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Research Note

THE OLDEST REPRESENTATION OF A BOMBARD

LU GWEI-DJEN, JOSEPH NEEDHAM, AND
PHAN CHI-HSING

An outstanding discovery was made by Robin Yates in June 1985, when visiting the Buddhist cave temples at Ta-tsu¹ (Dazu) in Szechuan, about 250 kilometers northwest of Chungking (see fig. 1; all superscript numerals refer to Chinese characters in fig. 1). In the Pei-shan² (Lung-Kang)³ complex (one of seven), he found in cave no. 149 a high-relief sculpture of a bombard held by a small demon with two horns.^a (See fig. 2.) The bombard or handgun is being let off, as appears from the blast issuing to the right from its muzzle, and a projectile is also represented in the flames^b (fig. 3). This was mentioned as appendix A in *Science and Civilisation in China*, volume 5, part 7.^c

There was, however, a great deal of uncertainty about the date, so this article's authors paid a second visit to the cave in November 1986. We now had the advantage of the full description of the cave temples in the *General Catalogue of the Stone-Carvings of the Ta-tsu Cave-Temples*, issued by the Szechuan Social Sciences Academy at Chungking in 1985.^d The result of our investigations, reported here, was a full confirmation of the original interpretation of Yates. The sculpture is indeed that of a bombard, and the date must be as early as A.D. 1128.

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^aThe original attribution was thought to be cave no. 146, but this was found to be clearly wrong. Robin Yates's visit was rather hurried, and he could provide us only with the photography reproduced as fig. 235 of Joseph Needham, *Science and Civilisation in China* (hereafter SCC), vol. 5: *Chemistry and Chemical Technology*, pt. 7: *Military Technology: The Gunpowder Epic* (Cambridge, 1986).

^bThis ball is half broken off, as if the high relief had come away, so that the ball now appears as a disc.

^cSCC, *Military Technology*, pp. 580–81.

^d*Ta-tsu Shih Kho Nei Jung Tsung Lu*.

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- | | | | |
|----|-----------|----|------|
| 1 | 大足 | 19 | 王子儀 |
| 2 | 北山 | 20 | 郭慶 |
| 3 | 龍崗 | 21 | 李湖從 |
| 4 | 天神像 | 22 | 乙卯 |
| 5 | 風神 | 23 | 己卯 |
| 6 | 雷神 | 24 | 呂伯虎 |
| 7 | 觀音自在如意輪菩薩 | 25 | 武經總要 |
| 8 | 神將 | 26 | 火龍經 |
| 9 | 任宗易 | 27 | 地霜 |
| 10 | 知軍州事 | 28 | 馬志 |
| 11 | 杜慧修 | 29 | 開寶本草 |
| 12 | 為一方瞻仰 | 30 | 唐慎微 |
| 13 | 干戈永息 | 31 | 證類本草 |
| 14 | 開封 | 32 | 蘇頌 |
| 15 | 金 | 33 | 本草圖經 |
| 16 | 楊起之 | 34 | 西溪叢話 |
| 17 | 何志升 | 35 | 姚寬 |
| 18 | 何長文 | 36 | 烏場 |

FIG. 1.—List of Chinese characters



FIG. 2.—The demon carrying the bombard, with its flames and ball issuing forth. (Cave temples photo.)

The bearer of the bombard is at the bottom on the right of a group of nineteen statuettes of cloud-treading personages (*thien shen hsiang*),⁴ of whom at least eight are holding weapons: one a bow and arrows, another a battle-ax, another a halberd, another a mace or war-hammer, while others bear straight two-edged swords (fig. 4). Others seem to be military officials. Some flags are also to be seen. Some figures appear to be robed saints, but six of them have horns and look like devils, with skull or demon faces. All this is on the right-hand wall of the shrine, while on the left there is a similar group of figures in three ranks, eighteen images in all, of which ten are bearing weapons and three have devil faces (fig. 5).

It was here that one of us (Lu Gwei-Djen) made an important discovery. The parallel figure on the left of the lowest rank, directly opposite the bearer of the bombard, is a figure holding a bomb in his right hand.^e (See fig. 6.) This gives us an important assurance that gunpowder is definitely in the picture. The assistant curator, who accompanied us, was quite sure that in modern times the bearer of the bombard was called by the local people Fêng Shen⁵ (the god of the winds), while his opposite on the left-hand wall was known as Lei Shen⁶ (the god of thunder)—but these names would not have been totally unsuitable for the weapons portrayed.

^eThe bomb and grenade were commonplace by A.D. 1000. *SCC, Military Technology*, pp. 161 ff.



FIG. 3.—A close-up of the depiction of flames coming from the bombard and the projectile itself, probably originally seen in relief but now only a flat disc. Perhaps it was put in as an afterthought. (Cave temples photo.)

The object of greatest interest to us here seems at first sight to be some sort of musical instrument, with the right hand of the figure plucking the strings. But a closer look makes out the flames coming from the muzzle and even the spherical, bore-occluding ball or bullet among them. Of course, the high-relief sculpture cannot have been done by anyone who knew anything about bombards or handguns, because the explosion chamber would have been much too hot to hold, and usually there was a socket cast on behind it, into which a wooden “tiller” was fitted for grasping. On the other hand, the bombards depicted in the Bodleian manuscript of Walter de Milamete in A.D. 1327 do not have any sockets either, only the great thickening of metal over the explosion chamber that makes them look closely like the bombard represented in the cave.^f (See figs. 7 and 8.) The bulbous shape of the thickened metal wall around the explosion chamber is too characteristic of these early gunpowder weapons to be mistaken. Such vase-shaped, or bulbous, guns are all very archaic.^g The oldest Chinese handgun (the one excavated in Heilungkiang province) dates from A.D. 1288,^h and the fact that it is only very slightly bulbous may well argue a long prior continuous development. Therefore, we may

^fIbid., pp. 287 ff.

^gDiscussed in *ibid.*, pp. 325 ff; cf. 316, 326, 327, 328.

^hIbid., p. 293.



FIG. 4.—Part of the group of nineteen figures on the right-hand wall (as seen from the front of the cave), with the bombard demon at the right in the bottom row. (Cave temples photo.)

well have here the oldest representation in the world of a bombard or handgun, using the propellant power of high-nitrate gunpowder similar to the larger bombards and primitive cannon that came afterward.

It now remains to describe the cave as a whole. The front is quite open, and the cave forms three sides of a square, 3.4 meters high, 3.22 meters wide, and 3.4 meters deep. The main figure at the back is the goddess Kuan-Yin (Avalokitésvara), “she of the Talismanic Wheel, and the pearl, denoting the answering of every prayer” (*Kuan-Yin tzu-tsai ju-i-lun Phu-Sa*).^{7,i} The main goddess figure is flanked to left and right by two other images of the same goddess or bodhisattva, all having aureoles on their heads and facing west. Behind the main statues, four spiritual generals (*shen Chiang*)⁸ are portrayed as small figures (fig. 9).

Also at the back, on the left, is the donor’s tablet, dated at 1128, and a statuette of the donor himself, Jen Tsung-I,⁹ who was military administrator of the prefecture (*Chih chün Chou Shih*).¹⁰ He is dressed as a civil official and has on his right-hand side a small boy, his son. His wife, Tu Hui-Hsiu,¹¹ stands on the right of the goddess and has

ⁱW. E. Soothill and L. Hodous, *A Dictionary of Chinese Buddhist Terms* (London, 1937); E. J. Eitel, *Handbook of Chinese Buddhism; Being a Sanskrit-Chinese Dictionary . . .*, 1st ed. (Hong Kong, 1870); rev. and enlarged 2d ed. (Hong Kong, 1888); addition of Chinese index by K. Takakura (Tokyo, 1904); photographic facsimile repr. of Tokyo ed. (Amsterdam, 1970).



FIG. 5.—Part of the group of eighteen figures on the left-hand wall (as seen from the front of the cave). The demon with the bomb (see fig. 6) is just off to the bottom left, paralleling the position of the one carrying the bombard. (Author photo.)

on her left a girl, presumably her daughter.^j In an accompanying tablet, she says that she was herself a sinful person, but that she was devoted to the Buddha. Both say that the cave was carved for people to visit, admire, and respect forever (*wei i fang chan yang*)¹² with the ardent prayers of the two founders for permanent peace, “that weapons of war be forever stilled” (*kan ko yung hsi*).¹³

One has to understand the significance of the date. It was just after the time when the Sung dynasty and people had to cross the River to the South, the capital Khaifêng¹⁴ having fallen to the Jurchen

^jThese two figures can be seen on the left of fig. 235 in *SCC, Military Technology*.



FIG. 6.—The demon carrying the bomb. Smoke from its fuse is visible over his left shoulder. (Cave temples photo.)

Chin¹⁵ forces in 1126. A glance at historical atlases shows that this part of Szechuan still remained (and was destined to remain until Mongol times) part of the Southern Sung empire. But all this raises the question of what the object was of having the thirty-seven personages to the right and left on the walls of the cave carry weapons? Presumably they were meant to depict the many forms of warlike weaponry that the founders prayed would be forever stilled. This is perhaps more likely than the idea that comes most obviously to mind, namely, that all these were spirit guards defending the goddess Kuan-Yin. As for Jen Tsung-I himself, we have not been able to find the



FIG. 7.—The earliest depiction of a bombard (A.D. 1327) known until now, from a Bodleian Library manuscript of Walter de Milamete's *De Nobilitatibus, Saoientis at Prudentis Regum*. A knight in full armor is applying a red-hot poker to the touchhole in a gingerly manner. The bombard is shooting forth an arrow, just as the earlier fire lances of China used to do, and there is no cast-on socket for a tiller. (Author photo.)

exact dates of his birth and death or any other information about him.

Other, later, dates are given in inscriptions carved on the front of the cave by those who came there to spend the hot summer days in meditation. Thus, one says that Yang Chhi-Chih,¹⁶ Ho Chih-Shêng,¹⁷ Ho Chhang-Wên,¹⁸ and Wang Tzu-I,¹⁹ together with five others, nine in all, did this in 1187. Another inscription says that Kuo Chhing²⁰ and his father and Li Su-Tsung,²¹ three altogether, spent two days of the summer heat in this cave. The inscription is not very easy to read, and if the date is an i-mao²² year, then it means either 1135 or 1195, while if it is a chi-mao²³ year, it means 1159. Similarly, on the adjoining cave, no. 150, there is an inscription saying that Lü Po-Hu²⁴ from Honan and four others did the same thing in 1186. Thus none of these inscriptions takes us out of the 12th century, and much time



FIG. 8.—Another picture from Walter de Milamete's manuscript. Here also the bombard is laid on some kind of trestle table, but three knights accompany the one with the red-hot poker. (Author photo.)

had yet to elapse before the dating of the oldest archaeologically excavated handgun at 1288. As for the dating of the Pei-shan cave temples as a whole, it is generally accepted that they were started during the Thang period (618–906) and ended in the Southern Sung (1127–1279).^k

So the experts were quite right in their conviction that the sculptures were of the early 12th century.^l How, then, can one explain the period of some century and a half that separates the two events? One possibility is that bombards like that in the carving were kept as a state secret in the arsenals of the Southern Sung for a century or so. Or again, it may well be that not enough high-nitrate gunpowder was

^k*The Stone Sculptures of Ta-tsu (Dazu)* (Chungking, 1982).

^lYang Chia-Lo, *Ta-Tsu Thang Sung Shih Kho* [*The Thang and Sung rock-carved (temples) at Ta-tsu (Szechuan)*] (Taipei, 1968); *Ta-Tsu Shih Kho* [*The stone-carvings (in the cave temples) of Ta-tsu (Szechuan)*] (Chhêngtu, 1962).



FIG. 9.—The main figures at the back of the cave. The three bodhisattva statues are backed by the four spiritual generals, and the statues of the donor, Jen Tsung-I, and his wife, Tu Hui-Hsiu, are seen at the left and right, respectively. (Author photo.)

available to make the use of the bombard really practicable on a large scale. Thus it is perhaps significant that the data for gunpowder compositions in the *Wu Ching Tsung Yao*²⁵ of 1044 never show a nitrate content of much more than 50 percent, while the *Huo Lung Ching*²⁶ data of 1350 have many examples of 75 percent and above.^m Until this proportion was reached, gunpowder could not fully exert its propellant power, so it is quite possible that the idea of the bombard preceded the possibility of its realization except on a small scale.

Perhaps another reason for the slow development of the projectile-throwing bombard was the conquest of most of the saltpeter-producing regions of China by the Jurchen Tartars.ⁿ The saltpeter appeared as an efflorescence (*ti shuang*)²⁷ on the ground in various places, as described by Ma Chih²⁸ in the *Khai-Pao Pên Tshao*²⁹ (973) or Thang Shen-Wei³⁰ in the *Chêng Lei Pên Tshao*³¹ (1083) or Su Sung³² in the *Pên Tshao Thu Ching*³³ of 1061. This last reference refers to a place

^mSCC, *Military Technology*, pp. 346, 352.

ⁿJoseph Needham, *Science and Civilisation in China*, vol. 5: *Chemistry and Chemical Technology*, pt. 4: *Spagyric Discovery and Invention: Apparatus, Theories and Gifts* (Cambridge, 1980), pp. 189 ff.

in Chekiang (pp. 192–93), but the others mention southwestern Hupei, Shantung, Honan, Shensi, Heilungkiang, and Liaoning, most of which were conquered by the Chin as they pressed south. If, then, there was a shortage of saltpeter in the Southern Sung domains, that could account for the failure to produce adequate amounts of high-nitrate gunpowder suitable for use with projectile-throwing bombards.

The lack of saltpeter might also be due to the comparative absence of animal husbandry in China. The European farming economy relied heavily on stock raising, and animal excreta were the chief source of manure. Saltpeter was derived in Europe from the mineralization of the nitrogen in the urine and excreta of animals in byres and stables, in manure heaps called niter-beds. By contrast, animals played a much more minor role in the Chinese agricultural economy, though manure from pigs was important. This was partially made up for by the universal use of human excrement.⁹ We have found only one reference to niter-beds in Chinese literature, in the *Hsi Chhi Tshung Hua*³⁴ by Yao Khuan³⁵ in 1150.^p It refers to a foreign country, Udyāna (Wuchhang),³⁶ a region in the Himalayan mountains near the western end of the tributary headwaters of the Indus.^q So the suggestion is at hand that in China people relied more on the naturally occurring efflorescences and less on the production of saltpeter from animal manure.

Last, one might readily ask of what material the Ta-tsu bombard was made. In *Science and Civilisation in China*, volume 5, part 7, table 1, pp. 290 ff., a number of cast-iron guns and bombards are mentioned, including several from the 14th century. One would naturally think that cast iron would be much too brittle for a gun or a bombard, but it was shown recently that, from the Warring States and Han onward, the Chinese knew how to make malleable cast iron. This is very much tougher and would be more suitable for the present purpose. The secret was the annealing of the metal for a week or so, whereupon subtle metallographic changes occur, so that the properties of the cast iron become quite different. This has been suggested already,^r but perhaps the point is worth making again here. So the bombard in our sculpture easily could have been made of malleable cast iron, if not of bronze.

⁹Francesca Bray, *Science and Civilisation in China*, vol. 6: *Biology and Biological Technology*, pt. 2: *Agriculture* (Cambridge, 1984), pp. 289 ff.

^pSCC, *Spagyric Discovery and Invention*, p. 188.

^qIbid., fig. 1531a; cf. Joseph Needham, *Science and Civilisation in China*, vol. 4: *Physics and Physical Technology*, pt. 3: *Civil Engineering and Nautics* (Cambridge, 1971), p. 197. Modern names for the country include Swat and Chitral.

^rSCC, *Military Technology*, pp. 315, 339.

In the end, perhaps the most important thing that the Ta-tsu bombard demonstrates is the length of time between its invention and its transmission to Europe. It has always seemed rather strange that only thirty-nine years elapsed between the oldest metal-barrel bombard or handgun known in China and its transmission to the Western world. But now the space of time is more like 199 years—a much more reasonable period as these things went in the Middle Ages.⁵

⁵This point has also been made in an article by Robert K. G. Temple, "Bang Goes a Gunnery Date," *London Sunday Times*, March 1, 1987, p. 28.