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**On the Design of a “Trebuchet”  
in the Tangut Manuscript of IOM, RAS**

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*Abstract:* The paper focuses on a unique Tangut manuscript (Tang. 46 inv. No. 156(2006), old inv. No. 5217) kept in the Institute of Oriental Manuscripts, Russian Academy of Sciences. In previous studies, it has been taken to be a constructional diagram of musical instrument. The writer concludes that the manuscript is the design for a *pao* 砲 (stone launcher, trebuchet, sling).

*Key words:* Tangut manuscript, Tangut script, Institute of Oriental Manuscripts, stone launcher, Khara-Khoto

A unique Tangut manuscript Tang. 46 inv. No. 156(2006), old inv. No. 5217 is kept in the Institute of Oriental Manuscripts, Russian Academy of Sciences. In previous studies, it has been taken to be a constructional diagram of musical instrument. Here, we translate the whole text and conclude that the document describes the design for a trebuchet, or sling (*pao* 砲).

### 1. Outline of the Material

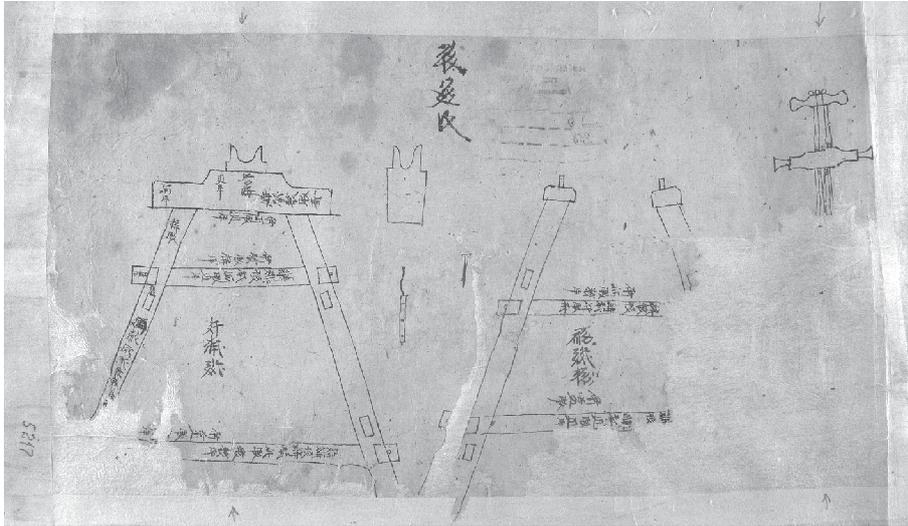
In the catalogue of the Tangut manuscripts and block prints published in 1963 the Tangut manuscript in question has been described as “no title. A drawing of a musical instrument.” The description of the material is as follows: “Manuscript. Scroll. 28×67(cm). In satisfactory condition (reconstructed). Three illustrations on one side of a piece of paper; right — the remaining half of the upper part of the neck of a musical instrument (the lower right part of the instrument being broken). According to the glyph, it is probably a two-stringed musical instrument. The depiction of the body consists of two variants for different sides. Each dimension is recorded in detail in the diagram. Sample illustrations of the nail and clamp for stability are drawn in the center of the plan. It is presumed that it is the name of the musical instrument which is written on the verso of the piece of paper in hard cursive handwriting”.<sup>1</sup>

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<sup>1</sup> GORBACHIOVA, KYCHANOV 1963, 113.

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Scholars have agreed on the above view until recent years. The catalogue of the exhibition held in Kyoto National Museum in 2009 describes it as “stringed instrument. Paper, Indian ink, 12th c., 34.0×76.7 cm”.<sup>2</sup> The manuscript is now kept in the Institute of Oriental Manuscripts, Russian Academy of Sciences under the shelf number Tang. 46, inv. No. 156(2006), old inv. No. 5217.”

According to my measurements, the original size of the document is 29.8×73.4 cm. The thick paper is of fine quality but the edge of the paper is covered with newer paper. Since both sides of the paper have been discolored by the sun, the color of it is nearly ecru. Old and new numbering for the material, to wit “Tang. 46, inv. 156(2006g.), st. inv. 5217”, are recorded on the upper right part of the paper.

## 2. Design and Tangut Scripts

The document contains three figures which we call A, B, and C from right to left. A is lacking the whole of the bottom part. B lacks more than half of the right side and the bottom part, while C lacks the extreme left and bottom part. The length of the broken parts in A, B, and C is 4.1 cm, 9.1 cm and 7.3 cm respectively.

<sup>2</sup> KYOTO NATIONAL MUSEUM 2009, 113.



A sketch of three pieces has been drawn between B and C. We call them D, E and F from the top. They measure; D: 4.8 cm, E: 2.2 cm, F: 4.8 cm in height. Part D runs through the top of C.

Tangut writing appears on both sides of the paper. There are three Tangut characters in the blank area between figures B and C (hereafter, X01) on the recto. X01 is located in the top middle and could be the title (or name) of the design. Every character in X01 is about 1.8×2.0 cm. All the texts in the manuscript run vertically along the parts of the diagrams. Figure A now has no text, although it is possible that there were originally some notes on it. This figure indicates the position of the texts.

The size of the Tangut characters for B1 and C1 is 1.5×1.5 cm. The size of the others is 0.9×0.7 cm on average. The large characters on the recto (three lines) are in cursive. From right to left, we shall call them Y01, Y02 and Y03. Y01 and Y02, the size of which is 8.0×7.0 cm per character, are lacking one or two characters at the bottom. Y02 appears to be the same as X01. In other words, it probably refers to the overall title of the design. Y03 consists of only one character, which is smaller than each character of Y01 and Y02 (6×5 cm).

### 3. Text and Translation

We show the Tangut scripts, phonetic transcriptions and translation of text with notes in the order X, B, C, and Y. ‘?’ means unknown or indefinite. ‘□’ means supposition by the author. Many terms appear to be loan words from Chinese or a phonetic transcription of Chinese. We show the Chinese characters with near phonetic reconstructions. (LiXXXX) in the notes means the code number of the Tangut script, recorded by Li Fanwen.<sup>3</sup>

X01

且 橐 悲

<sup>2</sup>a: <sup>1</sup>weq2 <sup>2</sup>phyo

A-WE? sling? (鴉? 鴉? 砲?)

B01

蚤 桂 接

<sup>1</sup>cyen <sup>1</sup>a? <sup>2</sup>nyeq<sup>2</sup>

Front (正一面)

B02

枢 忙 𪛗 教 𪛗

<sup>1</sup>ka <sup>1</sup>ldyIr <sup>2</sup>tshya <sup>1</sup>soq <sup>1</sup>tshywin

Distance- four *chi*, and three *cun* (間隔四尺三寸)

B03

椽 欣 槍 捩 袴 恍 𪛗 韓

<sup>2</sup>hwe <sup>1</sup>shyeu <sup>1</sup>ko:n <sup>2</sup>gu <sup>1</sup>jo: <sup>1</sup>cheu: <sup>2</sup>tshyan <sup>1</sup>kwI

Hui zhi guang (會枝枕) Both length- six and a half *chi* (共長六尺半)

B04

枢 葆 𪛗

<sup>1</sup>ka <sup>1</sup>sha:q <sup>2</sup>tshya

Distance- seven *chi* (間隔七尺)

<sup>3</sup> LI FANWEN ed. 1997 (Rev 2008).

## B05

皐輔槍捩袴肛髒肛嬭

<sup>1</sup>hya <sup>2</sup>chye <sup>1</sup>ko:n <sup>2</sup>gu <sup>1</sup>jo: <sup>1</sup>'a:r <sup>2</sup>tshya <sup>1</sup>'a:r <sup>1</sup>tshywin

*Xia zhai guang* (下寨枕) Both length- eight *chi*, and eight *cun*  
(共長八尺八寸)

## C01

牧喬接

<sup>1</sup>pi: <sup>2</sup>'a <sup>2</sup>nyeq'2

Front to PI (pi與面)

## C02

捩袴教髒韓

<sup>2</sup>gu <sup>1</sup>jo: <sup>1</sup>soq <sup>2</sup>tshya <sup>1</sup>kwI

Both length- three and a half *chi* (共長三尺半)

## C03

樽數

<sup>2</sup>tha <sup>1</sup>tin

Iron *deng* (鐙 鐙)

## C04

肛嬭

<sup>1</sup>'a:r <sup>1</sup>tshywin

Eight *cun* (八寸)

## C05

忙嬭

<sup>1</sup>ldyIr <sup>1</sup>tshywin

Four *cun* (四寸)

## C06

樞岐髒肛嬭

<sup>1</sup>ka <sup>1</sup>leu <sup>2</sup>tshya <sup>1</sup>'a:r <sup>1</sup>tshywin

Distance- one *chi* and eight *cun* (間隔一尺八寸)

## C07

樞教髒瓊嬭

<sup>1</sup>ka <sup>1</sup>soq <sup>2</sup>tshya <sup>1</sup>nyI' <sup>1</sup>tshywin

Distance- three *chi* and two *cun* (間隔三尺二寸)

C08

沮輔槍袴忙髑肛嬖

<sup>1</sup>sho:n <sup>2</sup>chye <sup>1</sup>ko:n <sup>1</sup>jo: <sup>1</sup>ldyIr <sup>2</sup>tshya <sup>1</sup>a:r <sup>1</sup>tshywin*Shang zhai guang* (上寨枕) Length- three *chi* and eight *cun*  
(長さ四尺八寸)

C09

玠髑

<sup>1</sup>nyI' <sup>2</sup>tshyaTwo *chi* (二尺)

C10

教嬖

<sup>1</sup>soq <sup>1</sup>tshywinThree *cun* (三寸)

C11

玠髑

<sup>1</sup>nyI' <sup>2</sup>tshyaTwo *chi* (二尺)

C12

忙饗愿袴紳髑紳□

<sup>1</sup>ldyIr <sup>2</sup>byeq <sup>1</sup>shyin <sup>1</sup>jo: <sup>2</sup>aq <sup>2</sup>tshya <sup>2</sup>aqFour pillar's length- ten *chi* and ten? (四弦身長十尺十…)

C13

枢葆髑□嬖

<sup>1</sup>ka <sup>1</sup>sha:q <sup>2</sup>tshya <sup>1</sup>tshywinDistance- seven *chi* and ...*cun* (間隔七尺…寸)

C14

阜輔槍捩袴庠髑萑教嬖

<sup>1</sup>hya <sup>2</sup>chye <sup>1</sup>ko:n <sup>2</sup>gu <sup>1</sup>jo: <sup>1</sup>gwyI' <sup>2</sup>tshya <sup>1</sup>woq <sup>1</sup>soq <sup>1</sup>tshywin*Xia zhai guang* (下寨枕) Both length- a little more than nine *chi* and three *cun* (共長九尺強?三寸)

Y01

臥? 坐? 蟬?

<sup>1</sup>bI: <sup>2</sup>T? <sup>1</sup>weEnemy? defense? (敵?防?擊?)

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Y02

且 橦 悲

<sup>2</sup>'a: <sup>1</sup>weq2 <sup>2</sup>phyo

A-WE? sling? (鴉?鷓?砲?)

Y03

求

<sup>1</sup>tsI:

Small (小?)

#### 4. What Does the Diagram Describe?

##### 4.1 Is it a musical instrument?

We have some problems if we suppose that the diagram represents a musical instrument.

First, the sizes of the parts are extremely large. If the length of a *chi* 尺 was about 30 cm in those days, the large parts (e.g. C12, C14 are nine and ten *chi* 九尺、十尺) would be too large (about 300 cm) for a practical musical instrument.

Second, although in figures B and C, the sizes of all the parts are specified by notes, the remaining figure A has no notes. It is strange that the main part of a ‘musical instrument’ is lacking all mention of size. In other words, the chief purpose of this diagram is to provide instructions for making the “main” parts B and C.

The last problem is the shape of piece A. If A is the neck of a stringed instrument, it is strange that the tuning ‘pegs’ run straight through the instrument. It is unnatural that the pegs are located in the way shown, because, usually, pegs are placed alternately.

##### 4.2 The draft describes the *pao* 砲

It is expected that pieces B and C are closely related in the construction. One of the reasons for this is that the positions of the beams and the sockets of the pillars are the same. The second reason is the correspondence of the ratio of length to width.

Based on a composition of B plus C, we can imagine a three-meter high wooden object with a trapezoidal cross-section. It resembles the base of an ancient weapon — the *pao* 砲, a stone launcher (sling) used in China. Probably, piece C is the front of the base and B is a side view. Therefore A is not the neck of a musical instrument but the turning arm of a *pao* 砲. If the

diagram did not lack the lower part of A, the complete thing would look like the image below.

**Figure Pao 砲** From *Wujing zongyao* 武經總要

A careful scrutiny of the labeling, dimensions, and numbers on our manuscript reveals a high degree of agreement. There are four kinds of beam: upper and lower beams of B and C respectively. The last word of all is 槍 <sup>1</sup>ko:n, which is used as a Tangut phonetic transcription of Chinese. It probably corresponds to the Chinese *guang* 杙 meaning ‘beam’. Below we compare the names of the parts in the Chinese version from *Wujing zongyao* 武經總要 with the Tangut names in the diagram.

**Table 1**

Chinese	Tangut (Underlining means phonetic transcription)
上會杙	會枝杙 (B03)
上扇杙	上寨杙 (C08)
下會杙	下寨杙 (B05)
下扇杙	下寨杙 (C14)

The Tangut name for a *pao* 砲 is apparently derived from the Chinese.

The top part of the object in Chinese is *antoumu* 鞮頭木. Instead of that name, the wedge-like part is called ‘iron’ (*deng* 鐙), probably because of its material and shape.

Let us look now at the length of the parts. As stated above, while a length of nine or ten *chi* (九、十尺) is too much for a musical instrument, still it is appropriate for a weapon like *pao* 砲. Some dimensions for the longest parts of a *pao* 砲 can be found in the *Wujing zongyao* 武經總要.

**Table 2**

Name	Size of pillar (脚柱)	Size of lower beam (下會杙)
<i>Danshaopao</i> 单梢砲	1 <i>zhang</i> and 8 <i>chi</i> 一丈八尺	1 <i>zhang</i> and 3 <i>chi</i> 一丈三尺
<i>Wushaopao</i> 五梢砲	1 <i>zhang</i> and 2 <i>cun</i> 一丈二寸	1 <i>zhang</i> and 9 <i>chi</i> 一丈九尺 <sup>4</sup>
Tangut <i>pao</i> 砲	10 <i>chi</i> and ? 十尺+?	8 <i>chi</i> and 8 <i>cun</i> 八尺八寸

<sup>4</sup> “Wujing zongyao 武經總要” vol. 12, leaf 36, 40.

While the Tangut version is a little smaller than the Chinese one, it is nevertheless long enough for the base of a *pao* 砲. Therefore, it is reasonable that the constructional design depicts such a weapon.

In the design, there are several expressions implying a ‘pair’. For example, B03, B05, C02, C08, and C14 all contain the same words ‘Both length...’. If the object is a *pao* 砲, those parts would be used in pairs in the construction. And the Tangut numeral ‘four’ precedes ‘pillar’.

#### 4.3 The *pao* 砲 in a Tangut document discovered in Khara-Khoto

Sato Takayasu discusses the situation of the Khara-Khoto area in the last days of Xixia based on two Tangut documents.<sup>5</sup> Of these, No. 2736 document is a letter or proposal from the Tangut officer *Renfu* 仁負. It is undoubtedly the most important source for understanding the situation of Khara-Khoto at that time. In the text *Renfu* emphasized his own achievements. We would like to draw attention to one sentence of great importance. We cite Sato’s translation.

“...since *Renfu* 仁負 has come to Khara-Khoto for the defense of the citadel... defending the citadel, preparing provisions, arms, and fifty six *pao* 砲?, both large and small...”<sup>6</sup>

E.I. Kychanov was the first to translate the Tangut character 悲 as a *pao* 砲, the view is still conjectural.<sup>7</sup> The character in question is the last in the name of the weapon in the manuscript. Furthermore, in the documents, the Tangut *pao* 砲 comes in several types, such as ‘large’ and ‘small’. If the last word of the title on the recto is taken to mean ‘small’, then we can conclude that the Tangut regarded the weapon depicted as a ‘small *pao* 砲 (stone-launcher).

## 5. Conclusion

Based on the study of the size and parts of the object, it seems reasonable to conclude that the Tangut material in question (Tang. 46 inv. No. 156(2006), old. inv. No. 5217) housed in the Institute of Oriental Manuscripts, Russian Academy of Sciences is a constructional diagram of a stone launcher *pao* 砲. However, the Tangut name of this weapon is still unknown.

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<sup>5</sup> SATO 2007, 57–79.

<sup>6</sup> SATO 2007, 59.

<sup>7</sup> KYCHANOV 1971, 189–201.

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