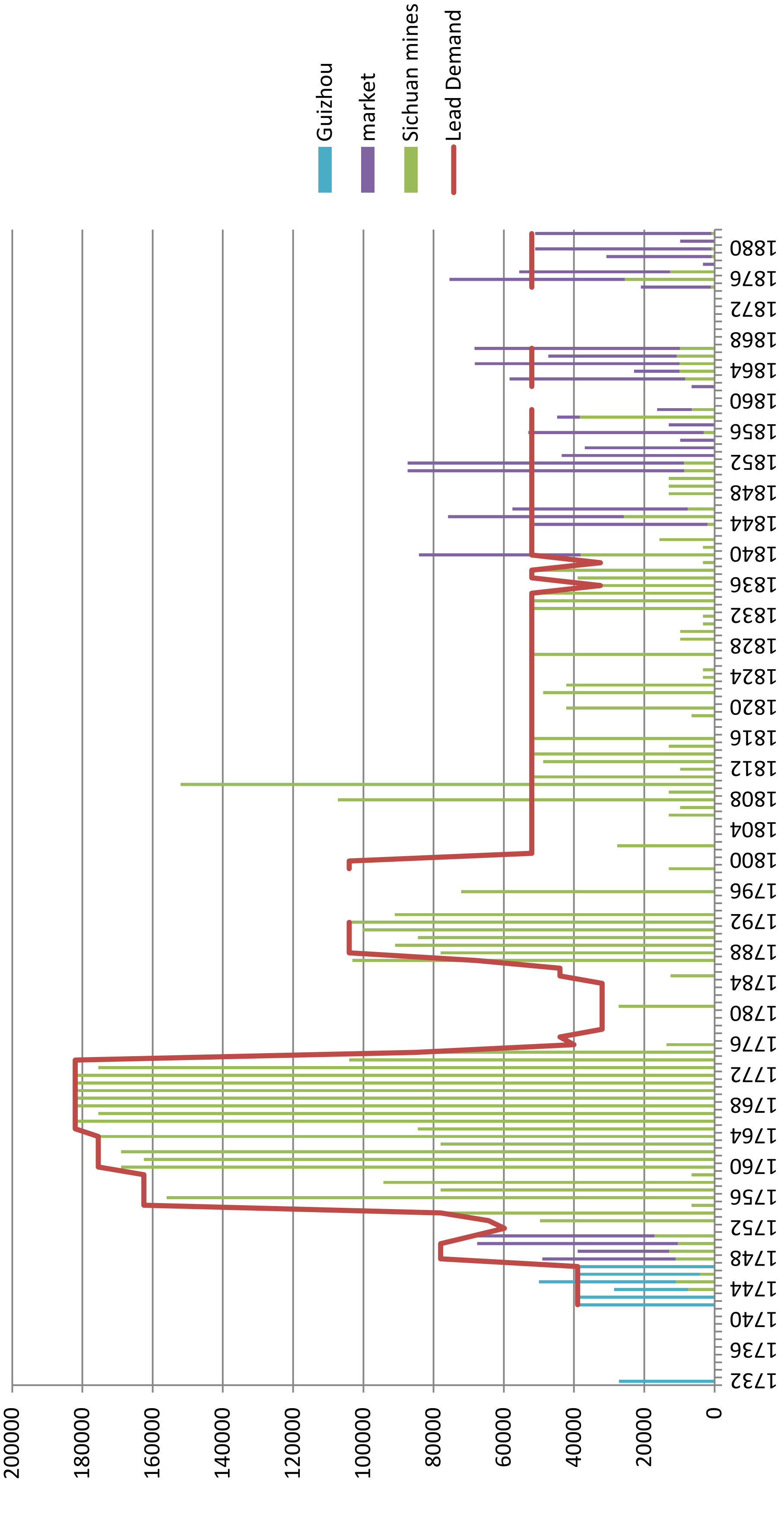
[43] GZZL, chap. 3, pp. 9a, 9b, 10a.

[44] GZDQL, vol. 38, p. 545.

[45] GZDQL, vol. 13, pp. 505-506.

[46] Calculated after the information of quantity in the routine memorials.

Graph 29: Lead demand and lead procurement of Baochuanju, 1732-1882 (in *jin*)



The funds for lead from different origins certainly varied, but the situation was altogether much simpler than in the case of zinc: lead from Sichuan received funds of 1.6[47] or 2 tael[48] per 100 *jin* while market lead was paid for more than twice as much, namely 4.27 tael.[49]

4.3.4 *Tin*

4.3.4.1 Demand and supply of tin

Sichuan did not produce any own tin for its mint. All tin thus had to be purchased either from other provinces or from the local market. From Graph 30 it can be seen clearly that at the beginning the required tin came from Guangdong; then "plate tin" (*banxi* 板錫) and later "furnace tin" (*luxi* 爐錫) was purchased from Yunnan. The exact meaning of the different types of tin cannot be identified any more but were supposedly related to the smelting process or the use of different ores. From 1785 onwards, tin was bought on the local market, i.e. in Chengdu[50]. However, it is impossible to identify its origin.

The funds for tin from different origins had big differences. The highest funds were provided for the purchase of Guangdong tin, and the lowest for the tin from Yunnan. More information can be seen from Table 31.

47 Shaji, see RM, 2.179.14817.11; Qianwanggai, see RM, 2.184.15458.9.

48 Tiantaishan, see RM, 2.181.15062.17; Panlongshan, see RM, 2.184.15557.2; Longtoushan, see RM, 2.215.19265.12.

49 RM, DG22/10/17.

50 See NGDK, 051770-001.

Graph 30: Tin demand and tin procurement of Baochuanju, 1742-1792 (in *jin*)

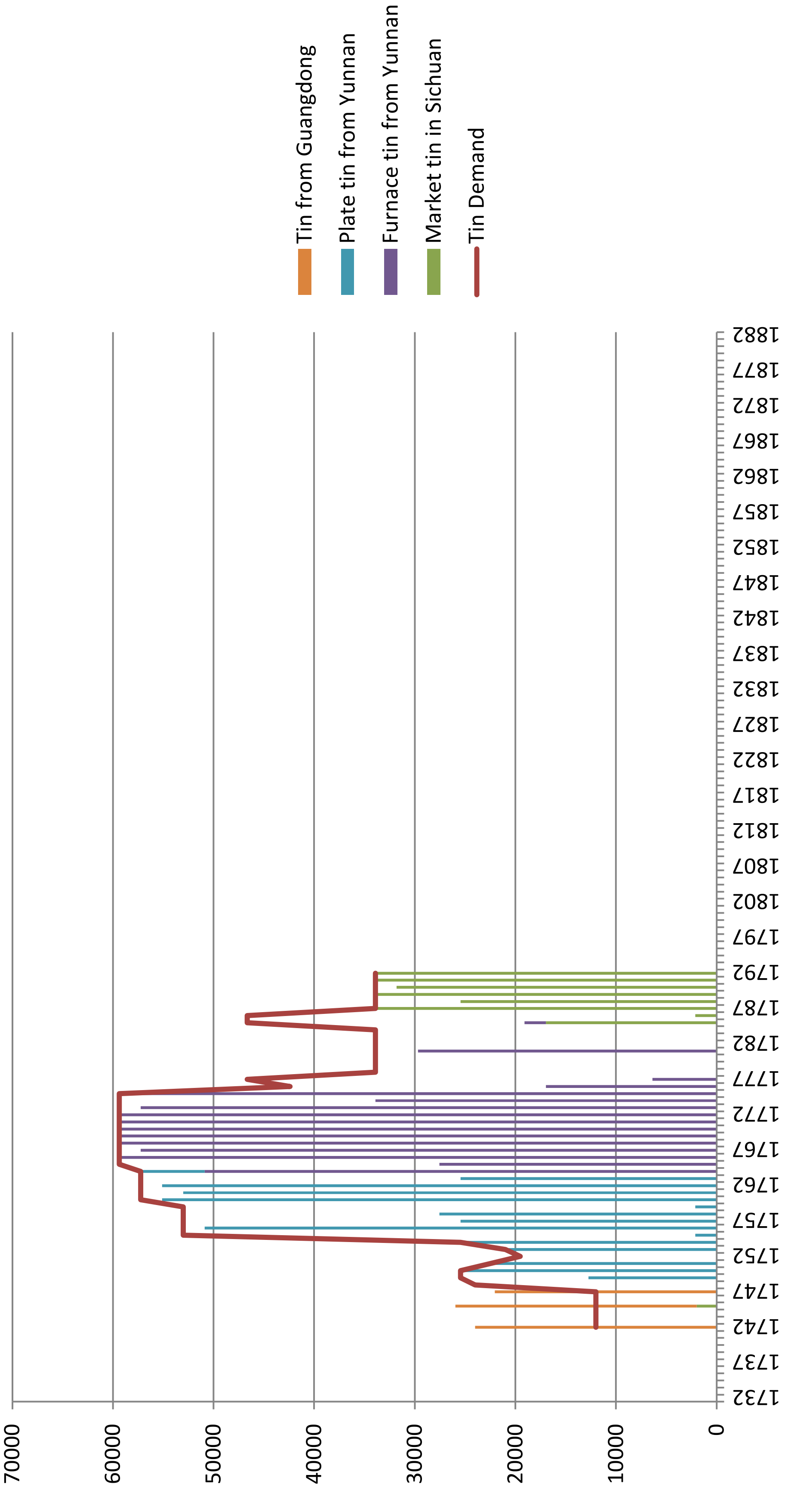


Table 31: Funds for the tin procurement of Baochuanju, 1742-1792[51]

<table>
<tr><th>Tin</th><th>Year</th><th>purchase fund
(tael per 100 jin)</th><th>transport fund
(tael per 100 jin)</th></tr>
<tr><td>Guangdong</td><td>1742-1747</td><td>13.8-14.4</td><td>0.97</td></tr>
<tr><td>Market tin, Sichuan</td><td>1745</td><td colspan="2">13</td></tr>
<tr><td>Plate tin, Yunnan</td><td>1749-1764</td><td colspan="2">2.927</td></tr>
<tr><td rowspan="2">Furnace tin, Yunnan</td><td>1764-1774</td><td colspan="2">3.96-4.054</td></tr>
<tr><td>1775-1784</td><td>4.054</td><td>4.181</td></tr>
<tr><td>Market tin, Sichuan</td><td>1785-1792</td><td colspan="2">8</td></tr>
</table>

4.3.4.2 Transport route and cost

4.3.4.2.1 Tin from Guangdong

From 1742 to 1747, Sichuan bought its tin from Guangdong. It was named "point tin" (*dianxi* 點錫), or also called "point copper" (*diantong* 點銅). Soon this way turned out to be too expensive and too long while the tin from Yunnan was located closer and much cheaper. Thus the former was replaced by the latter. However, it was said that the quality and purity of this type of tin was better than the one of the Yunnan product[52].

4.3.4.2.2 Tin from Yunnan

Like for the case of zinc purchase, one selected official from Sichuan was entrusted with the task of purchasing tin from Gejiu 個舊 in Yunnan. The "plate tin" was purchased

[51] Sources: RM, 2.175.14120.12, 2.174.13991.7, 2.175.14227.16, 2.177.14449.7, 2.178.14608.3, 2.186.15820.5, 2.186.15915.15, 2.199.17543.3.
[52] *Shu gu*, chap. 4.

from 1749 until 1764 when Yunnan began to complained about its declining tin production[53]. As a consequence, since then it was replaced by the "furnace tin".

The transport regulations for tin state the following: Always 100 *jin* were put into one bamboo basket, which cost 0.015 tael. From the mine in Gejiu to Yunnan Prefecture 雲南府, it was seven stations on the land way. Each station received a fund of 0.143 tael per 100 *jin*. From there on to Yongning it was another 23 stations on land, each of them being funded with 0.129 tael. From the mine to Yongning, every 10,000 *jin* needed one escort person, who was paid 0.05 tael per day for his food compensation. From Yongning to Chengdu this payment was only 0.04 tael per person and day. From Yongning to Chengdu tin transports used the same route like in the case of zinc purchases from Guizhou, which were transported by water way for twenty stations. Each station was funded with 0.024 tael for every 100 *jin*. To deliver the "tin-purchasing-silver" as well as "tin-transport-silver" from Chengdu to Yunnan Prefecture, for every 2,000 tael one mule was needed and was given 10 tael for the entire journey, half a bolt of packing cloth for packing 2,000 tael of silver was accounted for with 0.13 tael, the oil baskets for silver storage with 0.05 tael and the Packing paper, hemp rope and painting work (qigong 漆工), altogether with 0.09 tael. From Yunnan Prefecture to the tin mines in Gejiu, every official travelled with two mules. For 45 stations from Chengdu to Gejiu and 30 stations from Gejiu to Yongning, 0.26 tael were funded for each mule per station. For the transport official, from his departure until he reached Yongning with the tin, eight tael monthly payment were reserved. For the distance between Yongning and Chengdu, only five tael per month were paid[54]. This purchase mission was intended to be finished within eight months. [55]

[53] GZDQL, vol. 21, p. 122.

[54] GZZL, p. 64.

[55] GZDQL, vol. 34, p. 774.

4.4 *Casting coins*

4.4.1 *Staff*

Before entering into any descriptions about the technical details of the casting process, some observations about the personnel in the Baochuanju mint are useful. There were officials (*guan* 官), clerks (*yi* 役) and furnace-craftsmen (*lujiang* 爐匠).

As to the first level, the officials, the Baochuanju mint stood under the supervision of the Provincial Administration Commissioner (*buzhengshi* 布政使). He entrusted the circuit of Cheng Long Mian Mao (Cheng[du], Long[an], Mian[zhou] Mao[zhou] Dao 成龍緜茂道) to inspect (*jicha* 稽查) it. One Vice Prefect (*fuzuo* 府佐) was ordered to assist (*xieban* 協辦) the mint affairs. This official was selected among the First Class Sub-Prefects (*tongzhi* 同知) and the Second Class Sub-Prefects (*tongpan* 通判)[56] and had to take the full responsibility of the Baochuanju mint and thus was appointed to be the "Supervising Minting Official" (*jianzhu guan* 監鑄官). He did not receive any extra monthly payment though.[57]

Under his supervision, there were another two officials chosen among petty officials (*zuoza* 佐雜)[58]. One was named "Store Official" 庫官 (*kuguan*), whose responsibility was to distribute the metal storage. The other was named "Inspecting Official" (*xunchuoguan* 巡綽官), whose task was to observe the craftsmen and to prevent possible stealing cases.

The second level was the clerks. They were divided into four types: secretary-clerks (*shuban* 書辦), inspecting-clerks (*xunlan* 巡攔), runners (*zaoli* 皂隸) and night watchmen (*gengfu* 更夫). The number of these clerks originally amounted to four of each type[59], later it was increased or decreased when necessary[60]. When the mint developed and enlarged, the number of clerks also increased. Since Qianlong 19 (1754), when the

[56] JQ-SCTZ, vol. 99, p. 6a.

[57] SCBZL, p. 161.

[58] TZBL, chap.5, „各省錢局鼓鑄章程".

[59] RM, 2.170.13362.13.

[60] RM, 2.201.17843.3.

old furnaces' number was fixed as 30, there were eight secretary-clerks and twenty others, more than twice as much as before[61]. In Qianlong 59 (1794), when the Baochuanju mint stopped casting temporarily, 16 clerks were laid off[62].

As to the third level – furnace-craftsmen, the sources on this topic especially concerning the situation in the Baochuanju mint is very limited. It is thus necessary to consider the available general information about the Chinese mints in the Qing period. According to the *Qingchao wenxian tongkao* 清朝文獻通考 (Encyclopedia of the historical records of the Qing dynasty), every furnace had one "furnace-head" (*lutou* 爐頭). Under his lead, the craftsmen worked and were divided into eight professions:

- watching-fire-craftsmen (*kanhuo jiang* 看火匠),
- turning-sand-craftsmen (*fansha jiang* 翻砂匠), i.e., maker of sand moulds[63],
- brushing-ash-craftsmen (*shuahui jiang* 刷灰匠),
- miscellaneous-work-craftsmen (*zazuo jiang* 雜作匠),
- filing-edge-craftsmen (*cuobian jiang* 銼邊匠),
- rolling-edge-craftsmen (*gunbian jiang* 滾邊匠),
- grinding-coin-craftsmen (*moqian jiang* 磨錢匠), i.e., polisher of cash-holes[64], and
- washing-hole-craftsmen (*xiyan jiang* 洗眼匠)[65]

Their working situation is displayed vividly in the picture of a Qing mint in Figure 13, see next chapter.

The above shown labour division of the craftsmen already existed since the Kangxi reign-period (1661-1772)[66]. From the names of their professions, good parts of the

[61] RM, 2.180.14974.12. It shows in the Routine Memorials for the first time that the pay for officials and runners was 688 strings and 800 coins, which matches the number of personnel mentioned in RM, 2.201.17843.3.

[62] RM, 2.201.17843.3.

[63] Vogel (2005), p. 408.

[64] Ibid.

[65] QCWXTK, chap. 16, p. 18.

working process and techniques can already be deduced. Sources about other provincial mints tell that that the craftsmen usually were placed inside of the mint in furnace units. For example in the Baoguiju 寶桂局，the mint of Guangxi, ten craftsmen were needed for operating one furnace[67]; while in the Baozheju 寶浙局 mint Zhejiang, forty-one to forty-seven craftsmen per furnace were employed[68].

The situation in the Baochuanju mint presumably must have been similar to theirs. In Yongzheng 10 (1732) when the Circuit Intendant Zheng Qichu 鄭其儲 filed a report of arrangements in the Baochuanju mint, he suggested a number of 315 craftsmen for 15 furnaces, which indicates that 21 craftsmen were assigned to each furnace[69]. If so, the quantity of the craftsmen working in the Baochuanju mint could have been between 168 and 840 according to the number of installed furnaces at different times. These estimations are based on the assumption that the new furnaces installed in 1755 were provided with the same number of craftsmen as the old ones. Since the production of one new furnace was three times higher than the one of one old furnace, it can be generously estimated that the Baochuanju at the peak of its production may have employed up to 1260 craftsmen.

4.4.2 *Technology*

The techniques used for casting coins in the Chinese mints during the Qing period was called "sand-casting with mother coins (*muqian fansha fa* 母錢翻砂法)", which dates back probably until the 6th century into the Sui dynasty and was utilized in China until its replacement by the coinage by striking with machines which was introduced from the West by the end of the nineteenth and the beginning of the twentieth century[70].

Within the entire history of Chinese cast coinage, the "sand-casting" method marked the third phase following after a first phase of so-called "Upright Casting" with piece

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66 *Shiqu yuji*, p. 205.

67 *Guangxi tongzhi*, chap. 178, p. 10.

68 *Hangzhou fuzhi*, chap. 36, p. 14.

69 QL-SCTZ, chap. 15b.

70 Zhou Weirong (2002b), pp. 198-214.

moulds (*pingban fan shushi jiaozhu* 平板范豎式澆鑄) and a second phase of so called "Stack Casting" (*diezhu* 疊鑄)[71].

Within the process of sand casting, coins were cast in large numbers in batches in two-piece moulds arranged vertically. Moulds were prepared from fine sand re-enforced with an organic binder and contained within a wooden box. A pattern of 50-100 "matrix coins" were pressed lightly into the surface and then a second mould box was placed face down on top. An impression was thus taken of both sides of the mother cash pattern. The mould boxes were then turned over and separated so that the matrix coin remained on the lower mould surface. A fresh mould box was then laid on this and again the pair was turned and separated. In this way a series of two-piece moulds were obtained. After clearing out casting channels between the coin imprints and making a central runnel, the boxes were fixed together in pairs and, after a preliminary firing, metal was poured in. The result was a "cash tree" from which the coins were separated and subsequently cleaned up[72].

The matrix coins can be divided into two types i.e. engraved ones and cast ones. The former ones are made of wood, tin, copper or ivory, the latter ones could be made of copper or tin. They varied in different dynasties and time periods, while the changes in the sand casting method itself were rather marginal. The situation in the Qing period, according to the records in *Qingchao wenxian tongkao,* was to first carve the pure copper (*jingtong* 淨銅) into "master coins" individually (*zuqian* 祖錢), each of them weighing 2 *qian* 3 *fen* (ca. 8.5g), then to use them to cast copies and to obtain so-called "mother coins" or "matrix coins" (*muqian* 母錢), each weighing 1 *qian* 6 *fen* to 1 *qian* 7 *fen* (ca. 5.9-6.3g) and in the end then to cast copies of these mother coins in order to obtain "standard coins" (*zhiqian* 製錢)[73].

When and how exactly the sand casting method was invented is still unclear. Most scholars believe that the sand casting method should have been first applied no later than

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[71] See my article: "Cast in the Sand: Comparative Views on the Chinese Way of Minting before Mechanization", in: Monies, Markets and Finance Conference Tübingen October 2011.

[72] Bowman et al. (2005), p. 5.

[73] QCWXTK, chap. 16, p. 18.

the Sui dynasty (581-618), because moulds for stack casting since then has not been discovered anymore. However, no historical sources until now have been found to support this.

Recent archaeological excavations show that the sand casting method already existed during the Northern Wei period (386-534). One Wuzhu cash coin (*wuzhuqian* 五銖錢) from this period, which is collected in the Shanghai museum, shows an obvious character of the sand casting method. One coin tree from the Northern Zhou period (557-581), which was unearthed near Xi'an in 1990, was also clearly produced by sand casting. The same holds true for another coin tree, unearthed in Baoji, dating back to the Tang period (618-907). An excavation in Guangzhou in 2008 discovered a minting site from the early Tang period, in which the sand casting method was used as well. However, the written sources show that there was no governmental mint in this region at that time, thus probably this was a site for counterfeiting coins.

Some scholars hence suggest that the sand casting method started probably with counterfeiting, which means by using standard coins instead of master coins for shaping the sand moulds, and is thus an invention based on the already-existing technique of stack casting and was adopted by commoners for this practical purpose in periods of relatively loose state control.

It was an outcome of the developing technique of stack casting. Its specialty was that master coins and sand moulds were used, thus no moulds could be preserved. In order to get to know the technique of sand casting in detail, three sources can be consulted. The first one is by far the earliest detailed description concerning sand casting, it is given in a prose poem by Hong Zikui 洪咨夔 from the Southern Song period named *Daye Fu* 大冶賦 (Rhapsody of the great smelting) (1210)[74]. The second one is the *Tiangong kaiwu* 天工開物 (Exploitation of the works of nature) (1637)[75] by Song Yingxing 宋應星 and the last one is *Zhuqian shulue* 鑄錢述略 (A brief introduction of minting)[76] published in 1899. Generally speaking, the application of the sand casting technique for producing

[74] Hong Zikui 洪咨夔, *Pingzhai Wenji* 平齋文集 (Collected works of Pingzhai), chap. 1. See also Jost (2011).

[75] *Tiangong kaiwu*, chap. 8, "cash".

[76] *Zhuqian shulue* 鑄錢述略 (A brief introduction of minting), Han Guojun 韓國鈞, 1899.

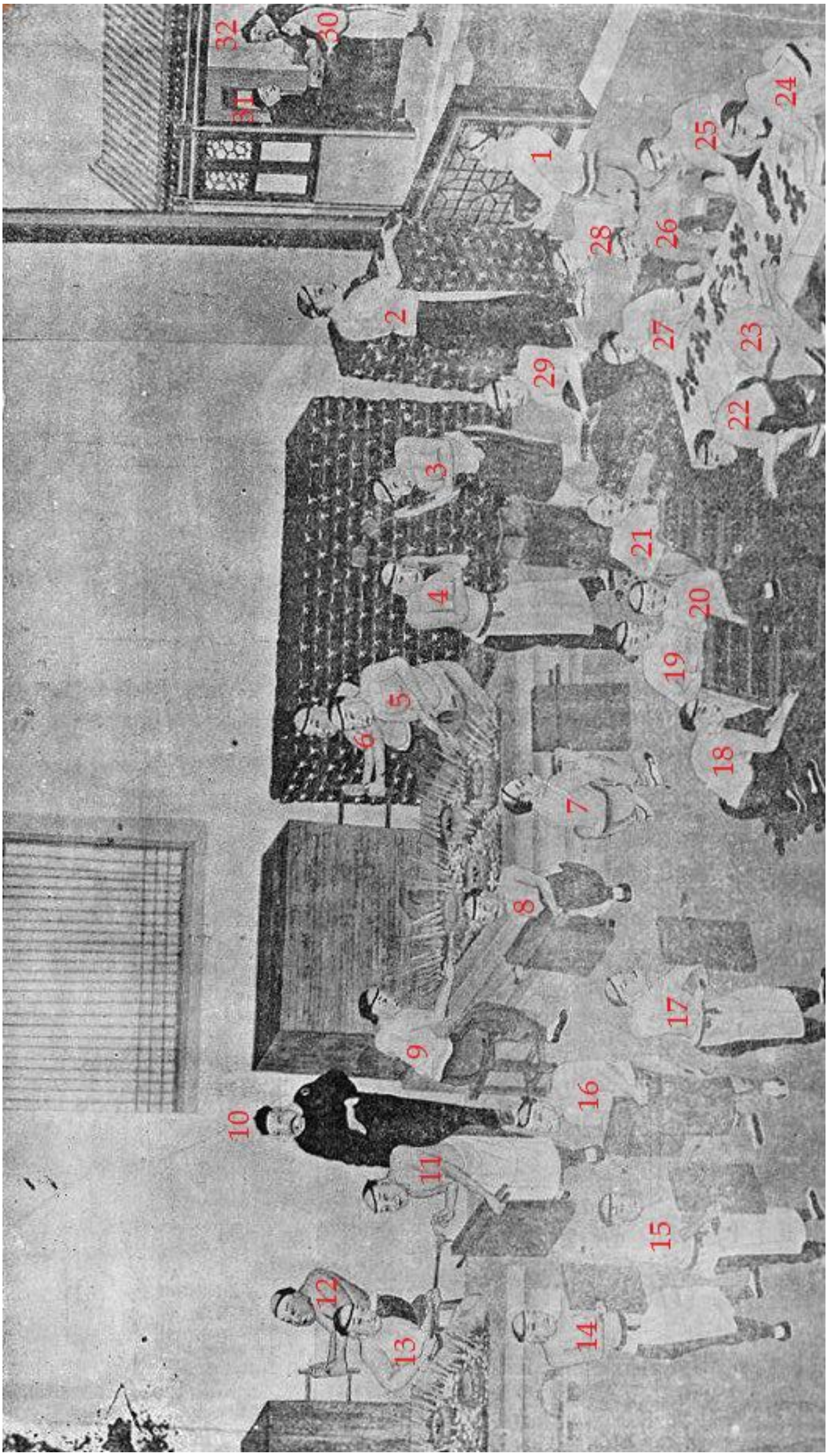


Figure 13: In a Chinese mint (Huo Ming-chih)

coins did not face any fundamental changes between its invention and its abolition. From the Song period until the Qing period, the labour division became more systematic and some working processes were added or cancelled.

Figure 13 shows intuitively how the coins were cast in the mints during the Qing period[77]. In the picture altogether thirty two people in two rooms can be seen. The main scene takes place in one room where 29 people are involved into the casting process, while three people in another house outside the room's door are dealing with the hand-over process.

The casting scene starts with the person number 1 in the right middle of the picture. He brings in one copper ingot. Then to the left, the person with number 2 is either piling up the ingots or just bringing one for the next step. Numbers 3 and 4 are beating an ingot into pieces. Again to the left, a furnace with one wind bellow and a cooking stove are shown. One cooking stove has four pans on it, with fire burning outside and the metal alloy melting inside. Person 6 is operating the bellows to heat the stove, while numbers 5 and 9 are observing the pans. Craftsmen 7 and 8 squat in front of the furnace with the sand boxes prepared in which moulds of coins are already installed. The numbers 5 to 9 constitute one working group. To the left there is another furnace. It can be imagined, that there are more furnaces and thus, more working groups in the same room, which are not shown in the picture any more. Craftsman 12 is exerting himself at pulling the wind bellows while person 13 is ladling out the liquid copper alloy and then filling it into the sandbox held by person 11. The box is held upright and the melt is filled in from the narrow upper part. Then a group of people is holding the filled boxes, waiting until they cool down, and can be forwarded to the next process. In this part of the picture, the furnace-head 爐頭 (number 10) is standing. He wears a dark robe and is supervising the whole working process. People 18 to 22 are opening the boxes, taking out the coin-trees, and breaking the coins off from it. Workers 23 to 27 are filing and grinding the coins smooth. Numbers 28 and 29 finally are stringing the coins.

Outside of the large working room, on the other side of the yard, another three people are depicted. Person 31 dresses the same way as person 10 and is thus either

[77] Huo, Ming-chih (Huo-Ming-Tse, Paul) (1930).

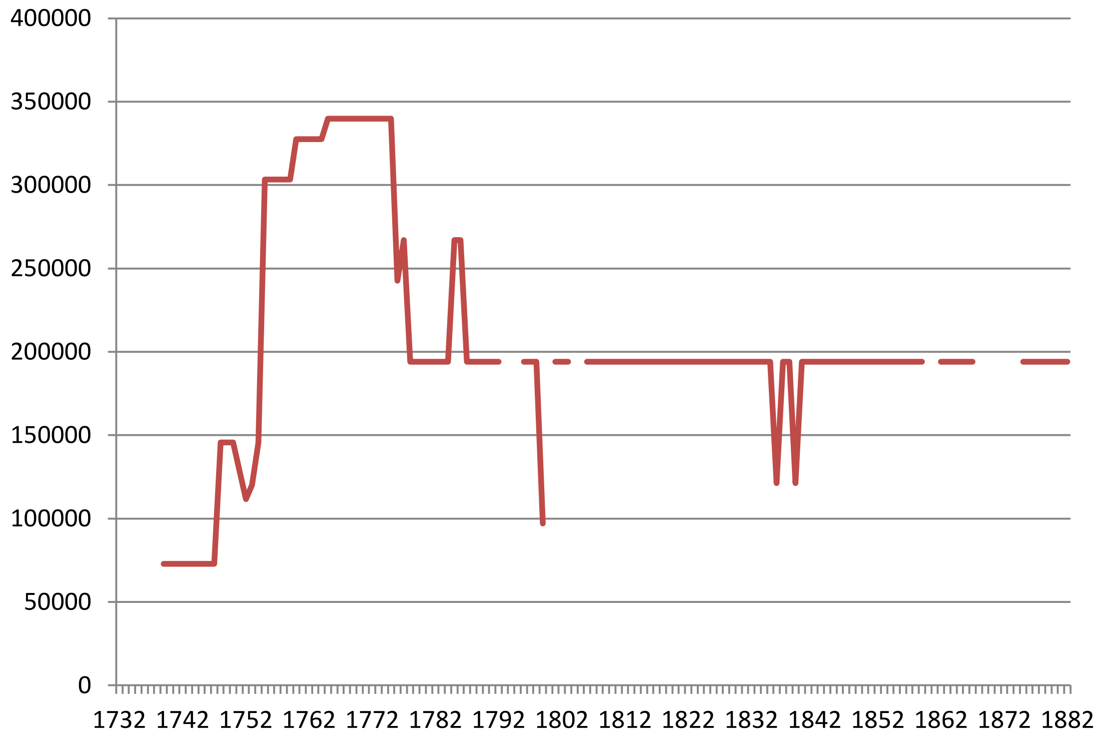
another furnace-head, or represents just the same person as in another scene. He is handing over coins to two people: one of them is an official, the other one dressed as a commoner, may be a merchant.

4.4.3 *Output*

The output of the coins is calculated by the quantity of the used mint metal. According to the regulation, the relation between the metal amount used for the production and the final coin output is such, that from every 100 *jin* of metal, 9 *jin* would be allowed as a deduction or loss (*zhehao* 折耗) during the casting process. Of the remaining 91 *jin*, always 7.5 *jin* could be made into one string of coins. Thus altogether from 100 *jin* of mint metal, 12 coin strings of 1000 coins each plus 133 separate coins could be produced.

The mint reports inside the Routine Memorials calculate the mint's coin output applying the above-mentioned relation.

Graph 31: Coin output of the Baochuanju, 1732-1882 (in *wen*)



4.4.4 *Cost of the casting process*

First, it is necessary to clearly define the term of "coin capital" (*qianben* 錢本). According to the authoritative regulation which can be found in the *Qinding Da Qing huidian* 欽定大清會典 (Imperially endorsed collected statutes of the Great Qing Dynasty), there were three types of costs. They consisted in firstly, the cost of mint metals including their transportation; secondly, the cost for administration; and thirdly, the cost of craftsmen's labour and other necessary materials, e.g. fuel, sand, salt, crucibles and so on. In most of the sources, the last type of cost was regarded as one item and called "the cost of labour and materials" (*lujiang gong liao qian* 爐匠工料錢), or simply, "casting cost". According to Peng Xinwei's statistics, the casting cost of different mints in the Qing period ranged from 9.77% to 22.2%, averaging somewhat above 15% of the total "coin capital"[78]. The cost of administration was the share used to pay mint officials and stationary (*guan yi shifei* 官役食費) as well as to pay for public expenses (*gongfei* 公費). These three parts, i.e., the cost of mint labour and materials, the payment for mint officials, and public expenses were paid in the form of coins from the output itself, with the exchange rate of 1000 strings of coins equalling 1 tael of silver[79]. All payments were paid from the day on when the casting started, i.e. the day when the furnaces opened (*kai lu zhi ri* 開爐之日)[80].

4.4.4.1 Cost of mint labour and materials

4.4.4.1.1 Calculation of the craftsmen's payments

Besides their workforce, the craftsmen also had to provide materials required for the casting process, such as coal, pots, sand, charcoal, salt and stringing threads[81]. Labour and materials were paid together. Craftsmen only got paid for casting one particular category of coins. It has been mentioned before, that the coins as well as the mint reports were

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78 Peng Xinwei (1965), p.531 and p. 536.

79 No later than QL 11 (1747), see RM, 2.174.13991.7.

80 RM, 2.174.13991.7.

81 QCWXTK, chap. 16, p. 18.

divided into six categories[82]. In each category, coins are again divided into two parts according to the minting purposes: the regular casting *(zhengzhu* 正鑄) and the incidental casting (*daizhu* 帶鑄) (not to be confused with the according terms defining the category types themselves). The proportion between them two is 92.34% to 7.66%. The craftsmen were, however, only paid for the regular casting.

Besides, the payments were calculated according to the quantity of mint metal used in the casting process. There was a certain ratio which defined, how much had to be paid for the use of which amount of metal. Ratios varied according to different furnaces. For every 100 *jin* of metal, the craftsmen together received 1 string and 820 coins (i.e., 1,820 coins) when the casting was carried out on the old furnaces, while 1 string and 638 coins when using the new ones. The quantity of wastage tin (*haoxi* 耗錫), however, needs to be first taken out of this calculation.

Thus the craftsmen's payment can be calculated in the following way:

<u>For the old furnaces:</u>

Craftsmen payment (in strings) = 1.82 * (amount in *jin* of copper + zinc + lead + tin – wastage tin) ÷100;

<u>For the new furnaces:</u>

Craftsmen payment (in strings) = 1.638 * (amount in *jin* of copper + zinc + lead + tin – wastage tin) ÷100.

4.4.4.1.2 Distribution of the Payments for the Craftsmen

Unfortunately there are no sources available, which contain information on the labour division and the payment levels of the craftsmen employed by the Baochuanju. However, since labour division into eight professions was prescribed by regulation for all the Qing mints and casting methods were the same everywhere as well, sources containing information about other mints can be consulted, too.

[82] see 4.2, Categories of reports.

The payments for each of the professions can be seen in the table below. They are given in the term of cash per *mao* (casting period), the unit is *chuan* 串 (string) and *wen* 文 (coin). Since 1 *chuan* is 1000 *wen*, thus for example 3.264 means 3 *chuan* and 264 *wen*, which is 3,264 coins.

Table 32: Payments for craftsmen in Chinese mints, 1734-1769 (in *chuan* and *wen*)

Type of craftsmen	Baoquanju, 1734[83]	Baoquanju, 1769[84]	Baozhiju, 1769[85]
watching-fire-craftsmen	3.264	3.264	3.264
turning-sand-craftsmen	5.28	4.4	4.4
brushing-ash-craftsmen	1.848	1.8	1.8
miscellaneous-works-craftsmen	3.264	3.004	3.004
filing-edge-craftsmen	1.872	1.6	1.6
rolling-edge-craftsmen	1.68	1.68	1.68
grinding-coin-craftsmen	6.72	6.72	6.72
washing-hole-craftsmen	1.008	1.008	1.008

The ratio of their payments in 1769, when the regulation was fixed, is displayed in Table 33.

[83] *Zhongguo jindai shougongye shi ziliao*, p.119.

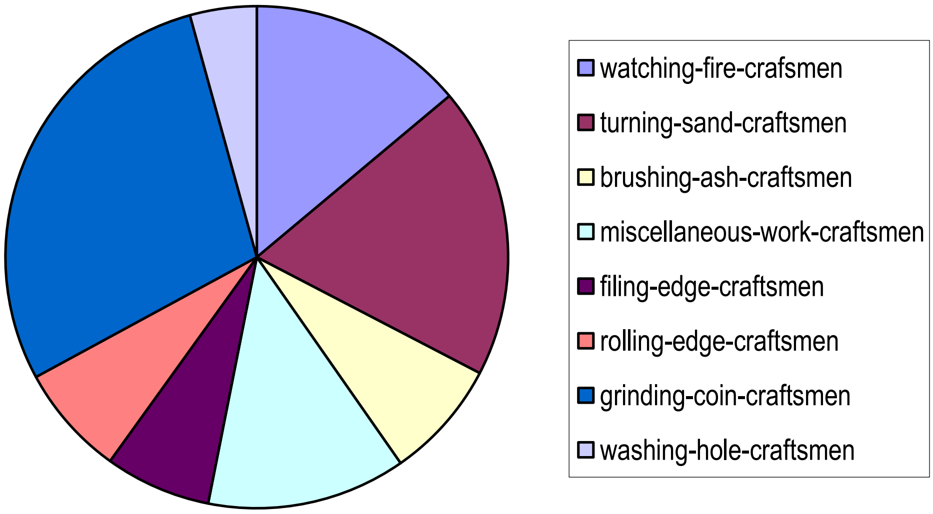
[84] GZZL, pp. 149-150.

[85] GZZL, pp. 153-154.

Table 33: Ratio of payments for mint craftsmen, 1769

Type of craftsmen	Percentage of all payments
watching-fire-craftsmen	13.90%
turning-sand-craftsmen	18.74%
brushing-ash-craftsmen	7.67%
miscellaneous-work-craftsmen	12.80%
filing-edge-craftsmen	6.82%
rolling-edge-craftsmen	7.16%
grinding-coin-craftsmen	28.63%
washing-hole-craftsmen	4.29%

Graph 32: Ratio of payments for mint craftsmen, 1769



From graph 32 it can be seen, that the most labour-intensive work in the mint was still the grinding of coins (*moqian* 磨錢), and thus those parts of the production process which were located after the casting itself and which were of a particular importance due to the fact that they made the quality of coins produced by governmental mints superior to the counterfeited ones.

In the plan created by Zheng Qichu for the organization of the Baochuanju in Yongzheng 7 (1729), he calculated after the precedence of Yunnan, that every craftsman would be paid 57 coins per day plus 8 *ge* 合 and 3 *shao* 勺 [ca. 0.86 litre] of rice, altogether valuing 67-68 coins[86]. Another source from Qianlong 18 (1753) shows, that a mint craftsman in Guangxi received 75 coins per day.[87] It can be again assumed, that the situation in the Baochuanju was similar.

The furnace-heads could earn good money from their work in the mints. It was said in a folk poem with the name "Bamboo Poem" (*zhuzhici* 竹枝詞) from 1805 in Chengdu, that "owning gardens, pavilions, flourishing flowers and bamboos at home, all the furnace-heads have advantageous positions" (家有園亭花竹盛，個個爐頭走上風)[88]. However, the poem continued with "but at present they are all just miserable worms!" (而今都是可憐蟲). The poem was made around 1805, just after the temporary suspension of the Baochuanju, which shows that the furnace-heads were able to experience quick fortune as well as a quick decline into poverty according to the operation of the mint.

4.4.4.2 Payment for mint officials and stationary

Besides the craftsmen, the payment for the mint officials and stationary has to be considered. The listing below shows the payments for them[89]:

[86] QL-SCTZ, chap. 15b. RM, 2.171.13578.1

[87] RM, 2.171.13578.1

[88] *Chengdu zhuzhici*, p. 55.

[89] Based on the following sources: RM, 2.170.13362.13; 2.174.13991.7; 2.201.17843.3.

Table 34: Payment for mint officials and stationary

Personnel	Number (1732-1754)	Number (1754)	Monthly Payment per person
Store Official	1	1	5 strings of coins (i.e., 5,000 coins)
Inspecting Official	1	1	5 strings of coins (i.e., 5,000 coins)
Secretary-clerks	4	8	800 coins
Inspecting-clerks	4	8	800 coins
Runners	4	8	800 coins
Night watchmen	4	4	800 coins

4.4.4.3 Public expenses

The last part of the cost consisted in so-called public expenses. They included the fees for the worship of the Furnace God (*lushen* 爐神) and daily cost for oil-lamps, paper, brush pens, ink and so on. For every quarter of a year 75 strings of coins were calculated for these purposes.

The above mentioned three types of costs together were paid from the regular cast coins from the old furnaces[90]. Together with the funds paid for the procurement of the mint metal, the overall cost of casting coins can thus be calculated:

Overall casting cost = metal procurement cost ÷ actual remaining coins (newly cast coins – three types of costs).[91] Following this calculation, the cost was ca. 0.75 tael of silver for one string of coins.[92]

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90 RM, 2.201.17843.3.

91 RM, 2.175.14120.12.

92 RM, 2.175.14120.12.

4.5 *Coin Development*

4.5.1 *Metal alloy*

In chapter 4.3. (mint metal procurement) it has already been mentioned, that there are up to four types of mint metal which form the alloy used for coinage: copper, zinc, lead and tin. The reason of using these four materials are explained clearly in Peng Zunsi 彭遵泗's book *Shu gu* 蜀故 (The past of Sichuan):

"Casting coins is based on copper, zinc and lead are mixed in and plate tin is added. Because of the brittle character of zinc, when it is mixed into the copper, the coins will be easily broken when beaten, so that the illegal melting by wicked people can be avoided. Lead has a character of spreading as well as a heavy weight, which makes copper unable to be separated out once they mix together, thus it can also help to prevent illegal melting. The plate tin is soft, which is expected to make the coin alloy shiny and bright. By combining soft and hard metal, it can prevent illegal melting to separate the copper."[93]

The proportions of these four metals in the coin alloy experienced many changes. For the coins cast by the Baochuanju it went through the following ones shown in Table 35:

Table 35: Metal proportions in the coin alloy, 1732-1882

Years	Years (reign period)	Copper	Zinc	Lead	Tin
1732	YZ10	50%	41.5%	8.5%	-
1733-1735		YZ11-13		unknown	
1736-1741	QL1-QL6	50%	50%	-	-

[93] *Shu gu*, chap. 4. 鼓鑄配料.

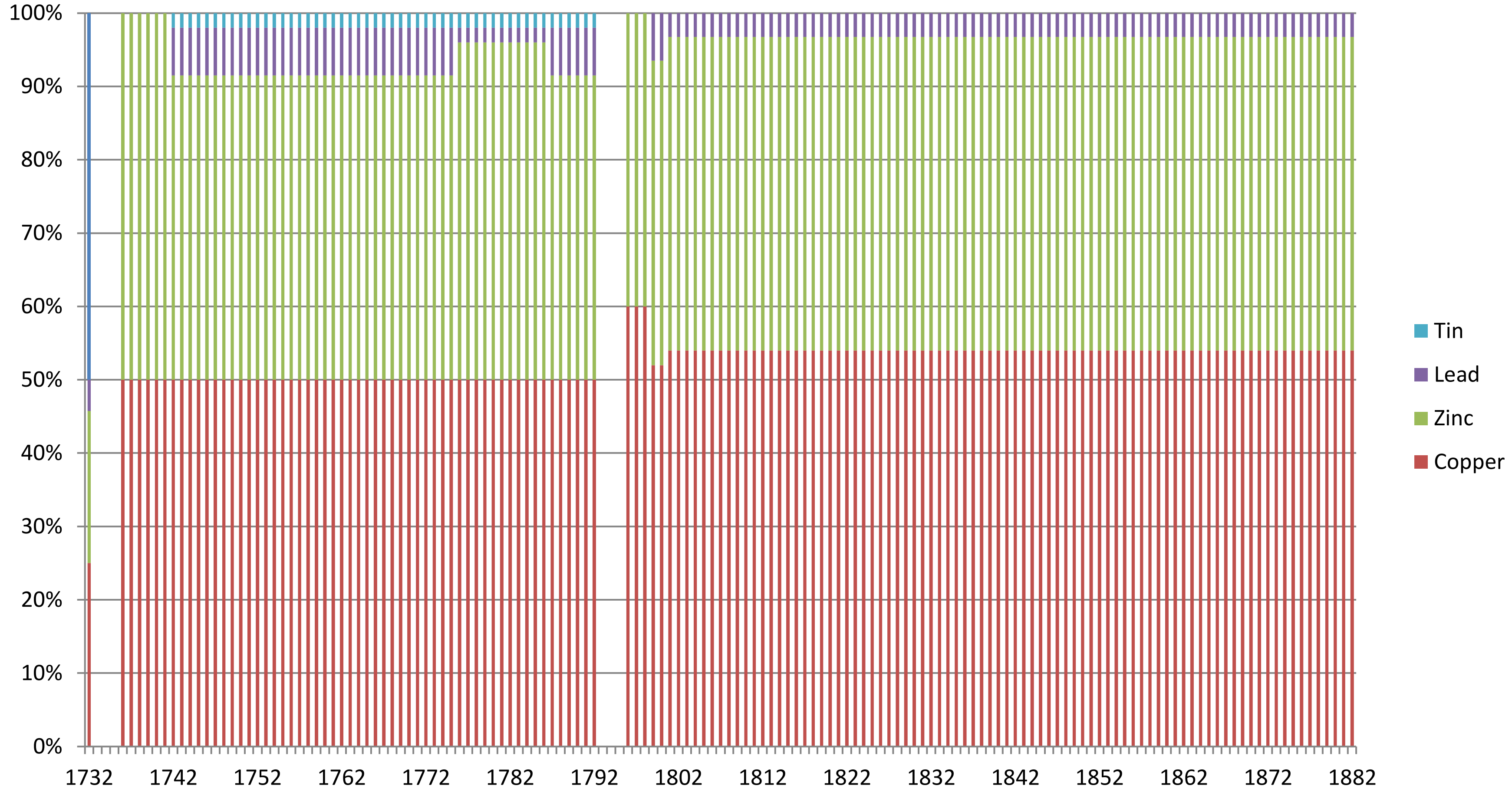
1742-1774	QL7-QL39	50%	41.5%	6.5%	2%[94]
1775	QL40	50%	41.5%	6.5%	2%
		50%	45%	3%	2%
		50%	46%	2%	2%
1776-1786	QL41-QL51	50%	46%	2%	2%
1787	QL52	50%	41.5%	6.5%	2%
		50%	43.7%	4.2%	2.1%
1788-1792	QL53-QL57	50%	41.5%	6.5%	2%
1793-1795		QL58-QL59		no casting	
1796-1798	JQ1-JQ3	60%	40%	-	-
1799-1800	JQ4-JQ5	52%	41.5%	6.5%	-
1801-1882	JQ6-GX8	54%	42.75%	3.25%	-

These proportions are visualised in Graph 33.

Sometimes the proportion change marked a big step after a long discussion, for example, to change “yellow cash” (*huangqian* 黃錢) into “green cash” (*qingqian* 青錢) in 1742. The difference between them two consisted mainly in the adding of tin. Tin did not only make the latter gain a greenish colour, but also prevented illegal melting down of

[94] Since 1749 Diantong 點銅 was replaced by Banxi 錫板 and later by Luxi 爐錫 in 1764, a little more tin was needed to match with the same amount of copper, zinc and lead. However, the proportion almost did not change.

Graph 33: Metal proportions in the coin alloy, 1732-1882



coins to obtain copper[95]. Sometimes other changes were not of such a fundamental character but were just carried out because of the available storage of mint metal at that time, as for example in the case of 1787.[96]

4.5.2 *Coin weight*

The official coin weights changed frequently during the early Qing time[97]. Since 1734 the standard weight of coin was defined as 1 *qian* 2 *fen* (ca. 4.4g)[98]. In fact, reducing the coins weight in order to make more profit was common, especially in the later periods.

In the Xianfeng reign-period (1851-1861), the Taiping rebellion (1854) had a significant influence on the coinage of the Qing. The principle effect was to increase the demand for coins to pay the army and at the same time to cut off the supply routes from the copper mines, leading to a great shortage of copper for minting. As a result, large coins (*daqian* 大錢) with high nominal values, iron coins, zinc coins and paper money were all introduced within a couple of years.[99]

According to the routine memorials, besides regular coin production, the Chengdu mint at least also cast 12 *mao* of "value ten large coins" (*dang shi daqian* 當十大錢) in 1858 and 1859, each weighing 4.4 *qian* (ca. 16g). The official exchange rate was one string "value ten large coins" could be exchanged into five tael of silver.[100] Although it is not mentioned in any record of the routine memorials, the Chengdu mint also must have cast "value fifty" and "value one hundred" large coins as well.[101]

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[95] Wang Xianguo (2006), pp. 9-15.

[96] NGDK, 095994-001.

[97] See QCWXTK, chap. 13.

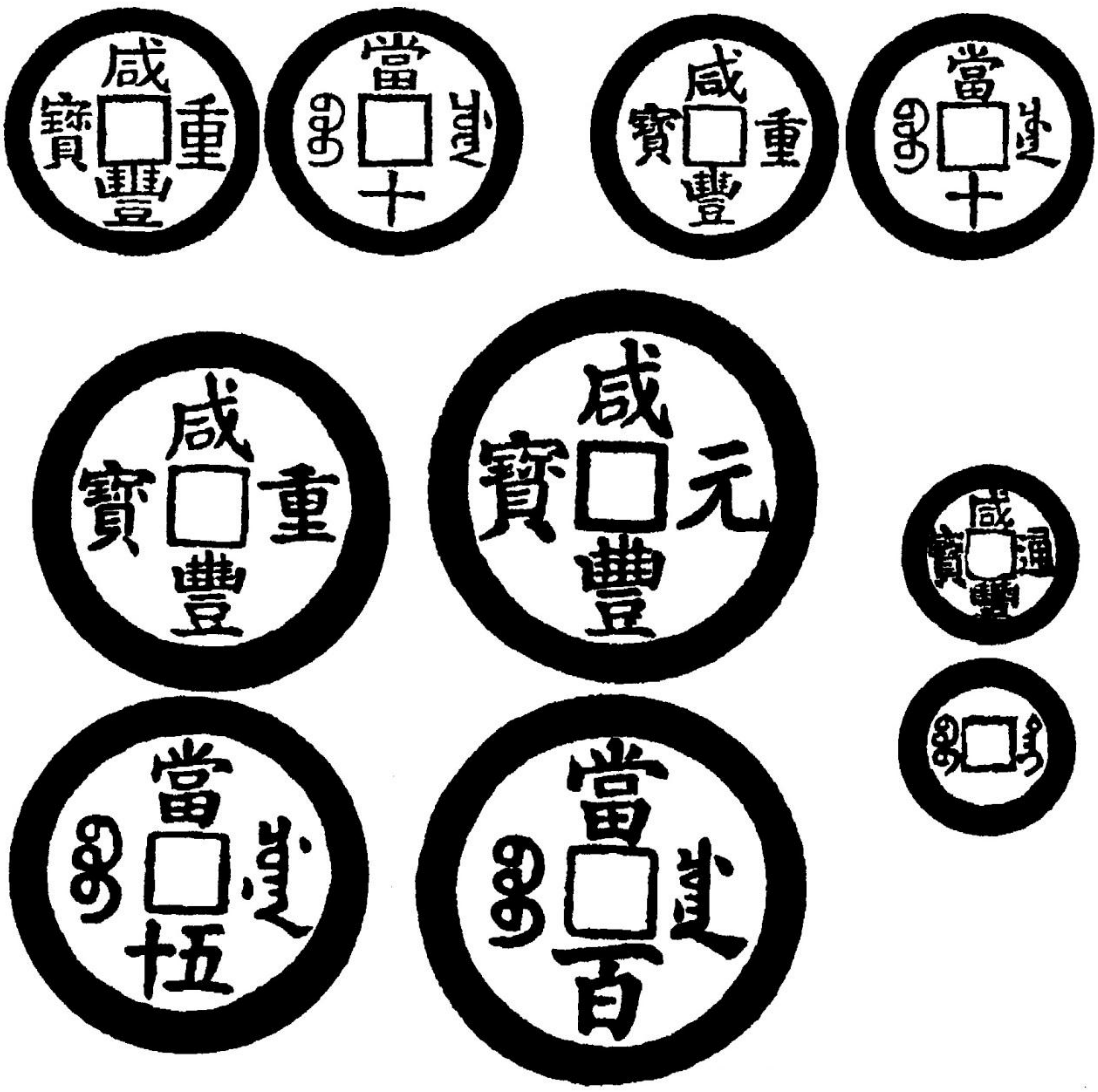
[98] QCWXTK, chap. 15, p. 28.

[99] Hartill (2005), p. 333.

[100] See RM, XF9/5/24, XF10/12/16, TZ1/2/5.

[101] Hartill (2005), p. 375.

Figure 12: Examples of *daqian* 大錢 from Baochuanju, Xianfeng reign-period[102]



[102] Hartill (2005), p. 375.

4.6 *Coin disposal*

After paying the above mentioned three types of costs including the craftsmen, the mint personnel and the public expenses, the rest of the cast coins in Baochuanju mint would be divided into the following five categories:

- maintenance of furnaces and other facilities
- provision for other provinces, especially Shaanxi and Gansu
- payments for civil officials and underlings
- payments for military officers and soldiers
- exchange into silver

After coins in the last category had been exchanged into silver, they could again be divided for different types of disposal, e.g. public works like city wall repairing or the awarding military officers and soldiers in different situations.

Interestingly, different disposals of cash were arranged in accordance to the different categories of casting. Thus from here on, the situation of cash disposals will be introduced according to the division of casting categories, which are "standard casting" (*zhengzhu* 正鑄), added casting (*jiazhu* 加鑄), and three types of "attached casting" (*daizhu* 帶鑄).

4.6.1 *Cash obtained from standard casting*

As already introduced in chapter 4.1.4, standard casting was carried out by the thirty old furnaces. In ordinary years, the quantity of cast coins under this category was 145,600 *chuan* (strings). After paying the craftsmen, personnel, and public expenses, 124,744 *chuan* and 144 *wen* should be left. Theoretically the mint metal procurement in terms of coins, including purchase costs and transport costs were paid first, the rest served three types of disposals:

The first type of disposal was to occasionally repair the mint facilities, such as furnaces and buildings[103]. The records show that this type of disposal appeared in the following years[104]:

Table 36: Cash disposals for the repairing of mint facilities, 1739-1754

Year	Purpose	Quantity
QL 4 (1739)	Repairing the 28 rooms for the west seven furnaces	95 *chuan* 285 *wen*
QL 5 (1740)	Repairing the "Big Hall", "Second Hall", west and east storages, wing rooms, and furnace rooms	221 *chuan* 931 *wen*
QL 8 (1743)	Repairing the walls for the west seven furnaces	80 *chuan* 428 *wen*
QL 19 (1754)	Repairing the re-opened seven furnaces	86 *chuan* 132 *wen*

The second type of disposal was a temporary activity, too, namely twice the provision for Shaanxi province in 1750 and 1751.[105] Due to a lack of copper and the high price of cash in this province, it was required from Sichuan to send 31,216 *chuan* and 636 *wen* of cash annually, which was half of the entire yearly output minus the casting cost in the Baochuanju.[106] The regulation of this transferring cash was suggested by Xu Qi 徐杞, the governor of Shaanxi, in 1747. According to his proposal the price Shaanxi had to pay for one string of cash from Sichuan was ca. 0.75 tael of silver, exactly equalling the production cost.[107] The total amount of these coins was divided into four parts, in each quarter of a year 7802 *chuan* 659 *wen* were delivered. The convoy from Chengdu to

[103] However, the repairing project which took place in QL 31 (1766) used the coins under another category, i.e. "attached cast which used remained mint metal in the mint" (*jucun yingyu tongqian daizhuqian* 局存盈餘銅鉛帶鑄錢). See NGDK, 080011-001.

[104] Sources: RM, 2.170.13362.13, 2.171.13578.7, 2.174.13991.7, and 2.180.14974.12.

[105] See RM, 2.178.14608.2 and 2.178.14692.4.

[106] See RM, 2.175.14120.12.

[107] See chap. 4.4.4.

Xi'an, the provincial capital of Shaanxi, needed to cross 2,300 *li* (ca. 1325 km) of land way and was planned to take 48 days, of which 20 days were admitted to stay in Chengdu and to wait for the cash to be prepared. One official was employed to escort the convoy and six runners were at his service. The transport fund for each convoy was 1921.4 tael. The calculation shows that the cast and transport together made the cost of cash for Shaanxi 0.994 tael per string[108]. However, the execution could not be carried out as well as it was planned. Due to the high cost the difficulties of transport and probably also the security reasons, Yinjishan 尹繼善, the General Governor of Sichuan and Shaanxi, suggested to stop the cash provision immediately, but to appropriate 250,000 *jin* of copper instead to Shaanxi by water and to let the cash be cast there[109], by doing so, the cost of one string of cash could be reduced from more than one tael of silver to about 0.9 tael.[110]

The third type of disposal appeared in the routine memorials since 1781. This was the use as payment for civil officials and underlings as well as military officers and soldiers. The coins allocated to this type of disposal were again clearly categorized into five parts:

- "cash for nourishing honesty of civil officials" (*wenguan yanglianqian* 文官養廉錢)
- "cash for nourishing honesty of military officers" (*wuzhi yanglianqian* 武職養廉錢)
- "cash for soldiers' payments" (*bingxiangqian* 兵餉錢)
- "cash for clerks on the provincial level" (*yuan si dao shuyi fanshiqian* 院司道書役飯食錢)
- "cash for clerks on the local level" (*ge fu ting zhou xian yayi minzhuang jingeng buwu gongshiqian* 各府廳州縣衙役民壯禁更捕仵工食錢), only from 1844 onwards.[111]

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[108] RM, 2.175.14120.12

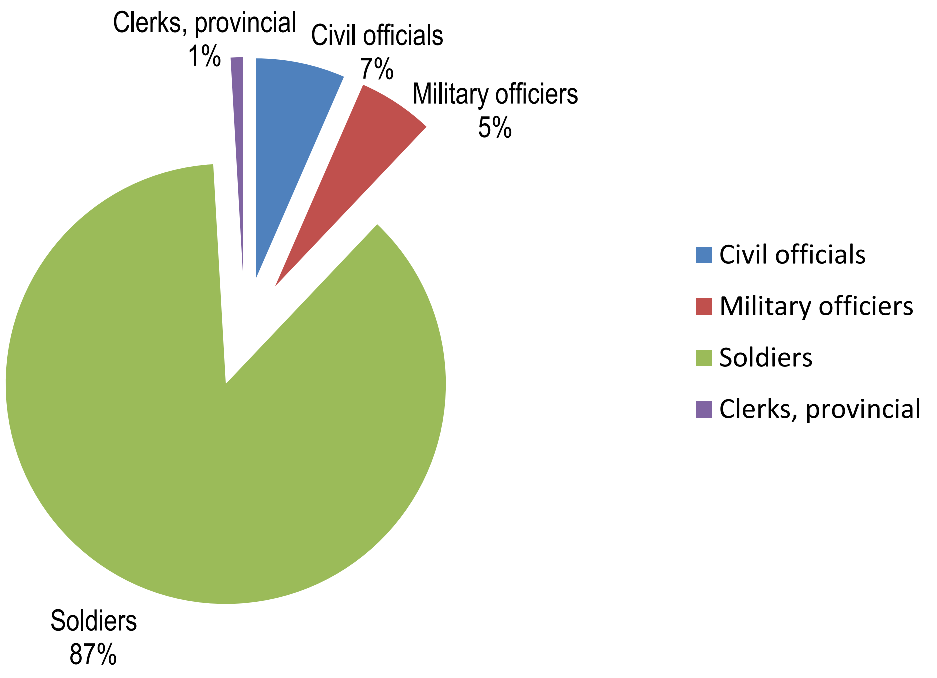
[109] QCWXTK, chap. 17, p. 12. See also chap. 2.4.3.1.

[110] RM, 2.179.14817.11.

[111] RM, 2.199.17543.3 and DG26/8/13.

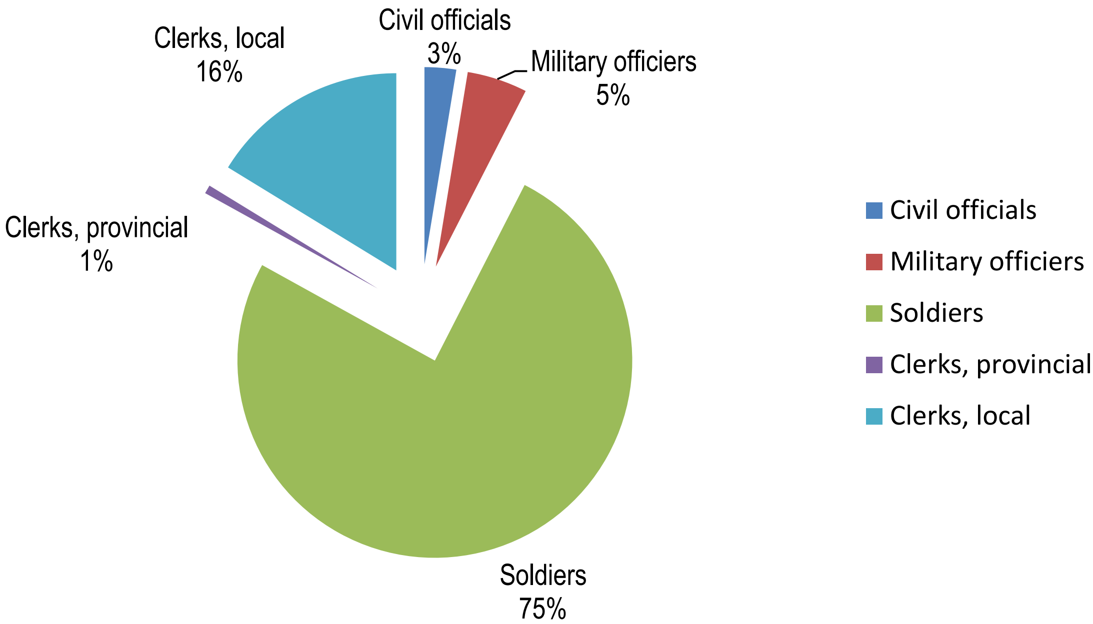
Between 1781 and 1843, the average amount of this type of disposal was 114,568 *chuan*, which amounted to 59% of the total annual coin output. The distribution during this time period can be displayed as below in Graph 34:

Graph 34: Distribution of standard casting, third type, 1781-1843



Since 1844, clerks on the local level also received their payments from this type of cash, which made the average amount increase to 124,585 *chuan* and 64% of the annual coin output. Certainly, the distribution proportions also changed.

Graph 35: Distribution of standard casting, third type, 1844-1882



4.6.2 *Cash obtained from added casting*

Added casting was in operation between 1756 and 1776. Its original purpose was to produce coins to provide capital for the repairing of the Chengdu city wall[112]. Its yearly production was also 145,600 *chuan*. After paying the craftsmen, personnel, and public expenses, 127,368 *chuan* and 50 *wen* were left. This entire amount was changed into silver at a fixed silver-coin exchange rate to pay the costs of mint metal procurement. Since 1755, the fixed governmental exchange rate for the Baochuanju mint was 950 coins per tael of silver while from 1767 onward it changed to 990 coins per tael of silver. The rest was saved for repairing the city walls of all the subjurisdictions of Sichuan. In this list the yearly profit of silver from added casting can be seen[113].

[112] See RM, 2.197.17298.4, also JQ-SCTZ, vol. 70, p. 14.

[113] Sources: RM, 2.182.15200.7, 2.184.15458.9, 2.184.15557.3, 2.185.15724.12, 2.186.15820.6, 2.187.15987.8, 2.188.16161.11, 2.188.16165.3, 2.189.16337.1, 2.189.16344.12, 2.191.16552.12, 2.192.16659.4, 2.193.16778.14, 2.193.16864.2, 2.196.17224.15, 2.197.17298.4.

Table 37: Profits from added casting in silver, 1756-1776

Year	Profit in silver (tael)
1756	67024.23
1757	unknown
1758	unknown
1759	unknown
1760	51958.66
1761	67072
1762	67070.68
1763	unknown
1764	64658.5
1765	unknown
1766	71044.04
1767	66445.85
1768	63724.73
1769	64513.91
1770	64530.04
1771	66514.63
1772	67063.56

1773	68224.91
1774	was not changed into silver
1775	was not changed into silver
1776	was not changed into silver

As intended, this amount of saved silver was in fact first use to cover the costs of repairing city walls. From 1757 to 1772, altogether more than 639,872 tael of silver were spent on the repairing of city walls in different subjurisdictions,[114] such as Xuyong Subprefecture 敘永廳[115], Cangxi District 蒼溪縣[116], etc. Later, when necessary, this silver was also used for other purposes. For example, in 1775, ca. 18,000 tael of saved silver were appropriated for awarding soldiers[117].

An exceptional case was the provision of Gansu province. In 1758 the Baochuanju was ordered to provide Gansu with 120,000 strings per year for free.[118] However, this operation did not last longer than two years. In 1760, it was already said that the cash price in Gansu had become so much normalised that only 25,263 strings were needed for this year and no additional strings in any later year.[119]

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114 RM, 2.191.16552.12

115 RM, 2.191.16552.12.

116 Cangxi 蒼溪 district got 1350.86 tael, see RM, 2.192.16659.4.

117 RM, 2.196.17224.15.

118 RM, QL25/8/6a.

119 RM 2.184.15458.9.

4.6.3 *Cash obtained from attached casting*

The third type was the "attached casting" (*daizhu* 帶鑄). In general, the purpose of this type of casting was to produce cash for awarding soldiers. As discussed in chapter 4.1.4., this type of casting consisted again in three different types

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4.6.3.1 Cash obtained from attached casting, first type

The first type was established in 1755 and served the aim of "drilling the barbarian garrison troops" (*caolian fantun* 操練番屯)[120], later this type of casting was simply called "awarding barbarians" (*shangfan* 賞番)[121]. "Barbarian garrison troops" (*fantun* 番屯) were garrisons established by the Qing government after the Jinchuan campaign in western Sichuan.[122]

This one *mao* of casting produced 12 133 *chuan* and 333 *wen* of cash annually. Minus the casting cost, 10 620 *chuan* and 804 *wen* were left and to be exchanged into silver. According to the official silver-cash exchange rate, the obtained silver was 11 179.79 tael before 1768 and 10 728 tael later. The obtained silver was first used to compensate its own mint metal procurement, the rest was saved to pay or award soldiers. At the beginning this profit was ca. 6000 tael per year.

The distribution of this silver underwent several changes after more and more proposals had been added in. In 1757 a more detailed plan about the disposals of this silver was issued:

Firstly it was used for drilling the soldiers in barbarian garrisons, these expenses included rations (*kouliang* 口糧), rewards (*niujiu* 牛酒), boni (*huahong* 花紅), and the repairing of equipment. 3,987 tael of silver per year were employed for this purpose.

Secondly it was used for the so-called "salt and vegetable stipend"[123] (*yancaiyin* 鹽菜銀) of the petty officers and privates who guarded at Bawang 巴旺, Mashu 麻書, and Jiaoluosi 角洛寺. 259.2 tael of silver per year were reserved for this purpose. The

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120 RM, 2.181.15062.17.

121 NGDK, 076796-001.

122 Pan Honggang (1988), pp. 62-71.

123 Theobald (2009), p. 122.

rest would be saved for dealing with general barbarian affairs (*yiwu* 夷務) and moving garrison troops in the future[124].

In 1770, another two disposals were added: one was for local soldiers' (*tubing* 土兵) roast-flour (*chaomian* 炒麵)[125] and tea-leaves in Batang 巴塘 and Jiangka 江卡, the other was for weddings and funerals of soldiers of the Eight Banners (*baqi bingding hong bai ershi* 八旗兵丁紅白二事).[126]

Since 1787, the silver was also used for invalidity payments (*yangshan* 養贍) for the local soldiers in the Zagu 雜谷, Wuzhai 五寨[127], Zanla 儹拉 and 促侵 garrisons[128].

4.6.3.2 Cash obtained from attached casting, second and third type

"Awarding barbarians" casting solved the problem of awarding the soldiers in barbarian garrisons and the Eight Banners and thus offered a successful example. Since Sichuan province still faced the pressure of awarding soldiers in the system of the Green Standard Army (Lüying 綠營), it increased another two types of casting soon: one consisting in 2 *mao* since 1760, with the fund from the official pawn-office of the Chongqing Brigade 重慶鎮 and another one including only one *mao* since 1765, with the fund from the official pawn-office of the Chongkui Brigade 重夔鎮[129].

As in the case of the added casting and the attached casting of the first type, the production needed to first pay for its own mint metal procurement. However, different from all the other types of casting, these two types had to also pay for the tax and wastage parts of the mint metal[130], thus the profit was comparably lower. In general, the second

124 RM, 2.181.15062.17.

125 Theobald (2009), p.219

126 RM, 2.189.16344.13.

127 RM, 2.199.17543.5.

128 RM, 2.199.17633.21

129 See Chapter 4.5, coins distribution. Concerning borrowing fund from official pawn-office, see Li Jingping（1999), pp. 60-61.

130 RM, 2.186.15916.1

and third type together served the demand of awarding soldiers' weddings and funerals in Sichuan, which was 10,000 tael per year.[131]

Since Qianlong 47 (1782), the above mentioned awarding changed to be paid by the regular land tax (*diding zhengxiang* 地丁正項) and the profit of these two types of casting plus savings from the "awarding barbarians" casting were all used to pay for military officers' nourishing honesty (*wuzhi yanglian* 武職養廉).

4.6.4 *Cash obtained from the "overall check" casting*

The regulation concerning the "overall check" casting in the Baochuanju was established in Qianlong 18 (1753). The coins produced as a part of this casting had to be saved for the repairing of furnaces and mint buildings.[132] Once the saving was also used to contribute to the repairing of city walls.[133]

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[131] RM, 2.186.15916.1

[132] GZDQL, vol. 26, pp. 4-5.

[133] RM, 2.191.16552.12.

4.7 *Evaluation of the routine memorials as a source*

Chapters 3.3 to 3.6 are written mainly based on the routine memorials as a preliminary attempt to reconstruct the accounts and activities of a mint in Qing China, which is so far unprecedented in any other research. After these chapters, it can be concluded that routine memorials offer much more than just numbers.

The advantages of the routine memorials are e.g. that they are of a very large quantity and thus offer an astonishingly vast corpus of material to base on. Moreover they offer some very detailed and for the biggest part absolutely unique information on their respective subjects. With the support and consultation of other sources, much about the circumstances of craftsman work and administration in the mints can be learned. All these benefits are provided over an extraordinary long stretch of time covering more than 150 years without major interruptions.

Nonetheless there is a whole series of constraints and doubts which constantly need to be taken into account for research based on this source:

Firstly, it is in many places only preserved incompletely. For some years one or more reports are missing, which makes the reconstruction of complete sets of data difficult. The incompleteness of the Routine Memorials also encompasses the fact that e.g. about the important Board of Works mint (Baoyuanju 寶源局) only one report has survived and there is absolutely no information about the situation in Xinjiang, Tibet and Taiwan at all.

Another problem is the trustability of the reported data. Some entries only reflect the regulations instead of the reality. In the case of transportation for example, the documents only show the funds provided for transportation, but not the actual cost and the exchange rate of cash to silver given in the Routine Memorials did not change over 130 years. Even the Grand Secretariat questioned this exchange rate in Qianlong 48 (1782) and replied: “how come this province’s exchange rate does not increase nor decrease over more than ten years but always stays at 990 *wen*? Are there any abuses like faking reports or embezzling and skimping?”[134] Nobody answered. In fact, due to the too low price of cash in comparison to silver, exchange could not possibly have been carried out as planned.

[134] RM, 2.197.17298.3.

However, in the routine memorials, calculation still continues, cash was still changed into silver at the fixed rate and soldiers still got paid. Thus it is important to look especially at these places in the source with a critical eye. Routine memorials as a matter of fact had to follow a certain standard format and had to obey a certain reporting pattern. Finding problems and abuses easily should thus not be expected in this type of sources. However, it could also not be compiled as "routine" as a copy of the years before. But exactly this phenomenon became more and more visible as time went on. Especially since the Tongzhi reign-period (since 1862), reports from every year look increasingly similar, each of them only with some numbers slightly changed. During this time period thus the value of the source clearly diminishes.

5 CONCLUSION

When the Mint of Chengdu closed its gates ultimately in 1904 it had produced coins for 172 years almost without interruptions. For a good part of this time it was the most productive among China's provincial mints next only to the two central metropolitan mints in Beijing. In contrary to every other Chinese province for virtually all of this time, Sichuan province was able to cover the mint's demand in copper from the production of its own mines.

In contrary to China's biggest copper producing province, Yunnan, the government of Sichuan did not take finance and organization of its mining industry in its own hands but left it to private merchants. Due to this reason especially during the initial period of large-scale copper mining, a long phase of negotiation between state and private sector was necessary before a set of regulations could be established, which granted at the same time a stable level of coin production for the government and a profitable mine operation encouraging further investment for the merchants. The resulting model divided the produced copper into a share of tax copper, which had to be directly handed over to the government, a share which could be purchased by the government at a fixed price and a share which was free to be sold on the market at a variable price.

Sichuan's copper mines during the Qing period were all located in the south of the province, predominantly around the prefectures of Ningyuan and Jiading. As in other parts of China, mining and smelting were carried out with techniques, which had passed through a long historical development but were still rather primitive and inefficient from a present point of view. It was thus necessary to invest an enormous amount of human labour, partly under high danger for life and health of the workers as well as large quantities of fuel. In spite of these and many other difficulties, it was possible to produce up to 1,400 tons of copper annually. The findings from Sichuan thus confirm Peter Golas' analysis of the Chinese premodern mining history as producing relatively high amounts of metal with mostly rather unproductive and inefficient methods.[1]

Another major obstacle within the commodity chain of Sichuan's mint copper was posed by the extreme geographical conditions especially of the Liangshan region. Only for a relatively small stretch of the transport route from the mines to the mint, water transport was possible. For the longest part, porters and pack animals needed to carry the heavy load over steep and narrow mountain passes. Like for the copper production itself, for the organization of the copper transport the government relied on private structures as well and employed brokers who had to take responsibility for the transport costs and were only reimbursed according to a system of very limited governmental funds.

This constellation was one of the reasons for an entire series of occasional and established abuses and other violations of the valid regulations. Because funds especially for governmental copper purchase and transport were too low, for each of the steps it was only possible to function properly, if certain levels of institutionalized corruption and contraband trade were possible. These developments, however, never undermined the system as a whole to an extent that would have made it impossible to carry on, but rather worked as a tool that adjusted existing financial imbalances which could not be regulated otherwise.

Administrative difficulties were particularly obvious in the border areas between Sichuan and Yunnan like in the region of Huili, where institutions from both provinces competed over the copper yields and thus imposed a doubled pressure on the merchants. Although the entire copper mining region belonged administratively to Sichuan, the biggest part of it was located closer and in an easier reach of Kunming, the capital of Yunnan than of the capital of Sichuan in Chengdu. The observation of resulting conflicts over questions of administration, resource exploitation, and transport routes supports the ideas of William G. Skinner, who draws the line between his physiographic macroregions of the Upper Yangtze and Yunnan-Guizhou closer to the Dadu River inside of Sichuan than to the actual administrative border along the Jinsha River. Besides the spatial orientation, mutual influences between the copper mining industry at the one hand and

[1] Golas (1999), p.413f.

the concerned region at the other were numerous. Mining attracted immigrants, who in turn brought along knowledge and capital for investment. A flourishing copper mine was also without doubt a great source of prosperity for its owners and at least to a certain level a source of income for the local population.

Nonetheless, on the local level positive effects of mining were far less enduring than negative ones: large-scale immigration into regions with limited arable land not only stirred up land use conflicts between miners and peasants but also ethnic conflicts between Han Chinese and the indigenous population of the Yi. Especially these ethnic conflicts at times escalated so far, that mines and settlements were pillaged and destroyed; by the second half of the nineteenth century the Qing government even completely lost control over large parts of the Liangshan region. Furthermore deforestation around the mines lead to soil erosion impacting on the local landscape until the present day.

On the provincial level, however, benefits were certainly visible. The large amounts of cash cast from Sichuan's copper could be used in several fields of public finance but more importantly supported the development of commercialization in the regional economy of Sichuan. For the quantitative analysis and reconstruction of these amounts, the related documents in the Routine Memorials form a source with outstanding qualities. From their evaluation the growth and continuous expansion of the Baochuanju as an institution can be seen as well as the development of its casting activities. Because these documents not only include the quantities of cast coins but also of the procured mint metals, they allow a fairly precise reconstruction of Sichuan's production not only in raw copper but also in minor mint metals such as zinc, tin and lead.

Connecting the fields of mint metal mining on the one hand and cash production on the other with the Routine Memorials as a central source, this piece of research sees itself as an exemplary beginning of a possible series of studies based on the same materials, which could contribute substantially to a deepened understanding of monetary policy, market structures and state finance in China during a crucial period of her history.

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