

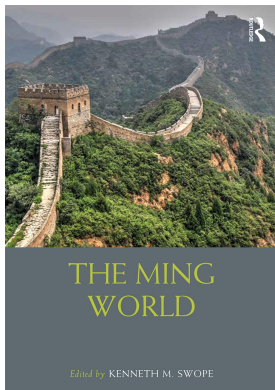
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How Yongle learned to stop worrying and love the gun

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CHAPTER 3

HOW YONGLE LEARNED TO STOP WORRYING AND LOVE THE GUN

Perspectives on early Ming military history



Tonio Andrade

In recent years, scholars have developed a new appreciation for Ming warfare. The early Ming state was, they have shown, the world's most powerful gunpowder empire, possessing gun-bearing infantry that were more numerous and effective than those of any other state in the world.¹ Nor did the Ming lose its military mojo over the following centuries. Whereas previously the mid- and late-Ming Dynasty military was seen as backwards, conservative, and ineffective, recent work has established that throughout the 1500s and early 1600s the Ming undertook a series of strikingly innovative reforms and adaptations, which kept it a major military power until its sudden military collapse in the late 1630s.²

Scholars have drawn attention to many different aspects of Ming military history – the wide and deep use of firearms in its armed forces (the proportion of firearm-toting units was higher than in Europe from the 1300s through the mid-1500s); the rapid and effective adoption of gunpowder technology from other peoples (from Vietnam, from the Portuguese, from the Japanese, from the Ottoman Empire, from northern Europe); the effective use of advanced (by the standards of Europe) infantry tactics such as the volley technique; advanced hybrid metallurgical cannon casting techniques; experiments with broadside ships and Renaissance artillery fortresses; and so on. Yet there is much work yet to be done, and this is particularly true of the early Ming period.

This chapter focuses on the two-decade reign of the third Ming emperor, the bellicose and ambitious usurper Yongle (r. 1402–1424). Most work on early Ming military history has focused on his father, the founder of the Ming Dynasty, Zhu Yuanzhang. This makes sense, because, as historians have noted, Zhu Yuanzhang invested heavily in firearm manufacture, working to increase the proportions of gunners within his infantry, gunners who helped him overcome his powerful Han Chinese rivals, run the Mongols out of China, and expand China's borders, laying the groundwork for the long and successful Ming Dynasty.

Yet his son Yongle carried forth his father's firearms innovations, systematizing and expanding them. It was under his rule that the central administrative structure of Ming firearms use, the Firearms Commandery, was established, and Yongle increased the proportion of gunners beyond the levels in his father's armies. He also focused

on the deployment of guns in his massive wars northwards against the Mongols and southwards against Vietnam (Đại Việt), and those wars helped stimulate firearms innovation, particularly the Đại Việt conflict.

Intriguingly, Yongle didn't start out as a partisan of the gun. Sources suggest that his attitude toward firearms changed as he made a transition from prince of the northern reaches to usurper fighting in the central plain. His embrace of the gun may thus shed light on a central problematic of Chinese military history: the question of whether guns evolved more slowly in China because the Chinese faced primarily mounted nomads as enemies, rather than infantry armies. As we'll see, it was during his war for succession in more southerly parts of China, to wit the central plains, that he came to appreciate the gun, and he did so, it seems, because guns were used successfully against him, leading to a significant defeat from which he barely escaped. After this episode, he rapidly increased his use of guns, and we can see further stages in his use of guns occurring during the huge military expeditions he undertook after he finally defeated his rival and came to the throne. In his use of guns against the Đại Việt state (itself a powerful gunpowder empire) and the Mongols, we see the development and systematization of the Ming gunpowder empire, a coming into being of institutions and practices that would in some cases remain extant for the rest of the Ming Dynasty.

YONGLE

The Yongle emperor had grown up in a martial world. At the age of nine, his father named him the Prince of Yan and gave him a fiefdom based in the city of Beiping (current-day Beijing), admonishing him to “diligently drill the troops and defend the domain.”³ In the golden book he was given that day, his father noted that rulership was difficult and recalled his own rise: “I came from the peasantry, battled with so many warlords, and endured all kinds of hardships.”⁴ These battles and hardships were fresh in mind. The Ming Dynasty had been declared just two years previously, in 1368, and throughout the previous decade his father had fought one rival after another. Guns and other gunpowder weapons were significant factors in his eventual victory.

Sitting now upon the dragon throne, he encouraged his sons to undertake military training, and the future Yongle, i.e., the Prince of Yan, proved an eager pupil. The boy enjoyed riding and practicing and parading, and he trained hard, living in the rain and snow, learning the use of gunpowder, firearms, and traditional weapons.⁵ He grew into an impressive man: tall, athletic, and better looking than his father. At the age of seventeen he married the daughter of China's top military man, Xu Da, who had helped bring his father victory on many occasions, as in 1367, when he captured the city of Suzhou, seat of the powerful King of Wu, Zhang Shicheng. The prince learned the art of war from his father-in-law and from another top general, Fu Youde, to whom the young prince served as aide-de-camp, helping in routine training, fortification, and patrols. He also accompanied his mentors northward on expeditions, including a famous 1381 campaign that his father launched against the Mongols, which gave a hint of his abilities as a field commander. When Xu Da died, the prince inherited the loyalty of the old general's men, the best army in China. This loyalty would come in handy starting in 1398, when his father died and the throne passed to his nephew rather than to him.

The new emperor, who took the reign title Jianwen, was young – not quite twenty-one – but he understood that his uncle was a threat to his authority. The Prince of Yan, for his part, felt with some justification that he was more capable than his nephew. The young emperor had more troops, more resources, and the legitimacy of the throne, but the prince was a canny leader and knew how to use deception. When imperial forces surrounded his palace in Beiping in 1399, he sent out word that he would surrender. His men waited for the two imperial officials charged with arresting him to enter the palace. Then the Prince of Yan had them seized and killed. The prince’s small force of loyal guards quickly took control of Beiping and its military forces and then prepared to seize the imperial throne.

The ensuing war of succession was hard fought. The Prince of Yan was outnumbered, and the new emperor had the advantage of legitimacy, but the prince was a superior commander. For example, in one of the first major episodes, an imperial army said to be 300,000-strong was sent against him (the actual numbers were lower – perhaps 130,000). It might have seemed prudent to wait and let the army attack, relying on Beiping’s stout walls, but instead the prince moved his army southward and attacked first. It was a bold wager, based on the calculation that the imperial army was still forming and might be broken if struck hard. He attacked the army’s garrisons and encampments, using ruses and stratagems. On one occasion, he hid soldiers in the water under a bridge and hid scouts along the road to watch. When the scouts saw the enemy approach, they fired a signal cannon, at which the ambush was sprung. The imperials were trapped on the bridge and two top imperial commanders were captured.⁶ From these commanders he learned which imperial garrisons were weak. He moved against them, and soon he had routed the main imperial force.

At this point it might have seemed best to press the advantage and continue the attack, but he had a masterly sense of timing, so instead took his spoils northward – including more than 20,000 horses – and consolidated his control there. The imperials attacked Beiping but were ill-prepared for the northern winter, wearing thin clothes and poor shoes. When they gave up the siege and returned to the south, they were weak and sickly. The Prince of Yan decided to keep them tired. He made a feint to draw their attention, and, indeed, the imperials duly marched north again, and then, when the danger had lifted, turned back toward the south. Many died on the way back, leaving armor and equipment on the road.

In these early battles of the war of succession, the Prince of Yan used guns only peripherally. We see plenty of evidence of signal guns and occasionally guns used offensively or defensively, but never in core functions.⁷ This may seem odd. After all, we know that under the Prince of Yan’s father, the Hongwu Emperor, some 10 percent of infantry were already armed with firearms, which indicates that there were on the order of 150,000 gun units in Ming infantry forces.⁸ Why might the Prince of Yan have used fewer guns?

The Prince of Yan was used to warfare in northern China, and particularly to conditions in Mongolia. Kenneth Chase has argued in his influential book, *Firearms: A Global History to 1700*, that guns are far less useful against mounted nomads than against standard infantry armies, because early guns were slow and clumsy and ineffective on horseback.⁹ According to Chase, the fact that China faced primarily mounted nomads as enemies helps explain why it did not “perfect” guns whereas Europe did. The Chase thesis has some problems with it – most notably, the fact that

it neglects the many other types of warfare that occurred in China. Southern Chinese warfare, for example, was quite a bit more like European warfare than was northern Chinese warfare.¹⁰ Yet if Chase's conclusions are too sweeping, he is nonetheless onto something. Northern warfare was different from southern warfare; guns were used differently against mounted nomads.

Until the war of succession, the Prince of Yan's experiences were primarily based on northern warfare. His father had deliberately situated his principedom in Beijing, knowing that his primary foes would be mounted nomads, primarily Mongols. The Prince of Yan was the second-highest ranking son but he was also the most able, and he ended up playing a major role in northern defenses, commanding various expeditions against "wild men" and frontier raiders. He was particularly successful against the Mongols. In early 1396, for example, he led troops to defeat a major Mongol force east of the bend of the Yellow River and then chased them to Uriyangqad, taking prisoner top Mongol commanders.¹¹ This type of warfare against Mongols frequently focused less on infantry – who were, after all, the primary types of troops armed with guns – and more on cavalry, who were generally armed with traditional weapons.

But when he fought against the forces of his nephew in the central plains of China, an area suited to infantry warfare, he experienced firsthand the devastating effect of guns. The most frightening battle of his life occurred in January of 1401. The prince, feeling confident, had moved against the commander-in-chief of the imperials, a general named Sheng Yong, who had garrisoned his troops in Dongchang City, in Shandong Province (present day Liaocheng City).¹² Although the sources differ on some particulars,¹³ the main contours of the battle seem clear. Sheng Yong had prepared carefully, feeding his troops, readying the walls, inspecting and reviewing battle formations, and, most importantly, "preparing and laying out firearms and poison crossbows to await [the Prince of Yan]."¹⁴ The prince's troops were confident, having won so many engagements, and they advanced at once upon Sheng Yong's troops. But when Sheng Yong's guns opened fire, the results were disastrous. The troops of the Prince of Yan "were all entirely wounded by the firearms."¹⁵

Sheng Yong, spirits buoyed by the arrival of reinforcements, pressed his advantage, and the prince found himself and his cavalry troops completely surrounded. As one source notes, "the Prince of Yan tried to attack and charge, but he couldn't escape."¹⁶ The enemy pressed in, and "the prince was in grave danger several times."¹⁷

Fortunately for the Prince of Yan, his nephew, the young emperor, had issued a filial order: no one was to harm the Prince of Yan, who, after all, had imperial blood. So although swords slashed close, the enemy soldiers never dared to cut him. The prince was saved by the arrival of some "barbarian cavalry troops," most likely Mongols who had joined the Ming. The mounted warriors charged the imperials' lines from the outside, extracted the prince, and galloped off. The prince survived, but the troops he left behind were less lucky. In the melee and under the fire of Sheng Yong's guns, perhaps ten thousand of the prince's troops expired.

All accounts of this key defeat focus on the devastating role of guns. The *Ming History* says that Sheng Yong "used firearms and powerful crossbows to annihilate the prince's troops."¹⁸ A history written by Ming scholar Tan Xisi noted that "Yan's troops suffered a great defeat from the firearms."¹⁹ The biography of Sheng Yong in the *Ming History* notes that "multitudes of Yan troops were wounded by the firearms."²⁰

The battle seems to have traumatized the prince. He was particularly preoccupied by the loss of one of his top generals, his friend and mentor Zhang Yu, who died trying to save him from encirclement. “Victory and defeat are part of life,” he is said to have exclaimed, “but at a time like this to have also lost such a teacher [as Zhang Yu] is deeply lamentable.”²¹ It seems that whenever the Battle of Dongchang was discussed, the prince became disturbed, having trouble eating and finding it impossible to rest.²² It is of course impossible to diagnose post-traumatic stress disorder from across a chasm of six centuries, but his symptoms certainly seem commensurate with such a diagnosis. And a traumatic battle experience like this – in which fear, responsibility, and near capture is combined with guilt at being saved while leaving comrades behind to die – is just the sort of thing to elicit such symptoms.

What is particularly intriguing, however, is that his military leadership seems to have changed. In subsequent battles in the war of succession, he was much more diffident – less bold, less decisive. As the *Ming History* notes, at the beginning of his revolt “the prince’s troops had been victorious and able, and there was nothing like Dongchang, but from that point forward, the Prince of Yan’s troops went southward only to Xu and Jin. They didn’t dare again go to Shandong.”²³

There was an even more important change to the prince’s warcraft after Dongchang: he began to integrate guns more firmly into his warcraft. After Dongchang, guns are mentioned more frequently in descriptions of battles. His gun victories weren’t always glorious. On one occasion, for example, he launched a dawn gun attack on an imperial encampment, and the imperials mistook the gunfire for signal cannon on their own side. They rushed out the gate and, panicking under fire, fell into the deep trenches that they themselves had dug.²⁴ But there were also great gun victories, as when the prince’s gunmen terrified Sheng Yong himself. The prince had dispatched a small force of gunmen to creep close to the great general’s encampment. Once within range, they opened fire. The imperials threw down their weapons and ran. Sheng Yong was supposedly frozen with fear, unable to climb on his horse, and had to be carried to a waiting boat.²⁵

After the gunmen’s victory over Sheng Yong, the prince’s momentum increased. He moved closer and closer to Nanjing. The fall of the imperial city, however, was achieved not by arms but by intrigue. The prince had collaborators within the administration of the young emperor, whose policies had alienated key blocs of power, including the once-powerful eunuchs. When the prince entered Nanjing in the summer of 1402, he did so by the most traditional means in China’s military history: through a gate opened by conspirators.

The prince ascended the dragon throne and took as his reign title the term Yongle, “eternal happiness,” but his reign is remembered less for happiness than for outlandish ambition and profligate spending. Much of this spending went to a huge military buildup, in which firearms played a key role.

Historians have shown that the Yongle period (1402–1424) saw the highest sustained gun production levels of the entire early Ming period (1368–1521, i.e., Hongwu through Zhengde reigns).²⁶ This production – which sometimes reached around ten thousand guns per month – was overseen by new centralized facilities, most notably the famous Firearms Commandery, a bureau tasked with overseeing firearms production and training. The protocols and structures he established continued in use throughout the dynasty. Those protocols and structures emerged,

however, in a somewhat ad hoc fashion, as part of a series of massive expeditions Yongle undertook, southward against the Đại Việt state, and northward against the Mongols.

Yongle's Vietnamese War

Although it is barely mentioned in our history textbooks, the Ming Vietnamese War was one of the most important wars of the late medieval period.²⁷ Whereas armies in contemporary European conflicts numbered in the thousands or tens of thousands, Yongle sent more than two-hundred thousand troops to Vietnam. It was also a war in which both sides – but especially the Ming – employed the most advanced weapons in the world. Indeed, according to historian Sun Laichen, whose wonderful work has explored this war in detail, the spectacular victory of the Ming invasion force was due mainly to “Ming China’s military superiority, including firearms.”²⁸

To be sure, there is a tendency among some scholars to overrate Ming technological superiority. Wang Zhaochun has written, for example, that the first time the Ming invaded Vietnam, the Vietnamese had no firearms.²⁹ This was clearly not the case. As Sun Laichen points out, Vietnamese annals make clear that the Vietnamese state – known as Đại Việt – deployed guns against its long-term enemy to the south, the Cham state, against whom it had been fighting a series of increasingly desperate wars. The Chams were led by a warlike king, who invaded Đại Việt over and over again in the 1360s, 1370s, and 1380s. By 1390, the Đại Việt state was on the brink of collapse. Guns saved it. Đại Việt forces shot and killed the Cham king with a Ming-style gun [*huochong*].³⁰

The Vietnamese adoption of Chinese guns saved their state, and after 1390 Đại Việt began to enjoy the upper hand in its battles with Champa, as noted by John Whitmore in the present volume. Indeed, by 1471 the expansive Vietnamese state had defeated and annexed its longtime rival, relegating Champa to the status of a historical footnote, one that is largely ignored in the West, thereby obscuring the Vietnamese accomplishment and glossing over the crucial role of firearms in the process. Many Western authors still ignore the widespread presence of firearms in Southeast Asia prior to the large-scale arrival of Europeans and completely discount the role of the Ming in disseminating these firearms as chronicled ably by Sun Laichen in his many publications.

It’s rarely a good idea for a great power to get involved in Vietnam, so what made Yongle decide to invade? In 1404, a man appeared in Yongle’s court and said he was the legitimate heir to the throne of Annam (i.e., Đại Việt) and that his family – the Tran – had been usurped by the Ho clan. After considerable diplomatic wrangling with the actual occupants of the Vietnamese throne, Yongle decided to try to reinstate the man. In early 1406, he sent five thousand soldiers to escort him to the Đại Việt capital. The expedition never made it. The Ho army ambushed them, killing most of the Chinese troops as well as Tran himself. When Yongle learned about the ambush he supposedly flew into a rage. “If we don’t destroy them,” he said, “then what are our armies for?”³¹

Was he really so furious? Had he really expected that five thousand Chinese troops would be able to impose his will on a state as powerful as Đại Việt? Or

did he perhaps deliberately send a vulnerable force of escorts so that, once it was attacked, he would have a pretext for war?³² We'll never know, but we do know that Yongle began preparing his campaign immediately after this outburst, and he put considerable care into it.

What is intriguing is that in making his preparations he recognized the fact that the Đại Việt troops were armed with powerful guns. He ordered his commanders to follow ten elements of his strategic plan, and among them was the following point:

[I have heard] that the enemy has prepared many firearms to resist the enemy. If our troops, when on the march, should encounter a mountain that is narrow and dangerous, they should rather avoid it than to waste our troops' strength. Moreover, [I] have heard that the enemy has prepared its equipment not thinking that there is anything to stand up against it . . . [I] order that the Board of Works discuss the development and production of a thicker armor in order to withstand their firearms.³³

Following this exhortation are stipulations about how workers should weave the armor out of bamboo and strengthen it with leather, with clear benchmarks for testing its resistance to projectiles at various ranges.³⁴ Yongle, like his father, paid close attention to the role of guns.

He also took measures to prevent his advanced gun designs from being leaked to the enemy. "It is most important," he commanded, that the miraculous weapon guns that are employed and all types of gunpowder weapons (*huoqi*) be kept in the strictest secrecy. It is not permitted to leak [them] to foreigners so that they can learn the techniques. When encountering the enemy, be certain to carefully and secretly gather them together [afterward].³⁵

How many gunners did Yongle send to Đại Việt? There are no detailed records, but we can make an estimate, based on the fact that a decree of Hongwu stipulated that ten percent of Ming infantry units be gun units. Given that the Ming invasion force numbered 215,000, most of which were infantry, we can guess that there were on the order of twenty thousand or so gunners. The importance of guns is also suggested by the fact that among the top officers sent were at least four generals specifically in charge of firearms, referred to by the title "Miraculous Weapon General."³⁶

Guns certainly appear in battle accounts. When the Ming troops moved southward, Đại Việt troops defended the passes into Vietnam with guns.³⁷ Ming forces easily defeated them and moved southward, stopping at the Red River to construct ships, which they armed with guns, quite possibly the bowl-mouth guns that were standard equipment on most Ming vessels by this point.³⁸ The Vietnamese attacked across the river with guns, but were routed, and the Ming were able to deploy their guns against a key point in the Đại Việt defense: the City of Do-bang, which guarded the entrance to the Red River plain, the heart of Vietnam.

Do-bang was amply armed with guns, but according to the *Ming Veritable Records*, the Vietnamese barely got a chance to fire them: Do-bang's impressive walls were simply climbed in a brilliantly conceived and daringly executed night move. The *Veritable Records* says that Ming troops, holding bits in their mouth to enforce silence, snuck through the darkness to the walls, placed their ladders against them,

and then climbed and began slashing at the defenders with swords. The latter were so surprised they didn't even have time to shoot.³⁹ Vietnamese records, however, suggest that the *Veritable Records* may not have been so veritable: "The dead bodies [of the Ming soldiers] piled up as high as the city wall, but [the Ming troops] still kept climbing and fighting; nobody dared to stop."⁴⁰ Both sources, however, indicate that Ming guns were not used to batter walls or gates or structures of any kind. They were aimed at people. And at elephants.

Once inside the walls, the Ming faced Đại Việt's elephant troops. The beasts were huge, towering over cavalry, with frightening tusks. They broke formations, trampling soldiers and smashing everything in their path. They could grab enemy soldiers and hurl them into the air, or smash them with the forehead, or gore and gouge with tusks, or crush beneath knees.⁴¹ To counter the elephants, Ming firearm generals arrayed gunners to the sides of a Ming cavalry corps, whose horses had been given lion masks to scare the elephants. "The firearms general Luo Wen and others deployed guns (神機銃) in front at the flanks. The elephants all trembled with fear and were wounded by the gun arrows, and they all withdrew and ran away, at which the enemy troops scattered in panic."⁴² Other sources suggest that the Ming also shot rocket arrows at the elephants.⁴³ Ming soldiers pursued and continued picking off enemy soldiers with arrows, handguns, and heavier guns (*pao*), killing many.⁴⁴ Elephant troops had long been a challenge to Chinese armies, and this wasn't the first time guns evened the balance. A famous battle in 1388 saw Ming gunners triumph against an enemy elephant corps in Yunnan.

In any case, with Do-bang defeated, Ming forces could move into the Red River Delta, and in these various battles of early 1407, firearms proved vital, as when on 21 February soldiers wielding firearms, including "bowl-mouth guns," attacked a huge Đại Việt fleet, the "firearms like flying stars and lightning."⁴⁵ As many as ten thousand Đại Việt troops were killed. On 18 March, Ming troops used "great general guns" to destroy more enemy ships. In early May, Ming forces, including four firearms generals, fought against a 70,000-strong Đại Việt force and hundreds of vessels. The Đại Việt were equipped with guns, but the Ming won decisively, killing as many as ten thousand and capturing hundreds of warships.⁴⁶ By summertime, Ming firearms generals and others were chasing the Ho king of Đại Việt southward. They caught him in mid-June, bringing the invasion to a successful close.

In the fall, six senior officers of the expedition returned to Nanjing to report the victory, including firearms general Zhang Sheng.⁴⁷ Yongle himself went to a city gate to welcome them home, and it was a major event, with all the civil and military officials in attendance. Doubtless there were crowds of onlookers as well, eager to catch a glimpse of the Đại Việt prisoners in their cages, among whom were the former king and his sons.

One son was Ho Nguyen Trung (Li Cheng, in Chinese), an expert in firearms who had been in charge of making guns for his father's armies.⁴⁸ Whereas other members of his family were imprisoned, he was put in charge of manufacturing guns and gunpowder in the Ming Military Armory Department [*bing zhang ju*]. Eventually he rose to be the chief of the Ministry of Works, one of the top posts in the Chinese bureaucracy.⁴⁹ He was so revered for his work that he was even offered a ritual sacrifice when the Ming court held a memorial ceremony for the "God of Firearms."⁵⁰ As a late Ming scholar wrote, circa 1606,

Our dynasty employed firearms to combat the northern barbarians, [which] are number-one weapons from ancient times to the present. However, the ingenious (*qing miao*, meaning literally “light” and “wonderful”) techniques of these firearms were not obtained until Emperor Wen (Yongle) pacified Jiaozhi. Hence, [our dynasty] hired its false Grand Councillor . . . to work in the Ministry of Works, [to be] solely in charge of manufacturing [Vietnamese-style firearms], and all the techniques were truly grasped.⁵¹

Nguyen Trung wasn't the only firearms expert the Chinese brought from Vietnam. In one cage was a Vietnamese firearms commander named Chen Tangmeng,⁵² and over the following months, thousands more prisoners arrived in the Ming capital, some of whom were artisans skilled at making gunpowder, guns (*huo chong*), and fire lances.⁵³ Indeed, historian Sun Laichen believes – with good reason – that the techniques and methods introduced by the Vietnamese helped transform Ming firearms technology. Perhaps the most notable improvement was a wooden chip that was rammed into place after the powder had been inserted, after which the projectile was placed on top. This created a complete occlusion of the barrel, so that the full force created by the gunpowder reaction was imparted to the missile.⁵⁴

Some historians even credit the Vietnamese with the creation of one of the most important military institutions of Ming China: the Firearms Commandery [*shen ji ying*]. The Firearms Commandery was one of the Three Great Commanderies of the Ming, central military structures based in the Ming capital. The other two great commanderies were devoted to infantry and cavalry. The Firearms Commandery was an elite fighting force in itself, but it was also responsible for training other divisions in firearms use.⁵⁵ It became a key part of Yongle's armed forces, but there are many mysteries about it.

We don't know, for example, when precisely it was founded. According to the official *Ming History*, “When Chengzu [i.e., Yongle] pacified Vietnam [Jiaozhi], the art of magical lances and guns was obtained, and a special Firearms Commandery was established to expand and practice it.”⁵⁶ But of course, the Ming knew of gunpowder weapons well before the invasion of Đại Việt, and there are various other bits of evidence to suggest other dates for the founding of the commandery.⁵⁷ We can say that it was probably founded sometime around 1409. That is in any case well before any remotely similar institution was established in Europe. Western historians have argued that the world's first “full-fledged” administrative organ pertaining to firearms was the artillery corps of the Frenchmen Jean and Gaspard Bureau, which appears to have been founded sometime around the year 1435.⁵⁸ But of course the Ming Firearms Commandery existed before that, and it was much larger. Whereas the Bureau brothers seem to have had thirty cannoneers and a small group of other technicians under their command,⁵⁹ the Ming Firearms Commandery had at least five-thousand men under it.⁶⁰

They practiced and drilled carefully. The loading and firing of a gun was not as simple as we might imagine it to be and required considerable practice to train soldiers to do it smoothly, something that had to be second nature to them, because they might have to do it when confronted by Vietnamese elephants or Mongol cavalry. The powder had to be added in precise amounts, and the measurements required were inscribed on the powder scoops that seem to have been standard issue with guns starting in the early Ming.⁶¹ The powder was tamped down with a tamping rod.

Examples of tamping rods have been excavated, although they are rare, because they were made of wood, which decomposes rapidly. On top of the powder was placed the “wooden horse chip”⁶² to contain the gunpowder explosion and increase the amount of energy imparted to the projectile. That was rammed down and then the projectile itself was added. Often the projectile was a hewn stone or cast iron ball, but there is evidence to suggest that many fire lances also shot arrows. Projectiles didn’t fit perfectly snugly against the side of the cannon, which is why you needed the plug. Then you’d hold the gun out, apply fire to the “fire-gate,” a bored hole in the body of the gun that led to the powder chamber, and the gun would go off. Ming guns were short, and the possibilities for misfires and backfire were legion, making training all the more important. Since most soldiers were illiterate, there were songs and chants to help them remember the stages.⁶³

All of this training was required just to learn to load and shoot the guns effectively, but gunners also had to learn to work in close coordination with each other and with other types of units. Drill and regimen were vital to the success of the endeavor, a fact which Yongle himself pointed out. He admonished his top military commander Liu Sheng to pay careful attention to training firearms units:

Magical-instrument *chongs* and *paos* are effective weapons for attacking in warfare, but in order not to make mistakes in using them, it is necessary to practice carefully and become proficient and skilled, and then one can use them when the occasion calls for it. You . . . must not be lax in this.⁶⁴

All this training paid off for Yongle when, accompanied by the Liu Sheng whom he admonished to pay attention to careful training, he personally marched northward against China’s greatest foes, the Mongols.

YONGLE MARCHES AGAINST MONGOLS

Although his father had driven the Mongols out of China, they were still considered a mortal threat. A new Genghis Khan might emerge and unify the clans. So Yongle was determined to take the fight to them personally and led five expeditions against them. Guns played a key role.

Consider, for example, the first campaign, a massive expedition that departed Beijing in the spring of 1410. Western language treatments of it omit mention of firearms – including Kenneth Chase’s short discussion, but it’s clear that guns were present and played a significant role.⁶⁵ When, for example, Yongle’s forces engaged Mongol leader Arughtai near the Great Khingan Mountains, General Liu Sheng “used firearms, serving as the advanced guard, and badly defeated Arughtai.”⁶⁶ We find a slightly more detailed account in the *Ming Veritable Records*:

The emperor chased the enemy to Huiqujin and ordered the Anyuan Marquis Liu Sheng to take the magical-device guns and serve as the vanguard. The guns fired and their sound thundered forth for ten *li*, and each arrow penetrated two men, and [the projectiles] also struck the horses, and all immediately died. The enemy, frightened, spurred their horses and departed. Our troops advanced bravely and defeated them, beheading their famous generals and hundreds of men.⁶⁷

Four years later, Yongle led a second campaign against the Mongols, and records of it have left even clearer evidence for the effectiveness of guns. It was a huge expedition, containing around a half a million men.⁶⁸ A civil official named Jin Youzi described the cold rain and the emperor's mood as they moved northward. "Look," Yongle said to Jin, "at this expanse, empty in all four directions! It's not something you see everyday. When you're tired, sleep a bit, and then stand up and look out in all directions, and you'll feel joy in your breast!"⁶⁹ He liked teaching him how to look for signs of wild game, like the paths through the grass made by antelopes and wild horses.⁷⁰ And he enjoyed instructing his soldiers how to search for traces of the enemy: hoofprints, horse dung along trails, dust swirling in the distance.⁷¹ He also liked teasing Jin and the other civil officials from the south, who weren't used to the weather. On one occasion, for example, when Jin rode with one hand on his hat, to keep it from blowing away in the cold wind, Yongle had laughed and said, "The esteemed scholar isn't having a good day today!"⁷²

Finally Yongle's troops met the enemy. Thirty thousand or so mounted Mongols occupied hills, each of them having three or four extra mounts. Yongle ordered his troops to array themselves on the steppe below. A few skirmishes occurred, but it was in the early evening that Yongle made his move. In the gathering darkness, Yongle led a vanguard of elite cavalry units forward, followed closely by General Liu Sheng's gun units. The Mongols came down, but Yongle didn't charge at first. Instead, he waited while Liu Sheng's guns opened fire. Several hundred Mongols fell, causing confusion and disarray in the Mongol ranks. At this point, Yongle and his cavalry – the elite iron horsemen – charged, driving the enemy back into the hills and capturing many horses. As Jin Youzi described the episode, when the Mongols came down the hills, finding the emperor too tempting of a target to resist they didn't even get a chance to strike before the guns fired in secret and the [emperor's] crack troops then again moved forward and attacked with great force, and each could stand against a hundred. The enemy was badly defeated, and the number of men and horses killed and hurt was uncountable, and they all screamed out in pain and left . . . Henceforth that place was called 'Barbarian Slaughtering Hold'.⁷³

Another account – in the *Veritable Records* – adds an intriguing detail: Liu Sheng's guns "fired in continuous succession." Historians in China have interpreted this passage – rightly I believe – as indicating the use of volley fire.⁷⁴ Given that western historians have hailed the later emergence of the volley fire technique in Europe as a hallmark of the military revolution, it is intriguing to find it here in Yongle's armed forces, but it is not surprising.⁷⁵ Historians of China have argued that the technique was used with firearms in China as early as 1388.⁷⁶ This makes sense, because the Chinese had used the volley technique for crossbows continuously since at the latest the Tang Dynasty, and probably earlier.⁷⁷

In any case, Yongle's gunners won a victory that day. Top Mongol commanders were killed and several thousand heads were captured, after which Yongle went after the survivors. In these subsequent battles, guns were similarly in evidence. When Mongol forces tried occupying highlands and small lakes, Ming troops "again used guns to first pound those occupying the two ponds, and these enemy, knowing they

could not resist, withdrew. The remaining bandits, those who were on the peaks of the gorge, feared the guns would come again, and also withdrew and left.”⁷⁸ Kenneth Chase does note the presence of guns on this expedition but downplays their importance, saying merely that guns frightened the Mongols.⁷⁹ Sinophone historians, on the other hand, believe – as I do – that guns played a dramatic role, causing significant casualties.⁸⁰

During the 1420s, Yongle led other expeditions against the Mongols, and then, too, he paid close attention to his gun units, focusing in particular on their drill and training. In the campaign of 1422, for example, he gave his generals precise and detailed instructions about drilling gunners so that they could coordinate effectively with cavalry:

The emperor ordered that all the generals train their troops outside each encampment by arraying the gunnery units [shen ji chong] in the front and the cavalry in the back, ordering the officers to practice and train in the free time. He admonished them as follows: “A formation that is dense is solid, while an advance force is sparse, and when they arrive at the gates of war and it’s time to fight, then first use the guns to destroy their advance guard and then use cavalry to rush their solidity. In this way there is nothing to fear.”⁸¹

Wang Zhaochun believes that Yongle was here discussing volley fire:

The meaning of this [passage] is that when fighting, the gun troops line up in front of the entire formation, and between them there must be a certain amount of space, so that they can load bullets and powder and employ shooting by turns and in concert to destroy the enemy advance guard. Once the enemy has been thrown into chaos, the rear densely arrayed cavalry troops together come forth in great vigor, striking forth with irresistible force.⁸²

It’s impossible to know for sure, but it wouldn’t be surprising. Yongle’s willingness to place thin rows of gunnery units in the front lines of a battle against Mongol cavalry shows that he believed those gunners would offer enough fire to keep the cavalry at bay, which suggests volley fire, but the passage in the *Veritable Records* doesn’t in itself make a clear case for it.

Whatever the drilling regime the troops practiced, they didn’t get much of an opportunity to test it against the enemy, because this campaign didn’t manage to find the enemy.⁸³ Yongle led subsequent expeditions northward against the Mongols, in 1423 and 1424, but those, too, were futile. The Mongols had learned to avoid Ming guns and instead simply slip into the steppes, to reemerge later at a time and a place of their choosing.

On the last Mongolian campaign, in 1424, Yongle became depressed and died of illness in Chahar, Mongolia. The expedition returned to Beijing, bringing his body in a sealed tin coffin. His funeral was as ambitious as his military exploits, and thirty palace women committed suicide to accompany him in death.⁸⁴ His successors stopped making incursions into Mongolia and pulled out of Vietnam, which had adopted Ming weapons and ended up defeating Ming armies badly. They halted the great maritime voyages Yongle had undertaken. As the *Ming History* noted, “During

the Hong[xi] (1425) and Xuan[de] (1426–1435) reigns, [the Ming court] became accustomed to a routine and peaceful life.”⁸⁵ The peace was interrupted in 1449, when Yongle’s great grandson, Zhu Qizhen, the Zhengtong Emperor, tried reviving the practice of grand Mongolian expeditions but was captured by the Mongols, who then marched on Beijing.⁸⁶ Thanks to many guns and good leadership, the Mongols were driven off, with heavy casualties; sources suggest that the guns and other Ming weapons killed ten thousand Mongols.⁸⁷ By the mid 1450s, the Mongol threat had receded again, not to reappear in a serious way for another century.⁸⁸

China’s powerful guns had helped the Ming to create the world’s most powerful empire, unparalleled in military power, but it seems that the death of Yongle in 1424 also corresponded with the end of the period of rapid experimentation with guns and their administration. Indeed, Sinophone historians argue that China’s indigenous gun technology reached its apogee under Yongle. A set of regulations for firearm production and design that Yongle’s administration issued in 1414 formed the basic blueprint for Ming firearms production for the next century, “becoming the Ming Military production method for guns.”⁸⁹ In 1419, Yongle’s court issued a new regulation according to which “all military weapons, aside from those that are kept for exercise or in deployment must be placed in the [central] armories . . . and there is not allowed any kind of private manufacture.”⁹⁰ These two decrees can be taken to mark the end of China’s period as the global leader of firearms technology. In the mid-1400s, just as Ming innovation was slowing, Europeans entered a period of rapid gun development, and when in the early 1500s Portuguese arrived on the Chinese coast, Ming officials were fascinated by their guns and began adopting them rapidly, effectively, and creatively. As Kenneth Swope and others have argued, the structures that Yongle had set up – particularly the Firearms Commandery – played an important role in the rapid adoption of European guns during the 1500s.

NOTES

- 1 See, for example, Li Huguang, *Da Ming diguo zhanzheng shi: da Ming longquan xia de huoqi zhanzheng* (Nanjing: Fenghuang chubanshe, 2010); Wang Zhaochun *Shijie huoqi shi* (Beijing: Junshi kexue chubanshe, 2007), 103ff; Li Yue, “Ming dai huoqi de puxi,” MA Thesis, (Dongbei shifan daxue, 2012) 5ff and 92.
- 2 The most significant works in English include Kenneth Swope, “Crouching Tigers, Secret Weapons: Military Technology Employed during the Sino-Japanese-Korean War, 1592–1598,” *The Journal of Military History* 69.1 (2005), 11–41; Kenneth Swope, *A Dragon’s Head and a Serpent’s Tail: Ming China and the First Great East Asian War, 1592–1598* (Norman, OK: University of Oklahoma Press 2009); Kenneth Swope, *The Military Collapse of China’s Ming Dynasty, 1618–1644* (London: Routledge, 2014); Nicola Di Cosmo, “Did Guns Matter? Firearms and the Qing Formation,” in Lynn Struve, ed., *The Qing Formation in World-Historical Time* (Cambridge, MA: Harvard University Press, 2004), 121–66; Peter Lorge, *The Asian Military Revolution: From Gunpowder to the Bomb* (Cambridge: Cambridge University Press, 2008); Peter Lorge, “Development and Spread of Firearms in Medieval and Early Modern Eurasia,” *History Compass* 9.10 (2011), 818–26; Peter Lorge, *War, Politics, and Society in Early Modern China, 900–1795* (London: Routledge, 2005); Kenneth Chase, *Firearms: A Global History* (Cambridge: Cambridge University Press, 2003); Hans van de Ven, ed., *Warfare in Chinese History* (Leiden: Brill, 2000). In Chinese see especially Wang Zhaochun *Zhongguo huoqi shi* (Beijing: Junshi kexue chubanshe 1991); Wang Zhaochun, *Zhongguo kexue jishu shi: jun shi jishu juan* (Beijing: Junshi kexue chubanshe 1998); Wang Zhaochun, *Shijie huoqi shi* (Beijing: Junshi kexue chubanshe 2007); Huang Yi-Long, “Ming Qing du te fu he jinshupao de xingshuai,” *Qinghua xuebao*, 41.1 (2011), 73–136; Huang

- Yi-Long, “Ming Qing zhiji hongyi dapao zai dongnan yanhai de liubu jiqi yingxiang,” *Zhongyang yanjiuyuan ji lishi yuyan yanjiusuo jikan* 81.4 (2010), 769–832; Huang Yi-Long, “Ouzhou chenchuan yu Mingmo chuanhua de xiyang dapao,” *Zhongyang yanjiuyuan lishi huayan yanjiusuo jikan* 75.3 (2004), 573–634; Liu Xu, *Zhongguo gudai huoyao huoqi shi* (Zhengzhou: Daxian chubanshe, 2004); Li Huguang, *Da Ming diguo zhanzheng shi: da Ming longquan xia de huoqi zhanzheng* (Nanjing: Fenghuang chubanshe, 2010); Zheng Cheng, “Fagong kao: 16 shiji chuan Hua de Ou shi qian zhuang huopao jiqi yanbian,” *Ziran kexue shi yanjiu* 32.4 (2013), 504–22; Shi Kang (Kenneth Swope), “Ming-Qing zhanzheng zhong dapao de shiyong,” *Qing shi yanjiu* 2011.3, (2011), 143–9; Nan Bingwen, “Zhongguo gudai de niao chong yu Riben,” *Shixue jikan*, 1994.2 (1994), 60–66; Li Yue, “Ming dai huoqi de puxi,” MA Thesis, Dongbei shifan daxue, 2012; Xie Lihong, “Hongyi dapao yu Manzhou xingshuai,” *Manxue yanjiu*, 1994.2 (1994), 102–18; Feng Zhenyu, “Lun Folangji zai Mingdai de tuhua,” *Ziran bian zhengfa tongxun* 34.3 (2012), 57–62.
- 3 The Hongwu Emperor, “Treasure of the Prince of Yan,” from 1370, cited in Shih-shan Henry Tsai, *Perpetual Happiness: The Ming Emperor Yongle* (Seattle: University of Washington Press, 2001), 26.
 - 4 The Hongwu Emperor, “Treasure of the Prince of Yan,” from 1370, cited in Tsai, 26.
 - 5 Tsai, 28.
 - 6 *Ming shilu*, *Taizong shilu*, juan 3; David B. Chan, *The Usurpation of the Prince of Yen, 1398–1402* (San Francisco: Chinese Materials Center, Inc., 1976), 53.
 - 7 Many passages in the sources note his use of guns as signal devices, and on one occasion he had ordered a cavalry force to fire a hundred guns, but this was a scare tactic and a diversion. Once there is evidence that he considered firing guns at a recalcitrant city, but he evidently reconsidered. So guns appear not to have been a core arm used in his early campaigns.
 - 8 *Ming Veritable Records* juan 129, Hongwu 13, cited in Wang Zhaochun *Zhongguo huoqi shi*, 103.
 - 9 Chase, *Firearms*.
 - 10 See Tonio Andrade, “Maritime China in Global Military History: Some Reflections on the Chase Model,” in Kenneth M. Swope and Tonio Andrade, eds., *Early Modern East Asia: War, Commerce, and Cultural Exchange*, (London: Routledge, 2018); Kenneth Swope, “Review of Kenneth Chase, *Firearms*,” *Journal of the Economic and Social History of the Orient*, 47.2 (2004), 284–6; and Stephen Morillo, “Review of Chase, *Firearms*, and Lynn, *Battle*,” *Journal of World History* 15 (2004), 525–30.
 - 11 Tsai, *Eternal*, 55.
 - 12 My interpretation of this battle differs a bit from that of David B. Chan, 72ff.
 - 13 The *Ming shilu*, for example, which was approved by the Yongle Emperor himself, treats his defeat as a mistake caused by the disobedience of his soldiers, who didn’t listen to his careful instructions, and it also emphasizes his own role in saving himself from encirclement, rather than crediting the “barbarian cavalry” who, it seemed, really did save his skin, as well as crediting him with saving a soldier who’d lost his horse, sweeping the man under his arm and galloping to freedom. *Ming shilu*, *Taizong Shilu*, juan 6. <http://www.jjwxc.net/onebook.php?novelid=377293&chapterid=10> retrieved 2012-11-26.
 - 14 Gu Yingtai, “Yan wang qi bing.” *Mingshi jishi benmo*, juan 16.
 - 15 Gu Yingtai, juan 16.
 - 16 Gu Yingtai, juan 16.
 - 17 Gu Yingtai, juan 16.
 - 18 *Mingshi*, juan 5 (benji section, Chengzu 1).
 - 19 Tan Xisi, *Ming da zheng zuan yao*, juan 11, 28a, available at <http://catalog.hathitrust.org/Record/009448303>, retrieved 2012-11-27
 - 20 *Mingshi*, juan 144, liezhuan 32, Sheng Yong, Ping’an, etc.”
 - 21 Gu Yingtai, juan 16.
 - 22 Gu Yingtai, juan 16.
 - 23 *Mingshi*, juan 142, liezhuan 30, Biography of Tie Xuan.
 - 24 David B. Chan, 80.
 - 25 David B. Chan, 81.
 - 26 Wang Zhaochun, 101–3.

- 27 It isn't mentioned in Michael S. Neiberg, *Warfare in World History* (London: Routledge, 2001); or in Christon Archer, John R. Ferris, Holger H. Herwig, and Timothy H.E. Travers, *World History of Warfare* (Lincoln, USA: University of Nebraska Press, 2002); or in most Chinese history textbooks, or even in Xiaobing Li, ed., *China at War: An Encyclopedia* (Santa Barbara, USA: ABC-CLIO, 2012).
- 28 Sun Laichen, "Chinese Military Technology and Dai Viet: c. 1390–1497," Asia Research Institute Working Paper Series No. 11, September 2003, 10.
- 29 Wang Zhaochun, *Zhongguo huoqi shi*, 106.
- 30 Sun Laichen, "Chinese Military Technology and Dai Viet: c. 1390–1497," 4. Sun draws the information from the *Dai Viet su ky toan thu* (Tokyo: Tokyo Daigaku Toyo Bunka Kenkyujo, 1984–86), vol 1, 464. Also the *Kham dinh Viet su thong giam cuong muc* (Taipei: Guoli Zhongyang Tushuguan, 1969), vol 11, 12a [this says *huopao*, which, Sun says, was a nineteenth-century alteration].
- 31 Cited in Jung-Pang Lo, "Intervention in Vietnam: A Case Study of the Foreign Policy of the Early Ming Government," *Qinghua xuebao*, 8[1970], 154–85. Also see Kenneth M. Swope, "Causes and Consequences of the Ming Intervention in Vietnam in the Early Fifteenth Century," in Craig Clunas, Jessica Harrison-Hall, and Luk Yu-ping, eds., *Ming China: Courts and Contacts, 1400–1450* (London: The British Museum, 2016), 37–45.
- 32 This is the conclusion of Jung-Pang Lo.
- 33 Li Wenfeng, *Yue qiao shu*, unpublished manuscript, circa 1540, juan 2, "Shu zhao zhi chi," fo. 17v. Copy held in University of Michigan Libraries, available online through Hathi Trust Digital Library, <http://hdl.handle.net/2027/mdp.39015082430755>, retrieved 2012-10-22. I learned about this source through the work of Sun Laichen but was so intrigued I had to see it for myself.
- 34 Li Wenfeng juan 2, "Shu zhao zhi chi," fo. 17v.
- 35 Li Wenfeng, fo. 18v.
- 36 *Ming shilu*, *Yongle shilu*, juan 56, Yongle 4, Month 7, Day 4 (18 Jul 1406). Geoff Wade's otherwise excellent translation of this passage leaves out an "and others." See *Ming shilu Taizong shilu*, juan 56. Geoff Wade, translator, "Southeast Asia in the Ming Shi-lu: an open access resource," Singapore: Asia Research Institute and the Singapore E-Press, National University of Singapore, <http://epress.nus.edu.sg/msl/entry/902>, accessed October 17, 2012. But the names of other firearms generals appear elsewhere in the documents about the invasion. See Wang Zhaochun, 110, citing the *Mingshi jishi benmo*, juan 22; and, of course, Sun Laichen, who suggests that there were at least four firearms generals on the expedition. Sun Laichen, "Chinese Military Technology and Dai Viet: c. 1390–1497," 6.
- 37 *Ming shilu*, *Taizong shilu*, juan 60, Yongle 4, Month 10, Day 10 (20 Nov 1406), Geoff Wade, translator. <http://epress.nus.edu.sg/msl/entry/860>, retrieved October 17, 2012.
- 38 This is from Li, *Yue qiao shu*, juan 6, fol 6b and vol 10, fo 6b, cited in Sun Laichen, "Chinese Military Technology and Dai Viet: c. 1390–1497," 7.
- 39 *Ming shilu*, *Taizong shilu*, juan 62, Yongle 4, Month 12, Day 11. My translation is a bit different from Geoff Wade's. See *Ming shilu*, *Taizong shilu*, juan 62, Yongle 4, Month 12, Day 11 (19 Jan 1407), Geoff Wade, translator, <http://epress.nus.edu.sg/msl/entry/928>, retrieved October 17, 2012. Cf Wang Zhaochun 110.
- 40 *Dai Viet su ky toan thu* [Complete Book of the Historical Record of Dai Viet], cited in Sun Laichen, "Chinese Gunpowder Technology and Dai Viet, ca 1390–1497," in Nhung Tuyet Tran and Anthony Reid, eds., *Viet Nam: Borderless Histories* (Madison, USA: University of Wisconsin Press, 2006), 72–120, 79.
- 41 Rob S. Rice, Simon Anglim, Phyllis Jestice, Scott Rusch, and John Serrati, *Fighting Techniques of the Ancient World (3000 B.C. to 500 A.D.): Equipment, Combat Skills, and Tactics* (New York: Macmillan, 2003), 126.
- 42 *Ming shilu*, *Taizong shilu*, juan 62, Yongle 4, Month 12, Day 11. My translation is a bit different from Geoff Wade's. See *Ming shi lu*, *Taizong shi lu*, juan 62, Yongle 4, Month 12, Day 11 (19 Jan 1407), Geoff Wade, translator, <http://epress.nus.edu.sg/msl/entry/928>, retrieved October 17, 2012. Cf. Wang Zhaochun 110.
- 43 Sun Laichen, "Chinese Gunpowder Technology and Dai Viet, ca 1390–1497," 79.

- 44 Sun Laichen, “Chinese Military Technology and Dai Viet: c. 1390–1497,” 7–8. Sourcing is from Li, *Yue qiao shu*, juan 6, p. 7a, juan 10, 7b–8a; *Ming shilu*.
- 45 Li Wenfeng, *Yue qiao shu*, juan 10, fo. 17r, cited in Sun Laichen, “Chinese Gunpowder Technology and Dai Viet, ca 1390–1497,” 80.
- 46 Sun Laichen, “Chinese Gunpowder Technology and Dai Viet,” 80.
- 47 *Ming shilu*, *Taizong shilu*, juan 71, Yongle 5, Month 9 (5 October 1407). Geoff Wade, translator. <http://epress.nus.edu.sg/msl/entry/1057>, accessed November 29, 2012.
- 48 *Ming shilu*, *Taizong shilu*, juan 71, Yongle 5, Month 9 (5 October 1407). Geoff Wade, translator. <http://epress.nus.edu.sg/msl/entry/1057>, accessed November 29, 2012.
- 49 Sun Laichen, “Chinese Military Technology and Dai Viet: c. 1390–1497,” 14–15.
- 50 Sun Laichen, “Chinese Gunpowder Technology and Dai Viet, ca. 1390–1497,” 92.
- 51 Shen Defu, *Wanli yehuo bian* 3 vols. (Beijing: Zhonghua Shuju, 1997), vol. 2, 433, cited in Sun Laichen, “Chinese Military Technology and Dai Viet: c. 1390–1497.”
- 52 *Ming shi lu*, *Taizong shilu*, juan 71, Yongle 5, Month 9 (5 October 1407). Geoff Wade, translator. <http://epress.nus.edu.sg/msl/entry/1057>, accessed November 29, 2012.
- 53 Sun Laichen, “Chinese Military Technology and Dai Viet: c. 1390–1497,” 14–15.
- 54 Sun Laichen, “Chinese Military Technology and Dai Viet: c. 1390–1497,” 14.
- 55 Wang Zhaochun *Zhongguo huoqi shi*, 106; Liew Foon Ming, *The Treatises on Military Affairs of the Ming Dynastic History (1368–1644), Part I* (Hamburg: Gesellschaft für Natur- und Völkerkunde ostasiens e. V., 1998), 349.
- 56 *Mingshi*, “Bing 4,” cited in Wang Zhaochun, *Zhongguo huoqi shi*, 104.
- 57 See Wang Zhaochun, *Zhongguo huoqi shi*, 104–105.
- 58 Jack Kelly, *Gunpowder: Alchemy, Bombards, and Pyrotechnics: The History of the Explosive That Changed the World* (New York: Basic Books, 2004), 48.
- 59 Jack Kelly, 48.
- 60 Liew Foon Ming, 349.
- 61 See Wang Zhaochun *Zhongguo huoqi shi*, 100–101.
- 62 These chips are discussed in various military manuals, such as the most famous Ming manual of all, Qi Jiguang’s mid-sixteenth century *Jixiao xinshu*. See Qi Jiguang, *Ji xiao xin shu: shi si juan ben* (Beijing: Zhonghua shuju, 2001). Wang Zhaochun believes, based on production quota data, that they were used in the early Ming as well. Wang Zhaochun, *Zhongguo huoqi shi*, 101.
- 63 There were even songs for the making of gunpowder, in the *huo long jing*, toward the very end. To my knowledge there’s no example of a gun-loading song from the Yongle period, but we can see what one might have been like by looking at a song from the mid-Ming period, from a military manual cited above. See Tonio Andrade, “The Arquebus Volley Technique in China, c. 1560: Evidence from the Writings of Qi Jiguang,” *Journal of Chinese Military History* 4.2 (2015), 115–41.
- 64 *Ming shilu*, *Taizong shilu*, juan 144, cited in Wang Zhaochun, *Zhongguo huoqi shi*, 104.
- 65 Chase, 44. Tsai, 168–170 (Tsai suggests that guns were not used until the second expedition, writing that in it Yongle “made use of prototype cannons and also blunderbusses” (171); W. Franke, “Yonglo’s Mongolei-Feldzüge,” *Sinologische Arbeiten* 3[1945]: 375–428, 379–81. Also see Henry Serruys, “The Mongols in China,” *Monumenta Serica* 27 (1968), 233–305.
- 66 *Ming shi*, juan 154, liezhuan 42.
- 67 *Ming shilu*, *Taizong shilu*, Yongle 8, Month 6, dingwei day (13 July 1410), juan 105.
- 68 Tsai, 170.
- 69 Cited in W. Franke, 375–428, 389.
- 70 W. Franke, 375–428, 392.
- 71 Tsai, 171.
- 72 Jin Youzi, “Bei zheng lu,” one juan. <http://www.guoxue123.com/other/gcdg/gcdg/020.htm>, retrieved 2012-11-30.
- 73 Jin Youzi, “Bei zheng lu.” <http://www.guoxue123.com/other/gcdg/gcdg/021.htm>, retrieved 2012-10-29.
- 74 Wang Zhaochun, *Zhongguo huoqi shi*, 110.
- 75 On volley fire and the European military revolution, see Geoffrey Parker, *The Military Revolution: Military Intervention and the Rise of the West*. 2nd ed. (Cambridge: Cambridge

- University Press, 2008), 20; Geoffrey Parker, *The Cambridge Illustrated History of Warfare: The Triumph of the West* (Cambridge: Cambridge University Press, 2008), 391; Michael Roberts, cited in David Eltis, *The Military Revolution in Sixteenth-Century Europe* (New York: Barnes & Noble, 1998), 8.
- 76 Wang Zhaochun *Zhongguo huoqi shi*, 109–10; Sun Laichen, “Military Technology Transfers from Ming China and the Emergence of Northern Mainland Southeast Asia (c. 1390–1527),” *Journal of Southeast Asian Studies* 34.3 (2003), 495–517, 500.
- 77 See Tonio Andrade, *The Gunpowder Age: China, Military Innovation, and The Rise of the West in World History* (Princeton, NJ: Princeton University Press, 2015), chapter 11.
- 78 Jin Youzi “Bei zheng lu.” <http://www.guoxue123.com/other/gcdg/gcdg/021.htm>, retrieved 2012-10-29.
- 79 Chase, *Firearms*, 44–5.
- 80 Wang Zhaochun *Zhongguo huoqi shi*, 110.
- 81 *Ming shilu*, *Taizong shilu*, juan 262, Yongle 21, Month 8, bingyin day (22 September 1423). Sinophone historians have interpreted this passage as indicating the use of volley fire. Wang Zhaochun, for example, writes, “The meaning of this is that when fighting, the shen ji qiangs and pao troops line up in front of the entire formation, and between them there must be a certain amount of space, so that they can load bullets and powder, and employ shooting by turns and in concert, to destroy the enemy advance guard. Once the enemy has been thrown into chaos, the rear densely arrayed cavalry troops together come forth in great vigor, striking forth with energy to topple mountains and turn over oceans.” Wang Zhaochun *Zhongguo huoqi shi*, 110.
- 82 Wang Zhaochun *Zhongguo huoqi shi*, 110.
- 83 Tsai, 173.
- 84 Tsai, 176–7.
- 85 See *Ming shi*, “Military Treatise I,” translated by Liew, Foon Ming.
- 86 The best English-language account of this episode is still Frederick W. Mote, “The T’u-Mu Incident of 1449.” In Frank Algerton Kierman and John King Fairbank, eds., *Chinese Ways in Warfare* (Cambridge, MA: Harvard University Press, 1974), 243–72.
- 87 Wang Zhaochun *Zhongguo huoqi shi*, 111.
- 88 Frederick W. Mote, 268.
- 89 Wang Zhaochun, *Zhongguo huoqi shi*, 89.
- 90 *Ming shilu*, cited in Wang Zhaochun, *Zhongguo huoqi shi*, 88.