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CRAFTSMEN AND SPECIALIST TROOPS IN EARLY MODERN CHINESE ARMIES

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This paper will analyze Chinese armies of the 17th and 18th centuries from the viewpoint of labor division. While most people interested in military history are aware that early armies consisted of infantry and cavalry troops, the position and identity of artillerymen and engineers are far less well known. Even in Europe, there were no formal artillery units until the late 18th century. In China, engineers and specialists often did not belong to the military corps, but were recruited according to need during campaigns. It will be shown what kind of work they had to do in the armies, how they were recruited, and how they were paid. Although the Qing government hailed the military achievements of the Banner cavalry, there is no doubt that without the support of specialists coming primarily from the private sector of economy, the victories of the mounted Banner armies could not have been achieved. The paper will focus on some outstanding examples and will, among other things, give a detailed account of the casting of cannons by craftsmen and the use of cannons by artillerymen as specialist troops.

Towards a definition of specialist troops

Why does an army need specialists and craftsmen? There are examples in history of armies that were totally independent of such personnel, like the Roman armies whose troops were trained to carry their luggage, repair their tent and weaponry, erect fortifications, and construct siege towers, crossbows, and catapults. They seemed to be all-round talents totally independent of specialists. This might have to do with the fact that by late Republican and Imperial Rome, the armies no longer consisted of peasants recruited for service, but of professionals.¹ As a shoemaker needs to know his profession, so a soldier is in need of basic knowledge about his weaponry. Yet if it comes to complex weapons like catapults or siege machines (including fire power artillery), the building of large fortresses, or even the construction of bridges, pontoons, boats, ships, or roads, the basic knowledge of the common soldier is not sufficient. There must be specialists in each army that know how to construct, build, and operate machines and how to destroy fortifications or assail cities.

Miners, sappers and gunners were such specialists in early modern armies and no army, whether in China or the West, could do without them. When looking at 18th century armies in Europe, the most surprising issue is that the artillery, today perceived as a very 'normal' unit, was still a corps of specialists, meaning tradesmen, not soldiers. Frederick the Great despised gunners as second-rate soldiers hardly fit for the society of the 'gentlemen' who officered the

¹ A very basic introduction into such specialist professions of the Roman army is given by Adrian Goldsworthy, *The Complete Roman Army*, London: Thames & Hudson (2003), pp. 145-149, 186-197.

other branches of the army, especially the cavalry units.² While the other members of the officer corps were often members of the aristocracy, artillerymen were looked down upon, not only in Prussia, but throughout Europe, and especially in France. In the same way, the rank-and-file gunners were normally not allowed to carry a musket like the elite troops of the infantry and cavalry. A qualified gunner, on the other hand, could be regarded as greatly superior to the enlisted men in the other arms of service because he knew how to operate complex weapons beyond the ability to handle a standard musket.³ The ordinary private artilleryman in Austria was the *Büchsenmeister* (master gunner), a fully trained technician who was supported by untrained infantrymen (*Handlanger*) providing the muscle. For this purpose, a regiment of artillery fusiliers was created in 1757. No foreigners were to be enlisted in this unit. The personnel received favored treatment and higher rates of pay (a skill premium). Literacy was essential. During battle, artillery companies were detached as batteries for the support of various infantry or cavalry units and by no means fought as a coherent unit.

While the age of absolutism is commonly called the age of fortifications and sieges, necessitating the use of siege artillery with mortars and heavy cannons, there was in fact also a need for mobile field artillery.⁴ Siege became less important during the 18th century, and with the Napoleonic wars artillery units became common in all European states. This development had begun a little bit earlier in France and Austria with Jean Baptiste de Gribeauval's (1715 – 1789) general reform and standardization of the artillery. Barrels and carriages were redesigned to reduce weight and increase mobility. Additionally, the so-called horse artillery was created, small and very mobile units staffed with mounted gunners. The importance of artillery can be seen in its pure number: In Austria, the number of field guns rose from 203 in 1756 to 1,257 in 1805.⁵ By the end of the Napoleonic wars, a standard European army consisted of three branches: infantry, cavalry, and artillery, which was often grouped into corps operating independently from the supreme commander.⁶ The personnel for the artillery units was educated in specialized academies and had classes in arithmetic, geometry, advanced maths, mechanics and ballistics, topography and surveying, tactics,

² Philip Haythornthwaite, *Frederick the Great's Army: 3 Specialist Troops*, London: Osprey (1992), p. 3.

³ Philip Haythornthwaite, *The Austrian Army 1740-80: 3 Specialist Troops*, London: Osprey (1995), p. 3.

⁴ Geoffrey Parker, *The Cambridge Illustrated History of Warfare: The Triumph of the West*, Cambridge: Cambridge University Press (1995), p. 168, mentions the common conception of the warfare of that age as 'revolv[ing] around sieges, not battles'.

⁵ David Hollins, *Austrian Napoleonic Artillery 1792-1815*, London: Osprey (2003), p. 4.

⁶ Parker, *Illustrated History*, p. 198.

logistics, staff, and adjutant work. The artillery officers were some of the most intelligent men of the whole army.⁷

Engineers were needed for the construction of fortresses. Starting in the early 17th century, European history of thought clearly differentiated between the architect and engineer. While the architect was more of a civilian – and a man of spirit and the arts – the engineer was a ‘child of Mars’ and dedicated his work to usefulness instead of creativity. The construction of fortifications is subject to the possibilities and needs of the artillery; it is an applied science of mathematics, and especially of geometry. The origins of the *architectura militaris* are to be found in Italy (with the star fort or *trace italienne* as its apogee under the Ancien Régime). In France, the title of engineer was tied to the king, emphasizing his important function in strategy. An engineer was to be better educated than a civilian architect. Besides being knowledgeable in construction, he had to be an expert in military affairs, especially in ballistics.⁸

In the 18th century, more emphasis was placed on temporary field fortifications and the outworks of already existing fortresses. The Prussian corps of engineers was relatively small and scattered over the various fortresses. In 1742 a pioneer regiment was founded, composed of sappers and miners. The troops were recruited from civilian miners.⁹ In Austria, there was an engineer academy to train the officers of the engineer corps. Each infantry regiment had a platoon of sappers, and a sapper corps was established in 1760. The miners were originally part of the artillery units and united into a small miner brigade in 1763, but transferred to the engineers in 1772. A pioneer battalion was established in 1758 with the duty to clear roads and erect bridges. These specialist units included not only experts in their own field, but also those of other professions, such as surgeons, fouriers, and chasseurs. Austria also had two companies of pontoneers managing 100 wooden and metal pontoons each at its disposal.¹⁰

Foresters and huntsmen were employed as *Jägers* (‘hunters’) and mainly entrusted with skirmishing. The Border corps of Austria also had two companies of sharpshooters. Light troops or hussars, often composed of people from the border nations, such as Pandours or Croats, served as independently operating support for the normal infantry. Frederick also despised these kinds of Austrian troops, because they allegedly lacked bravery and discipline.

⁷ Hollins, *Austrian Napoleonic Artillery*, p. 11.

⁸ Hartwig Neumann, *Festungsbau-Kunst und -Technik: Deutsche Wehrbauarchitektur vom XV. bis XX. Jahrhundert*, Augsburg: Bechtermünz/Weltbild (2000 [1988¹]), pp. 146-149.

⁹ Haythornthwaite, *Frederick the Great's Army*, p. 10.

¹⁰ Haythornthwaite, *The Austrian Army*, pp. 9-12.

General staff, medical services, transport, and the commissariat, as well as the *Freikorps* (privately organized units), can also be seen as specialist troops, not to forget the ‘second arms,’ the Navy.

In summary, specialist troops were engaged in the operation of military activities that required extraordinary knowledge and a different mode of fighting. They were deployed for the support of regular troops in field battle (cannoneer units), during siege (bombardiers, miners, sappers), on the way to the battlefield and back (engineers, pioneers, pontoneers), after the battle (medical services), or for the organization of the campaign itself (general staff, commissariat and transport).

I have made this excursion to show what we know about specialist troops in Western armies. By comparing this information with contemporary China, we will see that there were in fact similar concepts, but with different preferences. Unfortunately, an equivalent to the abundant treasure of written and visual sources we have at our disposal to study warfare in the West cannot be found for China. There are very few illustrations of warfare or warriors before the 19th century, and there are virtually no technical descriptions of the skills a gunner needed. Therefore, we must rely on administrative regulations and official chronicles and archival documents to gather information about specialist troops supporting the army.

While specialist troops (including physicians and chaplains) were a regular part of the army, the military also needed civilian specialists who were hired just for the duration of the campaign. Craftsmen were specialized persons serving the army in their field of knowledge during a campaign, from bakers to carpenters and miners. Craftsmen who were ordered to produce uniforms, tents, muskets, or gunpowder in peacetime will not be considered here, nor will the people doing unskilled labor for the army, like drivers or porters.

Specialist troops among the Banner units

First, we will look at the composition of the troops of Qing China, as reflected in the regulations for the fixed numbers (*ding'e* 定額) of troops in the various garrisons and units provided by the *Qingchao huidian zeli* 清朝會典則例, a collection of administrative regulations for the Qing state, in order to gain an impression of what types of specialist troops existed in the traditional¹¹ army of Qing China. This is much easier for the Banner troops (*baqibing* 八旗兵, *Manbing* 滿兵) than for the common Green Standard troops (*lüyingbing* 綠營兵, *Hanbing* 漢兵). Among the Banner troops garrisoned in the Capital, three units can be

¹¹ ‘Traditional’ means, before the creation of the new local militia during the mid-nineteenth century.

called specialist troops, namely the Firearms Brigade (*huoqiying* 火器營), the Scouting Brigade (*jianruiying* 健銳營) and the Vanguard Brigade (*qianfengying* 前鋒營). The specialization of the last two was rather in tactics and function than in their instruments of fighting.

The provincial Banner troops had the following specialists mentioned in the *Baqi tongzhi* 八旗通志,¹² the official statutes of the Eight Banners, at their disposal:

1) Artillery specialists

- Artillery regimental commander (*huo[qi]ying canling* 火[器]營參領): 1 person in Qiqihar 齊齊哈爾. Interestingly enough, this commander did not directly command any gunners, but only not further specified troops (*bing*) of Manchus, Soluns, Dagurs, Barhus, and Chinese. It might be that this regimental commander was dispatched from the Capital artillery regiment.
- Artillerymen (*pao xiaoji* 礮驍騎):¹³ 672 in provincial garrisons in China proper (not Manchuria).
- Gunners (*paoshou* 礮手): 237 in provincial garrisons in China proper (not Manchuria). The titles *pao xiaoji* and *paoshou* seem to refer to the same task, because they never both appear in the same garrison.¹⁴ The *paoshou*, nevertheless, appears to have occupied a lower position.¹⁵

There were thus in total 909 gunners in the provincial Banner garrisons, at least nominally.

2) Musketry specialists

- Musketry regimental commander (*niaoqiangying canling* 鳥槍營參領): 1 person in Ula 烏拉, Jilin. This person commanded 48 musketry officers (*niaoqiang lingcui* 鳥槍領催) and 626 musketeers (*niaoqiang xiaoji*).
- Manchu and Mongol vanguard musketry [officers] (*Manchu Menggu niaoqiang qianfeng [xiaoji?]* 滿洲蒙古鳥槍前鋒[驍騎]): 12 men. These persons are only mentioned among the staff of the garrison of Dezhou 德州, Shandong. They belonged to the imperial bordered and plain yellow Banners and commanded 188 musketeers (*niaoqiang xiaoji*).

¹² *Baqi tongzhi* 八旗通志, Changchun: Jilin wenshi chubanshe (2002), fascicles 32-35.

¹³ Charles O. Hucker, *A Dictionary of Official Titles in Imperial China*, Stanford: Stanford University Press (1985), has not translated the term *xiaoji* as a separate rank. In the Capital and the Northeastern provinces, *xiaoji* seemed to be a kind of elite cavalryman, but still a common soldier, not an officer.

¹⁴ The garrisons staffed with *paoshou* were located in Fujian, Guangdong, Shaanxi, and Gansu. This might hint to a peripheral status of these provinces. There were no gunners at all in Shandong and Jehol.

¹⁵ The subordinates of *xiaojixiao* 'lieutenants' are either called *xiaoji*, like in the *Baqi tongzhi*, or *bingding* 兵丁 'common troops', like in the listings in the war expenditures code *Junxu zeli* 軍需則例, in: *Xuxiu siku quanshu* 續修四庫全書, Shanghai: Shanghai guji chubanshe (2002), vol. 857.

- Musketry officers (*niaoqiang lingcui*):¹⁶ To be found in the provincial Banner garrisons in China proper, with a total number of 314. Musketeer units are to be found in the garrisons of Shanxi, Henan, Zhejiang, Hubei, and Gansu, reinforced by the 48 musketry officers in Ula, Jilin. In some places, the ethnic origin (Manchu, Mongol, Chinese) is specified.
- Mounted musketeers (*niaoqiang xiaoji* 鳥槍驍騎): Most musketeers, totaling 4,084, were commanded by the officers just mentioned (except the vanguard officers in Dezhou). There are two exceptions, namely 680 musketeers in the garrisons of Haiguan 海關 and Miyun 密雲, Zhili, that seem to have been incorporated into the non-musketeer platoons, with no special musketry officer commanding them.
- Musketry men (*niaoqiang bing* 鳥槍兵): 200 troops. They are only to be found in the garrison of Fuzhou, and were directly commanded by non-musketry officers. Like with the *paoshou* gunners, it seems that the *niaoqiang bing* had a lower status than the *niaoqiang xiaoji*.
- Infantry musketeers (*niaoqiang bubing* 鳥槍步兵): 400 men in Ningxia 寧夏, Gansu, commanded by non-musketry officers. The special mention of the term ‘infantry’ suggests that Banner musketeers normally disposed of a horse and were mounted musketeers.¹⁷

3) Naval specialists

- Supervisor-in-chief of the naval forces (*shuishiyong zongguan* 水師營總管): 1 person, in Qiqihar, Heilongjiang.
- Assistant commandants of the naval forces (*shuishiyong xieling* 水師營協領): 3 persons, in Lüshun 旅順, Shengjing (modern Liaoning), Fuzhou, and Guangzhou.
- Company commanders (*shuishizing zuoling* 水師營佐領), lieutenants (*shuishiyong xiaojixiao* 水師營驍騎校), and platoon commanders of the naval forces (*shuishiyong fangyu* 水師營防禦): These officers commanded the naval forces in Jilin, Heilongjiang, Fujian, and Guangdong.
- Overseers of dockyards (*chuanchang guanli zaochuan guan* 船廠管理造船官): These officials were actually not military personnel and are therefore only referred to with their

¹⁶ The *lingcui* is commonly regarded as a kind of NCO, or ‘corporal’. H[ippolit] S[emenovich] Brunnert and V. V. Hagemstrom, *Present Day Political Organization of China*, London: Kelly and Walsh (1912), p. 326. Yet because these persons do not have a superior in the garrisons, they must be considered officers.

¹⁷ Compare the characters for the Banner rank *xiaoji* 驍騎 that are written with the horse radical 馬. This word appears in the Former Han period (206 BCE – 18 CE) and is explained as ‘fierce rider’, cf. Luo Zhufeng 羅竹風 (ed.), *Hanyu da cidian* 漢語大詞典, Beijing: Hanyu da cidian chubanshe (1993), vol. 12, p. 882. The Manchurian counterpart of this term is *aliha cooha*, meaning ‘Manchu or Mongolian cavalryman’, cf. Jerry Norman, *A Concise Manchu-English Lexicon*, Seattle: University of Washington Press (1978), p. 14.

official rank (like *sipin* 四品 ‘4th rank,’ *wupin* 五品 ‘5th rank,’ etc.). They were nominally garrisoned in Qiqihar but were responsible for dockyards in the province of Jilin.

- Shipmen or mariners (*shuishou* 水手) were to be found in more places than those just mentioned. Just like the musketeers not commanded by a musketry officer, these seamen or ‘rivermen’ were apparently commanded by cavalry officers. This is true for the nominal 1,929 seamen in the various garrisons in Jilin and Heilongjiang, but also in Zhapu 乍浦, Zhejiang, as well as in Fuzhou, and Guangzhou. The 60 seamen in Lüshun were commanded by 50 officers or NCOs (non-commissioned officers, *lingcui*), which is quite a surprising ratio and shows that it is difficult to generally translate *lingcui* as ‘NCO,’ ‘officer,’ or ‘common soldier.’ In this case they seem to belong more to the lower ranks.

4) Scribes and clerks

Although scribes cannot be considered ‘troops’ because they do not fight (sappers or miners also do not fight directly against the enemy), they were of great importance for the administration of their garrison and the organization of warfare. They were experts in accounting and all the paper bureaucracy needed to exchange information between commanders, the general staff and the central government, and during the march to the front, when the troops were to be equipped with the necessary food and transport tools, and they had to care for the supplies in the camp. The omnipresence of scribes (Manchu *bithesi*, Chinese translit. *bitieshi* 筆帖式) in the official and archival documents demonstrates that the army could not do without them. The post of *bithesi* was a kind of lower official rank that is mentioned in the biographies of many high officers and therefore often seems to have been a kind of trainee position to learn about the organization of a campaign, before being promoted to the post of a ‘fighting’ officer.

Nearly all registers and lists of military staff mention scribes among the officers, and the officers are never without scribes. Their official rank ranged from 7 to 9. In many cases their role seems to have been that of a quartermaster or that of an accountant, as the following titles show: A *yinwu bithesi* 印務筆帖式 or *suiyin bithesi* 隨印筆帖式 controlled the seals, a *dangfang bithesi* 檔房筆帖式 took care of the garrison archive, a *lixing bithesi* 理刑筆帖式 was entrusted with penal matters, the *yinku bithesi* 銀庫筆帖式 with the funds of the garrison, and a *cang bithesi* 倉筆帖式, *taizhan bithesi* 臺站筆帖式, or *juntai bithesi* 軍臺筆帖式 with the provisions and the logistics. There were also translators, the *fanyi bithesi* 繙譯筆帖式.

Other types of specialist troops did not exist. Unfortunately, similar information cannot be obtained so easily for the Green Standard troops. Therefore, it is difficult to estimate how

great a proportion of the troops used muskets, or of how many cannons all types of troops had. Such data have to be extracted from sources than the official regulations for the garrisons (*bingzhi* 兵制). The Green Standard garrisons of Xuanhua 宣化 and Datong 大同, Shanxi, for instance, were staffed with 1,000 gunners (*paoshou*).¹⁸

The information above show that there were, scattered across various places in the empire, artillery and musketry units that were sometimes commanded as separate units, and were sometimes integrated into other units. They operated as part of a corps and could be deployed whenever there was a need for such specialist troops.

A question I am still battling with is how many troops had muskets at their disposal. Looking at the directives in the *Baqi tongzhi*, it seems as if the elite Banner troops in the northeastern provinces did not make use of muskets at all, while up to 50 per cent of the troops of the banner garrisons in the central provinces were equipped with muskets (see table below), while all others only used bows and arrows. This raises the question which armament was that of specialists: Was it the muskets, a seemingly advanced but highly unreliable and imprecise weapon? Or was it the bow, which demanded much higher skill and greater bravery but had a better rate of hitting the target effectually, and was even an efficient weapon even when fired at full speed? Bows and arrows were extensively used in war, as can be seen in the copper plate engravings of the Qing wars produced in the 18th century, as well as in the accounting book of the second Jinchuan war (1771-1776), which states that almost 500,000 arrows were used in a five-year war,¹⁹ in contrast to 2,525,086 *jin* (1,507 metric tons) of lead for bullets and cannonballs.²⁰ Yet the use of muskets as a convenient and easy-to-manufacture weapon must have been so widespread at the end of the 18th century that one can no longer speak of musketeers as specialists. Even during the rebellion of Wu Sangui 吳三桂, contingents of 2,000 Green Standard musketeers seem to have been quite available.²¹

¹⁸ *Pingding Zhonggar fanglüe* 平定准噶爾方略, in: *Yingyin Wenyuange Siku quanshu* 影印文淵閣四庫全書, Taipei: Shangwu yinshuguan, 1986 (repr. by Shanghai: Shanghai guji chubanshe, 1987; oldest facsimile by Shanghai: Shangwu yinshuguan, 1934), vol. 357-359, *Zhengbian* 正編, fascicle 1 (QL 19/run4/yihai).

¹⁹ *Pingding Liang Jinchuan junxu li'an* 平定兩金川軍需例案, comp. by Zheng Qishan 鄭棲山, ed. by Xizang shehui kexue yuan 西藏社會科學院, in: *Xizangxue Hanwen wenxian huike* 西藏學漢文文獻彙刻, series 2, Beijing: Quanguo tushuguan wenxian suowei fuzhi zhongxin (1991), fascicle 2, fol. 185a.

²⁰ *Pingding Liang Jinchuan junxu li'an*, 2, fol. 184b. The figure above would result in a daily firing rate of more than 34,000 charges each and every day over a five-year period (with an average bullet calibre of 6.4 *qian* or 24 g). The use of no more than 273 arrows per day is also purely statistical and does not correspond to the real importance of bow and arrow in battle.

²¹ *Pingding sannu fanglüe* 平定三逆方略, in: *Yingyin Wenyuange Siku quanshu* 影印文淵閣四庫全書, Taipei: Shangwu yinshuguan, 1986 (repr. by Shanghai: Shanghai guji chubanshe, 1987; oldest facsimile by Shanghai: Shangwu yinshuguan, 1934), vol. 354, fascicle 42 (KX 17/12/yisi).

Permanently employed craftsmen among the Banner units

A lot of Banner garrisons had a fixed number of permanently employed craftsmen (*jiang* 匠) at their disposal. Most of them were entrusted with special tasks, but the regulations often merge them under the term *gong-jian-tong-tie jiang* 弓箭銅鐵匠, ‘craftsmen for bows, arrows, brass, and iron.’ In the Capital and the garrisons in the province of Shengjing, ironsmiths were prevalent, and no other craftsmen are mentioned at all. Their main task might have been producing horseshoes, arrowheads, and weapons. More detailed information is provided for some garrisons in Heilongjiang and some provincial garrisons in China proper. Bowmakers (*gongjiang* 弓匠) and arrowmakers (*jianjiang* 箭匠) were part of many provincial garrisons. Their high numbers show how important bows and arrows were as weapons, in contrast to muskets, which were still seen as special weapons in the early 18th century, at least ideologically. In the copper plate engravings of the great 18th century wars, therefore, bows and arrows are the most prevalent weapons of the Banner units, whose troops fought as mounted archers. Mounted musketeers are only seen among the Dzungars. Qing musketeers were exclusively infantrymen, at least in these illustrations.²²

	<i>Hangzhou</i>	<i>Fuzhou</i>	<i>Jingzhou</i>	<i>Chengdu</i>
<i>Gunners</i>	160	28	80	48
<i>Musketeers</i>	736	240	1824	
<i>Infantrymen</i>	322	320	700	256
<i>Craftsmen</i>	96	120	168	96
<i>Trainees</i>	128	220	400	144

Relations of different arms and functions in selected provincial Banner garrisons

A comparative table²³ shows how important a part the craftsmen played among the troops. In two garrisons in Gansu, Huining 惠寧 and Huiyuan 惠遠, the term *jiangyi* 匠役 is used, suggesting that these craftsmen were not permanently employed but recruited from among the local trades according to need. Yet in fact, the dated term *yi* 役 simply points at someone working for the government or an individual official (officer) belong to a government institution, like the *genyi* 跟役 ‘manservants’ allotted to each soldier and officer during war. Garrisons disposing of naval or fluvial personnel also employed boat-carpenters (*chuanjiang* 船匠).

²² A series of these copperplate engravings is to be found on <http://crossasia.org/digital/schlachten-bilder/index/english-start>, from the collection of the Berlin State Library, as well as in the private, yet scholarly, online collection ‘Battle of Qurman’, see <http://www.battle-of-qurman.com.cn/e/hist.htm>.

²³ The numbers do not include officers.

Artillery units in action

In the following part of the paper, I will examine the activities of the artillery units, as well as the types of cannon used by the Qing armies.

Artillery pieces in early and mid-Qing China were cast of iron or brass. Only a few military units possessed artillery weapons at all, and the most important of these was the Firearms Brigade (*huoqiying*) in the Capital. Uniaxial mountings, which Europe used for field artillery from the 16th century onwards at the latest, and which allowed the artillery units enormous mobility, were not totally unknown in China, but rather rare. Of the twenty-four types of cannon and howitzer presented in the picture volumes of the *Da-Qing huidian* 大清會典 ‘Collected statutes of the Great Qing,’ only seven were mounted uniaxially, most others biaxially.²⁴ Most barrels (*paotong* 砲筒) were installed on square biaxial carriages (*paoche* 砲車) with four often very small wheels, like in Western naval artillery, that did not allow long-range movement. These cannons were solely made for defense purposes in fortifications.

Light cannon types with a barrel weight of 100 *jin* (59 kilos) or so could be transported on the back of a mule or by two porters. Some heavier pieces could be carried by camels (therefore sometimes called ‘camel guns,’ *tuopao* 駝礮, or probably more generally ‘cannons carried by beasts’),²⁵ but for the heavy artillery, the only transport possibility was melting them down and recasting them near the front. This was the custom during three wars, namely the First and Second Jinchuan campaigns (1747 – 1749, 1771 – 1776) and the campaigns against Burma/Myanmar (1766 – 1770). There were also some types of cannon whose barrels consisted of pieces which could be screwed together (*jiujiapao* 九節砲), yet those cannons only had a very small caliber, and the construction could diminish the effect of the propellant gases.

Therefore, all materials for cannons and equipment, from gun metal to cleaning shovels, had to be procured in the home garrisons and be transported by porters or mules to the war theatre. Iron for cannonballs (*paozi* 炮子) and barrels was bought on the free market and was therefore called ‘merchant iron’ (*shangtie* 商鐵).²⁶ Brass and lead (for bullets) were often confiscated from among the metals earmarked for the provincial mints.²⁷

²⁴ *Da-Qing huidian tu* 大清會典圖, Taipei: Wenhai chubanshe (1992), fascicle 98, [fol. 18-22]; 100, [fol. 3-25].

²⁵ *Pingding Zhonggar fanglüe, Zhengbian*, fascicle 77 (QL 24/8/xinchou).

²⁶ *Pingding Liang Jinchuan junxu li'an*, 2, fol. 43a-b.

²⁷ *Pingding Liang Jinchuan fanglüe* 平定兩金川方略 (Military annals of the war against the two Jinchuan), in: *Yingyin Wenyuange Siku quanshu* 影印文淵閣四庫全書, Taipei: Shangwu yinshuguan, 1986 (repr. by Shanghai: Shanghai gu ji chu ban she, 1987; oldest facsimile by Shanghai: Shangwu yinshuguan, 1934), vol. 356, fascicle 48, fol. 18a-19a (QL 38/1/xinhai). *Pingding Liang Jinchuan junxu li'an*, 2, fol. 46a-46b.

When the materials necessary to cast the cannons arrived at the designated location, the commanding officer had to determine an adequate place to install a camp foundry (*suiying paoju* 遂營炮局, ‘cannon foundry following the camp’). Here, the furnaces were erected in which the metal was melted down and the cannons, howitzers, and cannonballs were cast. But casting was only part of the work. The casting molds were made of clay and sand and therefore gave the cannonballs and barrels only a very crude shape. In a workshop, all parts of the barrel could be processed correctly, especially the ‘soul’ inside the barrel, whose surface has to be as smooth as possible and fit the size of the cannonballs exactly in order to let as little of the propellant gas as possible escape. In the Jinchuan mountains, producing a high-quality soul in the artillery pieces was impossible. Therefore, the barrels had to be cast as ready-to-use pieces without a rifled bore, the cannonballs had to be adjusted to the concave diameter, and both—cannonballs and barrel—had to be made as smooth as possible. Regulations like the *Gongbu junqi zeli*, the Ministry of Works’ regulations for military equipment, and the *Da-Qing huidian tu* contain details concerning not only the exact dimensions of the particular types of guns, but also the weight of the projectiles and the amounts of gunpowder required. Thus, the quality of the guns cast on the spot cannot have been very high – the destructive force and range of the cannons were below the standard of the guns produced in the normal state workshops in the provincial capitals or the garrisons. Among the materials needed for casting cannons were tools like drill heads (*zuantou* 鑽頭), but barrels were cast with a hollow core (*paoxin* 炮心), without applying any drilling or rifling process, except probably boring the touchhole.²⁸

When cannons and ammunition were ready, they were transported to a battery platform that cannot have been very far from the furnaces, since the cannons were cast on-site because they were not easy to transport. As can be seen in the copper plate engravings, wheel-furnished mounts served to pull the guns to the batteries for just a short piece of way, where the road or a path could be made broad and even enough for the purpose. Yet there were also some barrels that were simply mounted on wooden balks. A device for adjusting the barrel to the target seems not to have existed in such constructions. The battery itself was protected by redoubts against shots and attacks of the rebels that would try to harass the gun crew while loading, cleaning, and adjusting. The dimensions of such a battery and its surrounding could be enormous, as some figures from written sources prove: For one battery, seven wooden redoubts had to be erected. Within the surroundings giving enough protection to the gunners and the other staff, the battery was erected with a dimension of six to seven *zhang* (about 20

²⁸ *Pingding Liang Jinchuan junxu li'an*, 2, fol. 64a.

meters).²⁹ As the cannon was meant to fire down from the battery platform, it must be assumed that the cited dimension corresponds to the height. Yet this would mean that the batteries were erected as a kind of ramp inclined along the slope of the hills just above the fortifications of the enemy. That the construction of such large platforms consumed time and manpower can be attested by several documents: Several thousand troops were used to erect wooden constructions and to pile up a battery platform.³⁰ For this purpose, trees were cut down to erect palisades for protection.³¹ The batteries ideally had to reach at least the same ground level as the fortification of the enemy.³² When the batteries were high enough, the enemy's hideouts would be easier to aim at. Other battery platforms were only two to three *zhang* high (about 8 meters),³³ or four to five *zhang* (about 14 meters).³⁴

Because of the inferior quality of the barrels, the range of fire cannot have been very impressive: According to several statements it was only the distance of an arrowshot, or even less.³⁵

The guns and howitzers proved most effective when placed above the target. This meant that the batteries often had to be erected on a mountain ridge and the cannons fired down on the enemy's war towers.³⁶ This made the transport of cannons even more difficult, but it also shows either that the imperial gunners did not know their job very well, or that the gunpowder and the cannons cast in the mountains were of really poor quality. Howitzers (*chongtianpao* 衝天砲) were rarely used in spite of the steep angle which made them, with their highly inclined parabolic trajectory, more effective in bombarding the enemy towers and trenches than cannons, with their less inclined trajectory.

There are many proofs that the quality of the guns was nothing to write home about: For example, the melting furnaces of the camp foundry were not allowed to be set up too near the battery. Bursting gun barrels seem to have been such a commonplace incidence that the generals took precautions to prevent too many soldiers or workers from being injured or killed by metal fragments. Once workers or porters had taken the cannonballs and gunpowder to the battery, they had to leave immediately and go back to the foundry.³⁷ The imperial artillery had a major problem: The cannons cast on the spot regularly exploded and caused damage to

²⁹ *Pingding Liang Jinchuan fanglüe*, 63, fol. 4a (QL 38/6/yiyou).

³⁰ *Pingding Liang Jinchuan fanglüe*, 19, fol. 13b-14a (QL 37/2/guiwei).

³¹ *Pingding Liang Jinchuan fanglüe*, 50, fol. 1b-2a (QL 38/2/bingyin).

³² *Pingding Liang Jinchuan fanglüe*, 51, fol. 17a (QL 38/2/jiashen); 57, fol. 24a-24b (QL 36/r3/yiyou).

³³ *Pingding Liang Jinchuan fanglüe*, 58, fol. 8b-9a (QL 38/4/bingshen).

³⁴ *Pingding Liang Jinchuan fanglüe*, 61, fol. 17a-17b (QL 38/6/dingyou).

³⁵ *Pingding Liang Jinchuan fanglüe*, 52, fol. 1a (QL 38/3/gengyin); 54, fol. 16a (QL 38/3/jiwei).

³⁶ *Pingding Liang Jinchuan fanglüe*, 21, fol. 5a (QL 37/2/guisi); 22, fol. 2b (QL 37/3/renyin), 12b-13a (QL 37/3/ yisi); 48, fol. 10a (QL 38/1/bingwu).

³⁷ *Pingding Liang Jinchuan junxu li'an*, 2, fol. 43b-44b.

equipment and people. It became evident that the brass was of inferior quality because it contained too much slag (*kuangxing* 礦性), and that it was useless as gun metal.³⁸ Yet the need for cannons and howitzers was so urgent that the commanding generals nevertheless ordered artillery pieces to be cast in the camp foundries. It was ordered that only when not the slightest impurity (*shayan* 砂眼) was to be seen, was the material suitable for casting. Therefore, it was a better method to spend time refining the metal than to cast the pieces prematurely and lose time through recasting the exploded cannons—and lose the lives of gunners and workmen to boot.³⁹ Half of the burst cannons was ‘as black as soot,’ due to the very high amount of lead compounds (*qiansha* 鉛沙) contained in the material.⁴⁰

The staff of the camp foundry was to be recruited from the logistics stations. These persons did not only bring the material for the cannons—brass bars or rods or ‘crab shells’ (*xieke* 蟹殼) produced in Leshan 樂山⁴¹ – from Chengdu 成都 to Jinchuan, but also had to transport the finished barrel along with the ammunition from the camp foundries to the battery and thus provided the gun crew with new supplies.

Head of the camp foundry was a foreman or ‘engineer’ (*suiyingju zhangfu* 遂營局長夫) who had to supervise the cannon casting, which means that he was a skilled workman and an expert in metallurgy. The workers serving in the foundry and later transporting the guns and the cannonballs to the battery were allowed to walk back to the foundry without having a specified task to do and were thus paid for a non-productive period. The foreman, who as an expert craftsman was much more expensive than the unskilled laborers, was not allowed to go back to the foundry without doing productive work. If this regulation was not just made for principle, it seems clear that the distance between the foundry and the battery must have been at least several *li*. One reason for this great distance might be that the locations of battery and foundry were not calculated according to the danger arising from bursting guns or from enemy snipers, but rather according to topography – there had to be a location convenient enough to establish a foundry as near the battery as possible – and to the danger that the enemy might be able to make a counter-attack. Should the enemy conquer the battery or some cannons—which happened several times during the war—, at least the foundry would not fall into their hands. The distance between the foundry and a battery could be up to ten stations, or day-travels, which seems possible when it was only a question of transporting cannonballs,

³⁸ *Pingding Liang Jinchuan fanglie*, 19, fol. 19a-19b (QL 37/1/guiwei).

³⁹ *Pingding Liang Jinchuan fanglie*, 51, fol. 19a (Q 38/2/jiashen); 53, fol. 7a-7b (QL 38/3/jiachen).

⁴⁰ *Pingding Liang Jinchuan fanglie*, 57, fol. 1a (QL 38/r3/dingchou).

⁴¹ *Pingding Liang Jinchuan fanglie*, 58, fol. 7a-7b (QL 38/4/xinmao).

but not if a freshly cast cannon had to be pulled forward to the battery.⁴² Nevertheless, there was a long period of time during the first half of the war when the finished barrels had to be transported up to the top of mountain ridges to fire down on the enemy's castles. This practice also seems to have been common during other wars, like in Mongolia, where fortified batteries were set up on top of mountains in Uliastai 烏里雅蘇台.⁴³

Whenever the front advanced, the battery had to be relocated too, and ideally the foundry followed it at a corresponding distance. During long periods of the war, the front advanced only very slowly, and therefore the camp foundries often remained in the same place for months. When the battery was moved, the commanding official had to decide which cannon could be pulled forward on its mount and which cannons should be melted down, either because they were too heavy to be transported, because the mountain path was too narrow or too steep, or because a cannon had become unusable. The responsibility for this decision was borne by the supervising Grand Minister (*zongli dachen* 總理大臣), because the cannon brass was of high value and any loss would have to be refunded to the 'owner,' in most cases the provincial mint.

Metal that is cast and recast several times will of course lose much of its original quality, and in order to regain the original pureness of the brass, the foreman had to add eight or nine *jin* of 'pure' brass to every 100 *jin* of remelted brass. If the brass had already been remelted and recast several times, or had been buried in order to hide it from the enemy and was therefore heavily corroded, the foundry master had to add up to 16.375 *jin* (16 *jin* 6 *liang*) to every 100 *jin* of the corroded material.

We will now take a look at the 'normal case,' in which cannons were not cast on the spot but brought with the troops from the garrisons. Unfortunately, there is no evidence of how the cannons and howitzers were produced in the garrisons. It might be that the furnaces of the provincial mints were used for this purpose. Artillery pieces were cast according to about two dozen models described in detail in the *Da-Qing huidian tu* 大清會典圖,⁴⁴ or according to local custom, so that in the end, each provincial garrison possessed its own types of guns. Standard cannons were not common. Even in the West, standards for field and siege artillery were only adapted in the course of the 18th century.

⁴² *Pingding Liang Jinchuan junxu li'an*, 2, fol. 44a-45b.

⁴³ *Pingding Zhunggar fanglüe, Qianbian* 前編, 34 (YZ 11/4/gengshen); *Zhengbian*, 53 (QL 23/4/dingmao).

⁴⁴ *Da-Qing huidian tu*, fascicles 98-100.

The campaign against Wu Sangui made it necessary to cast a special type of cannon, the ‘great red-coat cannon’ (*da hongyi pao* 大紅衣炮, actually ‘great Dutch cannon’).⁴⁵ Twenty pieces were cast especially for this war, apparently in Beijing or in a larger provincial garrison, and sent to the war theatre in Changsha 長沙, accompanied by two officials, one from the Ministry of War, and one from the Ministry of Works.⁴⁶ The efforts of the Jesuit missionary and scholar Ferdinand Verbiest (Nan Huairen 南懷仁, 1623 – 1688) to cast cannons were well remembered at that time.⁴⁷

During the campaigns against the Dzungars, cannons were brought from the garrisons, along with other equipment or foodstuff. The same caravan of mules that brought rice also transported cannons to the front. Three camels (or other beasts of burden?) could be tied together side by side to transport one cannon (*mei pao yi wei pei tuo san zhi* 每礮一位配駝三隻), but the copper plate engravings show that one camel could also carry one smaller gun.⁴⁸ Horses were also used to transport cannons. Of a total contingent of 5,150 horses, for instance, 150 beasts were used for the purpose of carrying artillery pieces.⁴⁹ The numbers were surely not very high: General Siju 席柱, for example, was allowed 30 pieces of mother-and-child cannons (*zimupao* 子母礮), General Fiyangu 費揚古 50 pieces.⁵⁰ It seems to have been very common to join small batteries with a platoon of musketeers (*qian pao qi fa* 鎗礮齊發),⁵¹ a method that can also be seen in many scenes on the copper plate engravings. Garrisons in the conquered territory were immediately equipped with artillery, like the four batteries of *zimu* cannons in Ulaangom 烏蘭古木.⁵² The cannons were to be procured by the Ministry of Works (*gongbu* 工部), which can only mean that the cannons were produced in a foundry in Beijing and then sent to the troops’ garrisons in the east, like the 40 pieces of cannon sent to Ningxia 寧夏 in 1724.⁵³ Yet not all cannons used by the various garrisons were

⁴⁵ Joseph Needham, *Science and Civilisation in China*, vol. 5, *Chemistry and Chemical Technology*, part 7, *Military Technology; The Gunpowder Epic*, Cambridge: Cambridge University Press (1986), p. 392, and Nicola di Cosmo, ‘Did Guns Matter? Firearms in the Qing Formation,’ in Lynn A. Struve (ed.), *The Qing Formation in World-Historical Time*, Cambridge, MA: Harvard University Press (2004), p. 140, describe the advent and early use of the *hongyi* cannon in China. The word *yi* 衣 ‘clothes’ was used by the Manchus to avoid the taboo word *yi* 夷 ‘barbarian’. The word *hongyi* 紅夷 ‘red [hair] barbarian’ referred to the Dutch. See also Lu Xixing 陸錫興 (ed.), *Zhongguo gudai qiwu da cidian* 中國古代器物大詞典, *Bingqi xingju* 兵器型具, Shijiazhuang: Hebei jiaoyu chubanshe (2002), pp. 137-138.

⁴⁶ *Pingding sannifanglüe*, 29 (KX 16/3/yisi).

⁴⁷ *Pingding sannifanglüe*, 8 (KX 13/8/dingyou).

⁴⁸ *Pingding Zhunggar fanglüe, Qianbian*, 53 (QL 16/10/yiyou).

⁴⁹ *Ibid.*

⁵⁰ *Pingding Zhunggar fanglüe, Qianbian*, 2 (KX 54/6/renshen).

⁵¹ *Pingding Zhunggar fanglüe, Qianbian*, 5 (KX 57/run8/bingwu); similar statements in 8 (KX 59/10/yimao), 9 (KX 60/9/guichou), etc.

⁵² *Pingding Zhunggar fanglüe, Qianbian*, 10 (KX 61/7/dingyou).

⁵³ *Pingding Zhunggar fanglüe, Qianbian*, 15 (YZ 2/11/gengxu).

new. Some pieces were retained after the demise of the Ming and continued to be used during the campaigns in Xinjiang, much to the discontent of the leading generals Huang Tinggui 黃廷桂 and Arigun 阿里衮, because the four large ‘divine’ cannons (*da shenpao* 大神礮) used in the camp of General Yarhašan 雅爾哈善 were already worn out (*duanlie* 斷裂) and too dangerous to be fired.⁵⁴ Probably as a result to such experiences, as well as the fact that the transport of cannons from Beijing to the ‘Wild West’ was a complicated matter, it was decided that new cannons were to be cast in Liangzhou 涼州, Gansu. This case from the Jinchuan wars was treated as a precedent in the campaign against Muslim insurgents of the Tarim Basin, and cannons were cast directly in the war theatre. Yarhašan asked to send craftsmen (*jiangyi*) as well as all materials needed to the camps, as well as to cast cannons in the camp. For the casting of 20 to 30 new cannons, experts were to be hired, and Generals Sunggari 嵩阿禮 and Huang Tinggui were to strictly observe if they put the right spirit into their work.⁵⁵ Apparently, the cannon casters were either hired on the labor market, for example from blacksmiths or producers of agrarian tools, or selected from workers employed in state-owned workshops like the provincial mint. For this extraordinary task expert state officials and craftsmen ‘from far away’ were especially sent to Liangzhou. The experience the Generals Jaohui 兆惠 and Šuhede 舒赫德 had gained during the Jinchuan war was now to be useful in producing cannons to fight the rebel Khwāja-i Jahān (‘Hojijan’ 霍集占).⁵⁶ The craftsmen were not sent directly home (to the indefinite *neidi* 內地, ‘inside the provinces’) after the necessary cannons had been cast, but remained with the army and casted further pieces or artillery in Aksu 阿克蘇, where 120 gunners operated the batteries.⁵⁷ Cannons and other weapons were also produced in Suzhou 肅州, Gansu.⁵⁸ The brass used to cast the cannons was not brought back, neither in the shape of cannons nor as brass ingots or rods; instead, the material was to remain on the spot for the casting of new, Chinese-style coins in Xinjiang. The brass thus became part of a complex reorganization of the whole coinage system in the newly conquered territory. Therefore, the casters remained for one or two years to realize these monetary politics.⁵⁹ Many cannons were also to remain in the conquered territory as a means of protecting the garrisons that were to be established or manned to prevent future uprisings, like Hami 哈密, Barkol 巴里坤, Yarkant 葉爾羌, Kašgar 喀什噶爾

⁵⁴ *Pingding Zhunggar fanglüe, Zhengbian*, 56 (QL 23/5/guichou and jiayin).

⁵⁵ *Pingding Zhunggar fanglüe, Zhengbian*, 57 (QL 23/6/xinwei); 59 (QL 23/7/wushen).

⁵⁶ *Pingding Zhunggar fanglüe, Zhengbian*, 60 (QL 23/8/bingyin).

⁵⁷ *Pingding Zhunggar fanglüe, Zhengbian*, 64 (QL 23/11/wuxu); 66 (QL 23/12/wuyin).

⁵⁸ *Pingding Zhunggar fanglüe, Zhengbian*, 72 (QL 24/5/yihai).

⁵⁹ *Pingding Zhunggar fanglüe, Zhengbian*, 75 (QL 24/7/dingwu).

or Ili 伊犁. The contingents left in these garrisons included a considerable number of craftsmen: Namely, there were 160 officers (*lingcui*), 320 vanguard cavalrymen (*qianfeng* 前鋒), 2,800 normal cavalry troops (*mabing* 馬兵), 600 infantry troops (*bubing* 步兵), 40 gunners (*paoshou*), 80 craftsmen (*jiangyi*), and 240 trainees (*yangyubing* 養育兵).⁶⁰ The ratio of gunners to craftsmen in Ili (40 : 80) was thus similar to other provincial capitals like Chengdu (48 : 96) or Jingzhou 荊州 (80 : 168), Hubei, but they disappeared behind the large number of cavalry troops.

Different types of craftsmen employed and hired by the army

A sufficient number of different cannons seem to have been available in the western garrisons, so that on each campaign against the Dzungars and the Uighur city-states in the Tarim Basin, cannons could be brought along with the equipment. These outposts were extremely important for supplying the campaigning troops. General Yue Zhongqi 嶽鍾琪 was entrusted with the fortification of Barkol, where ramparts and a number of batteries of an unknown size were built.⁶¹ The defense of a fortification was taken over by specialized troops, namely musketeers and gunners. For this type of fortification, laborers (*fuyi* 夫役) were recruited from the provinces to undertake the construction work (*chenggong* 城工). At least some of the laborers seem to have been convicts (*renfan* 人犯) sentenced to do this hard work for 60 days. Their penalty fulfilled, they were allowed to become soldiers or were free to return to their home villages.⁶² For wooden fortifications, craftsmen of princely establishments or from workshops in the capital could also be dispatched.⁶³ The irrigation canals of the military colonies (*tuntian* 屯田) were also planned and dug by craftsmen (*gongjiang*), while the fields themselves were worked by the troops.⁶⁴ As an expression of imperial power, steles with inscriptions (*bei* 碑) were erected on the sites of victory. The inscriptions were incised by craftsmen who were especially brought to the sites of the battlefields, like Yarkant.⁶⁵ Specialists in metal processing were dispatched to the military colonies to help the troops in the colonies cast their own tools for working the fields. There were several different ways to obtain iron. The most convenient way was to melt down

⁶⁰ *Pingding Zhunggar fanglüe*, *Xubian* 續編, 31 (QL 30/7/renchen). The *yangyubing*, Manchurian term *hūwašabure cooha*, were 'young men brought up at state expense' that were destined for military service, cf. Norman, *Manchu-English Lexicon*, p. 142.

⁶¹ *Pingding Zhunggar fanglüe*, *Qianbian*, 24 (YZ 9/6/gengxu).

⁶² *Pingding Zhunggar fanglüe*, *Qianbian*, 27 (YZ 9/11/renxu).

⁶³ *Pingding Zhunggar fanglüe*, *Qianbian*, 31 (YZ 10/9/guichou).

⁶⁴ *Pingding Zhunggar fanglüe*, *Zhengbian*, 45 (QL 22/10/gengwu).

⁶⁵ *Pingding Zhunggar fanglüe*, *Zhengbian*, 82 (QL 24/11/yisi).

weapons ('swords to ploughshares'), but the craftsmen also cooperated with local experts in prospecting different places where rocks contained a sufficient amount of iron ore to make iron of. The tradesmen were to train the colonist troops in working the iron, and were then sent back home.⁶⁶ Such experts did not necessarily come from the private labor market. The Mongol Banner troops (or Dzungars?) settled down in the colony of Khobdo 科卜多, Mongolia, were first to be trained how to use agrarian tools. Green Standard troops, already experienced with the military colony system, were sent to Khobdo, along with several experts in woodcutting, stonecutting, and smithery (*mu-shi-tie jiang* 木石鐵匠), to provide the basic work for the colonists.⁶⁷ Green standard troops, like the Banner troops, apparently included a handful of craftsmen, as another statement about the colonization of Ili shows: Craftsmen from the Green Standard troops were to be selected to purchase the necessary materials and prepare the first sets of agrarian tools that the colonists would later use.⁶⁸ This incident proves that the Green Standard garrisons, like the Banner garrisons, also had regularly employed craftsmen at their disposal.

During the war against Wu Sangui and his allies, boats played an important role in the deployment of troops. Therefore, boat carpenters (*duogong* 舵工, *chuanjiang* 船匠) were often hired to prepare tools that would allow the army to cross rivers and waterways,⁶⁹ but war ships (*jian* 艦) also played an important role in many battles.⁷⁰ The army often used pontoon bridges (*fuqiao* 浮橋), and they sometimes had to be repaired by specialists.⁷¹ They played a very important role in the Jinchuan wars, during which craftsmen were once sent out at night to connect the two banks of a mountain creek.⁷² Rope bridges (*suoqiao* 索橋) or makeshift bridges (*pianqiao* 偏橋) were also often used. An important bridge south of an enemy castle at Giyarżisang 甲爾日磾 was destroyed by divers from Hunan, who tore down the wooden pillars of the construction.⁷³

Craftsmen were also to be used to produce camel saddles (*luotuo anxie* 駱駝鞍屜). Many families in the province of Shanxi specialized in the processing of wool and the making of ropes. These were to be entrusted with the production of the tools needed by the army, and

⁶⁶ *Pingding Zhunggar fanglüe*, *Xubian*, 17 (QL 27/5/renzi).

⁶⁷ *Pingding Zhunggar fanglüe*, *Xubian*, 22 (QL 28/9/wuyin).

⁶⁸ *Pingding Zhunggar fanglüe*, *Xubian*, 27 (QL 29/11/gengwu).

⁶⁹ *Pingding sannan fanglüe*, 25 (KX 15/7/jiyou), or 31 (KX 16/6/renzi)

⁷⁰ *Pingding sannan fanglüe*, 42 (KX 17/11/jiachen).

⁷¹ *Pingding sannan fanglüe*, 42 (KX 17/11/yihai), or 59 (KX 20/10/dingwei).

⁷² *Pingding Liang Jinchuan fanglüe*, 12 (QL 36/12/bingzi).

⁷³ *Junjichu yue zhe bao* 軍機處月摺報 2776.156, no. 37513 (QL 40/8/16, memorial by Artai 阿爾泰), quoted in Zhuang Jifa 莊吉發, *Qing Gaozong shiquan wugong yanjiu* 清高宗十全武功研究, Beijing: Zhonghua shuju (1987), p. 164.

paid an appropriate price.⁷⁴ Craftsmen for all kind of specified work were often hired from among the people. Unlike the Roman soldiers mentioned in the beginning, the Qing troops did not do the crude work. They saw themselves as gentlemen and not as men of the trades or the workshops. It seems that not even the manservants (*genyi*) of the troops, who each officer was served by in large numbers, engaged in woodcutting and construction work. This dirty work was taken over by craftsmen from among the people.⁷⁵ The fine work, however, was done by experts in the garrisons, like huge amounts of arrows that were sent to the war theatre in Jinchuan from the nearest Banner garrison, as well as from Beijing. The making of arrows required real expertise and could only be done by craftsmen who were regularly employed in the garrisons, as was seen above.⁷⁶

Craftsmen (or laborers?) could even be granted a reward that was normally a privilege of soldiers.⁷⁷ Craftsmen (*jiangyi*) in the camps were so important that the emperor issued a special edict stressing the need to nourish them sufficiently. The military seems to have regularly abused the funds for the civilian craftsmen.⁷⁸

The pay of hired craftsmen and experts

The regulations for war expenditure, *Junxu zeli* 軍需則例, promulgated in 1784, provide detailed instructions about the payment granted to craftsmen hired by the army.⁷⁹ Alongside many less or not specialized persons, like granary workers (*cangfu* 倉夫) and grain measurers (*douji* 斗級), logistics laborers (*zhanfu* 站夫), and workers constructing sheds and stables (*tagai fupeng/mapeng renfu* 搭蓋夫棚/馬棚人夫), real specialists are also dealt with, categorized into different professions. The regulations determined that all workers coming from provinces other than the one where the war took place (in the case of the western campaigns, Gansu, probably including Shaanxi) were to be granted a so-called baggage payment (*xingzhuangyin* 行裝銀) of six silver *liang*. This money was to cover the travel expenses. Craftsmen hired in the province where the war took place were given four, five, or six *liang*, depending on the distance to the war theatre. All craftsmen were furthermore paid out a sum of three *liang* of ‘money for the comfort of the family’ (*anjiaiyin* 安家銀). This sum was to cover the losses incurred if the family’s nourisher could not work for his business. On

⁷⁴ Pingding Zhonggar fanglüe, *Qianbian*, 17 (YZ 7/11/bingzi).

⁷⁵ Pingding Liang Jinchuan fanglüe, 64 (QL 38/6/bingchen).

⁷⁶ Pingding Liang Jinchuan fanglüe, 57 (QL 38/run3/renwu).

⁷⁷ Pingding sannan fanglüe, 1 (KX 10/12/jiwei).

⁷⁸ Pingding Zhonggar fanglüe, *Qianbian*, 33 (YZ 11/2/gengshen).

⁷⁹ *Junxu zeli*, *Hubu junxu zeli*, 6.

the march from their hometown to the border of the province (in case the war took place beyond the borders of the proper provinces), the craftsmen obtained a daily pay of 0.06 *liang* (or six *fen*) to buy food with, and outside the provincial borders one *sheng* (1.035 litres) of rice. This regulation was also common for soldiers. It was apparently easier to distribute rice than to organize moneychangers and food stalls. In the war theatre, the monthly pay granted to the craftsmen differed according to their profession. Cannon casters were given three *liang* per month, and others, like boat carpenters (*chuanjiang* 船匠), blacksmiths (*tiejiang* 鐵匠), stone cutters (*shijiang* 石匠), wood cutters (*mujiang* 木匠), tailors (*caifeng* 裁縫), and artisans mounting pictures or maps (*biaobei* 裱背), were given only two *liang*, while ferrymen (*dufu* 渡夫) and boatmen (*shuishou* 水手) received only one and a half *liang*. They were also fed daily with one *sheng* of rice, and their families were granted a monthly share of three *dou* of rice, equivalent to one *sheng* per day.⁸⁰

Other groups of specialists were physicians (*yisheng* 醫生), hired employees of government agencies (*gongshi* 供事), scribes (*shushi* 書識), painters (*huajiang* 畫匠), and papermakers (*zhijiang* 紙匠). The money for the comfort of the families of physicians was as high as 50 *liang*, that for the others half of this sum. The baggage pay for the physicians was 30 *liang*, that of the others 15 *liang*. The monthly pay for the physicians was three *liang*, the same as for cannon casters. Employees of state agencies were granted a mere one and a half *liang*, the others two *liang*. Physicians and state employees were allowed the assistance of a manservant, for which they were also given money. All persons of the latter group were not given any money for their travel to the war theatre.⁸¹ This makes it evident that the army set up a clear hierarchy of who was really needed, namely the men of the physical trades, with the cannon casters, who were real professionals in their field and could not be replaced, at the top. Compared with the rest, their work was also quite difficult, dangerous, and demanding. Craftsmen of other professions stood in second place, and those with the easiest physical work, like scribes, painters, and papermakers, were valued less. It is interesting to see that the labor pay for a physician was not higher than that for a cannon caster, but that he was given more allowances to carry all his luggage and equipment with him, and granted a higher pay for his family. It is not certain what kind of work the *gongshi* ‘state employees’ did (probably *yamen* runners, *li* 吏), but it seems that, in one way or another, they were experts in

⁸⁰ *Junxu zeli, Hubu junxu zeli*, 6, paragraph *Ge xiang jiangyi anjia gong-shi-lu fei* 各項匠役安家工食路費.

⁸¹ *Junxu zeli, Hubu junxu zeli*, 6, paragraph *Yisheng gongshi shushi huajia deng zhengzhuang anjia gongshi kouliang* 醫生供事書識畫匠等整裝安家工食口糧.

bureaucratic matters and could be hired out from their actual workplace to do some work in the war theatre.

Finally, there is the interesting question of how long craftsmen and experts were used for the army. From the regulations just explained it seems as if there was no time restriction and that they could be hired as long as the campaign lasted. This was different from the peasants, who were, according to the household registers, recruited to do the portering labor in the logistics stations. These porters had to be replaced every five months before they were set free to return to their fields.⁸²

Summary

Early modern Chinese armies included several specialist troops, which were mainly musketeer companies and artillery units. In the course of the 18th century, the *niaoqiang* musket became so common that one can no longer speak of their handlers as specialists, although officially, some Banner regiments still continued to use the specialist designation of ‘musketeers’ as a kind of elite troop. The bow and arrow remained the preferred standard weapon of many Banner units, be it because of tradition or heroism, but surely not because of lower cost. Artillery units were still very rare at the end of the Qianlong reign (1736 – 1795), and there were very few field cannons available for the troops to the battlefield. Instead, cannons were often cast when needed, either in government workshops, in garrisons close to the battlefield, or even on the spot. Heavy artillery was used against fortresses, mainly in the shape of howitzers, but light guns were likewise regularly used against enemy troops in battles. Yet compared to 17th and 18th century Western armies, artillery played a far less important role in Chinese warfare. The same is true for musketeers. Other weapons, like bows and arrows in the Banner troops, or the shields, sabers or pole-arms used by the Green Standard infantry units, were still very important and even gained more importance with the increasing use of village militia from the late 18th century onwards.⁸³

In late imperial Chinese warfare, siege warfare did not play a crucial role. There were virtually no techniques for crushing a fortress by digging tunnels. Accordingly, there was no specialized miner corps among the Chinese troops of that age. Sappers were needed more often to do ad-hoc construction work of ramparts, saps, or trenches in the field when conditions on the battlefield required a static type of warfare. Yet there was also no

⁸² *Junxu zeli, Hubu junxu zeli*, 6, paragraph *Zhanfu anjia gongshi kouliang* 站夫安家工食口糧.

⁸³ For this topic, compare Philipp A. Kuhn, *Rebellion and its Enemies in Late Imperial China: Militarization and Social Structure, 1796-1864*, Cambridge, MA: Harvard University Press (1970).

specialized sapper corps, and the people digging out trenches or erecting barricades were hired civilian workers.

Most garrisons had a certain number of tenured craftsmen at their disposal, mainly blacksmiths and bow- and arrow-makers. During warfare, there was a huge need for all different kinds of experts. These were mainly hired from the population of the region, and in many instances came from far away districts. The army hired a lot of craftsmen to do all the work that surpassed the 'normal' job requirements of a soldier. All work with wood and stone was done by civilian experts, and the army engaged private ferrymen and boat carpenters, as well as physicians and secretaries. Yet what is most astonishing is that the army did not employ tenured experts in cannon casting. Although there must have been casters in various state-owned workshops, like the mints, apart from fortress artillery, the arsenals of the huge armies of Qing China had only a small array of cannons at hand. Field artillery was rarely used, and if problems with the material occurred, private experts or semi-experts were hired. For geodesy, surveying, and even for ballistic calculations, the army made use of Jesuit mathematicians like Felix da Rocha (1713 – 1781).⁸⁴ This is an excellent example to demonstrate that, although Chinese armies were staffed with experts and specialists, and knew how to integrate civilian craftsmen into the army during war, any kind of scientific education for engineers was missing. But the reasons for this are another story.

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⁸⁴ Joanna Waley-Cohen, *The Culture of War in China: Empire and the Military under the Qing Dynasty*, London: Tauris (2006), p. 58.

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