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THE GADEN TANGKA OF TIBET

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The Gaden Tangkas are among the most common of all Tibetan coins, but they are also the least understood. I have now developed a classification for them, which is based on the ornamentation in the outer angles between the petals on both sides of the coin, and is supplemented by a major change in the order of the eight lucky signs and changes in style and weight standard. A description of the mints involved and some of the arguments for attributing particular classes of coins to each is given in Information Sheet No. 19, "Tibetan Mints" (Rhodes, 1978).

A close study of all the variations in detail of design has enabled a sequence to be identified. Within this sequence the coins fall naturally into 8 different classes. The first two classes are distinguished by major differences in weight or style, but thereafter occasional changes made in the outer ornamentation provide the basis for classification. Within each class the details of the lucky signs change in a systematic manner and have been noted as varieties.

Details of all the significant varieties are set out in Appendix I, but the main differences between the classes may be summarised as follows:-

<u>Class</u>	<u>Obverse</u>		<u>Reverse</u>		<u>Weight</u>
	<u>Outer angles</u>	<u>Waterline below lotus</u>	<u>Outer angles</u>	<u>Centre circle</u>	
A	∴	None	⌚	Pellet	c 5.1 grm
B	∴	2 lines	⌚	3 Crescents	c 4.5 grm
C	∴	1 line	⌚	2 Crescents	c 4.5 grm
D	∴	1 line	∴	2 Crescents	c 4.7 grm
E	⌚	1 line	∴	2 Crescents	c 4.7 grm
F	.	1 line	∴	2 Crescents	c 4.7 grm
					reducing to
					c 4.2 grm

<u>Class</u>		<u>Obverse</u>		<u>Reverse</u>	<u>Weight</u>
	<u>Outer angles</u>	<u>Waterline below lotus</u>		<u>Outer angles</u>	<u>Centre circle</u>
G	None	1 line		None	2 Crescents c 4.2 grm
H	.	1 line		.	3 Crescents c 4.1 grm

Class A stands out, because of both its style and weight. It is the only class to have an average weight of more than 5 gms, and there is no water-line below the lotus flower. Numerous minor differences may be observed between specimens, but I have only divided the issue into two groups, on the basis of style. A(i) consists of fine style pieces, while A(ii) pieces are cruder and less uniform in style. The most distinctive feature is that the three lotus stems are separate in A (i) and joined in A(ii). It would be natural to assume that the fine style pieces precede the cruder style, but as there is no discernable difference between them in weight standard and the coins are relatively scarce, I believe that they were all struck over a relatively short period of time.

This class was the only one published by de Lacouperie (1881), who dated the coins to 1772 because he totally misunderstood the inscription. Walsh (1907) subsequently corrected the reading of the inscription, but retained the attribution to the 18th century. I would, however, regard a date as early as this unacceptable for many reasons, but particularly because of the provenance of the coins in the British Museum.

The British Museum received three gifts which included Tibetan coins between 1847 and 1853, totalling 8 Sino-Tibetan coins and 4 Kong-par Tangkas. During the 1860s three further gifts were received, consisting of 3 Sino-Tibetan, 2 Kong-par and 3 Gaden Tangkas. This evidence provides a firm terminus ante quem of 1865 for Gaden Tangka A(i), but it is also significant that none of the early gifts, and particularly that of James Prinsep, contained any coins of this type. The Prinsep gift was very representative, and there is little doubt that he would have acquired a Gaden Tangka if one had been available when he was collecting coins in India. This suggests a terminus post quem of about 1835.

The known dates on Tibetan coinage, show that the Chinese continued to strike coins in Tibet, albeit sporadically, until 1836. It is therefore unlikely that the Tibetan Government would have introduced a new coin type while the Chinese were still powerful enough to issue their own coins. After 1836, however, the influence of the Chinese declined, and there was no reason why the Tibetans could not then have struck their own coins with a purely Tibetan design. Unfortunately there is little further evidence to narrow down the period of issue. It is only the wear on the British Museum specimens which suggests that the coins were struck early in the period rather than later, probably in the 1840s.

Class B is easily distinguishable because of the smaller flan, the reduced weight standard and two lines, representing water, below the lotus flower. B(i) has lucky emblems identical to those on Class A, but in later varieties the SW symbol changes significantly. B(i) and B(ii) have a plain arch in the NNW angle on the inscription side instead of the three little crescents, and they also have a dot to the left and a dash to the right of the central lotus flower. B(iii) has an additional pellet by the conch shell, and the dot and dash (now more like a hook) appear on the inscription side. This variety has another secret mark, whereby the top petal on the inscription side is joined to the central octagon by a faint line. B(iv) makes some minor changes in the lucky signs and seems to drop all use of other secret marks. B(iia), B(iva) and B(ivb) are clearly errors. Pieces omitting the secret marks are sometimes found, but these are usually, if not always, contemporary forgeries of light weight and poor alloy.

These secret marks indicate a sophisticated control of the details of the design, and it is probable that they were introduced partly as a method of detecting forgeries and partly to identify the date of issue and the official responsible.

This class is extremely common and represents nearly one in four of all Gaden Tangkas. This was the first time that coins had been struck on such a large scale in Tibet. The issue must have caused a significant

increase in the number of coins in circulation. It would not have been possible to strike so many coins without a major influx of silver into Tibet. These factors both help to indicate a likely start date for the issue of this class. In September 1879, the explorer Kishen Singh mentioned that there were two types of Tibetan silver coin in circulation, the "chanja paulung" (clearly the Sino-Tibetan coins) struck in fine silver, and the other coins "distinguished by the names of the rulers who issued them" (presumably referring to the old Nepalese coins) with alloy (Rawat, 1973). Both were equal in value at 6 annas, and it is probably significant that this traveller makes no mention of Gaden tangkas. (If, as suggested above, Class A coins had only been struck in small numbers thirty years earlier, then it is not surprising that Singh makes no reference to them.) By December 1881, Sarat Chandra Das (1892) was able to say that "there were four varieties of tankas then current in Tibet, two of Nepalese minting, two made at Lhasa, the best being that known as Gaden Tanka", and he also said that 3 tangkas were equivalent to 1 rupee, so the tangka was valued at $5\frac{1}{3}$ annas. Hence, between 1879 and 1881 the Gaden Tanka had become well-known, and the value of the tangka in relation to the rupee had fallen by over 10% which strongly suggests that Class B was introduced about 1880. Furthermore it was in 1879 that the British opened up the road to the Jelep La, between Sikkim and Tibet, and in 1881 the Darjeeling Hill Railway was finished. The opening of these routes helped to encourage trade between Bengal and Tibet, and as this trade was nearly always unbalanced, numerous silver rupees found their way to Tibet and would have ensured a steady supply of silver to the Tibetan mint from then on.

The mint used at this time was almost certainly Dod-pal, the Government metal factory described as a mint by Jaeschke (1881) in his Tibetan-English dictionary. Class B probably continued until about 1894. A date well after 1891 is indicated by the fact that the Kong-par Tangkas dated 15-24/5 (1890/1 AD) have lucky signs similar to B(iii), so B(iv) was probably struck after 1891. Also a drawing of a specimen of B(iv) was sent to Spinks in 1894 (Spink 1895).

When writing "Tibetan Mints" (Rhodes 1978) I had assumed that as the Tip arsenal opened in 1895, and as Waddell (1906) had mentioned the mint in the same sentence as the Tip arsenal, it was reasonable to assume that a mint was located at Tip. Since then, however, I have located a further eye witness account of the Tibetan mint written by the Buriat Mongol G. C. Tsybikoff (1918), who visited Lhasa in 1900/1. As this account is of particular interest, I reproduce it in full:-

"...the coins ... are now locally struck by hand in the mint in the Potala, under the supervision of the Lama Treasurer. I was fortunate to actually see the striking. It was done by a hand forging process from a copper-silver alloy. First thin bars were forged on long, narrow, stone anvils, the discs were cut from them with shears which were then struck in a vice with an engraved die. During my time in Lhasa a foreigner, who looked as if he came from India, had set up a machine to strike coins in the mint, but I was unable to see with my own eyes the coins struck with this new process." (My thanks to Dr K. Gabrisch for providing a translation of this work). From this account it seems clear that the mint was situated in or near the Potala. As Dod-pal was located just at the foot of the Potala it must be the mint described by Tsybikoff. There seems no reason to think that coins were struck at Tip at this, or at any other time.

In Class C, the whole style changes. The lotus flower now has only one water-line and in the centre on the inscription side there are now only two crescents, instead of the three which appear on Class B. This style continues unchanged into Class D, where, for the first time, the symbols in the outer angles of the petals were changed, so that 3 dots replaced the three crescents on the inscription side. The order of the varieties is clearly determined by the progressive changes in the lucky signs at the N, NW and W points. During Class D the weight standard seems to have been increased from about 4.5 gms to about 4.8 gms. This may have led to the change in design, although, the reason for the increase in weight standard is now unknown. A specimen of D(iv) was illustrated by W. Carey (1902) and as he visited the Chumbi Valley in July 1899, it is probable that this variety was struck in or just before 1899. D(v) has identical symbols to D(iv) and was probably struck in the same year, although a much more sophisticated

coin press must have been used, presumably the machine seen by Tsybikoff in 1900/1. A specimen in mint condition was obtained by Walsh in 1902. The rarity of this variety suggests that only a few pieces were struck before the machine attracted official disapproval and the use of it was abandoned in favour of the traditional method. Varieties D(iv) and D(v) have a slightly different central lotus flower, which continued to be used in Class E.

Class E is distinguished by the appearance of three crescents in the outer angles between the lucky signs. Otherwise the style continues unchanged, and a steady progression of changes in the lucky signs at NE, E, SE and NW show the order of the subvarieties. The only uncertainty is the relative position in the sequence of E(iv) and E(vi). The average weight fluctuates slightly during this class, but the main change in the metrology is a significant increase in the standard deviation of the actual weights of specimens around the mean. This indicates a change in the way the mint controlled the weight standard. In addition, the artistic quality of the dies deteriorated, particularly in E(iv).

Among the varieties of Class E, E(v) stands out. The style is totally different from the other varieties, in that the whole die is much smaller and it lacks the two dots to right and left of the central lotus flower. Otherwise details of the lucky signs are similar to E(iv), so it seems likely that the two varieties were struck in the same year. However the styles are so different that it is tempting to think that the two varieties were struck in different mints. This may indeed have been the case, as the new mint at Dode was nearly ready in 1904, when it was visited by Ottley (1906), although it was only opened for full production around 1907. It is not impossible that a small trial issue of coins could have been struck there either just before the British arrived in Lhasa in August 1904, or sometime in the following year, but this is only conjecture, as the employment of a new die cutter at Dod-pal could equally well explain the differences between E(iv) and E(v).

Class E was followed by Class F, which is distinguished by a single pellet in the angles between the lucky signs. The average weight and

standard deviation is initially similar to Class E, and the reason for the change in design was probably the transfer of the mint from Dod-pal to Dode in about 1907. Dode was a purpose built mint, where a water-wheel was built to help power the coin presses. The sequence of varieties is not quite so clear as for the earlier classes, but a progression can be observed in some symbols such as those at NE, NW, W and SW, and the altered die F(iiib) proves that F(ii) preceded F(iii). F(ia) and F(iaa) are mules, although I have not yet been able to examine these rare errors carefully enough to find die-links with adjacent types. The die-link between F(iv) and F(v) is the only die-link I have observed between varieties for the whole series. In Appendix I, I have distinguished between F(vi) and F(vii) by the diameter of the central circle, although my analysis of weights has thrown into doubt the validity of this distinction. It is possible that some pieces of this design were struck to the higher weight standard used up to variety F(v), but this is not certain, and no satisfactory way of distinguishing the heavier coins on the basis of design alone has been found.

Variety F(iii) can be dated with some degree of certainty. The details of the lucky signs are identical to those on the special fine silver tangka, Yeoman (1974) No.14, which was struck specially for distribution to monks by the Dalai Lama on 21st February 1910. About 600,000 of these special tangkas must have been struck towards the end of the Tibetan year 15-43 (1909/10); F(iii) must therefore have been the type of Gaden Tangka being produced at that time.

A consideration of how many varieties there are between F(iii), probably struck in 1909, and Class C, probably struck around 1895 indicates 14 main types for about 15 years. This can hardly be coincidence, and it is very tempting to suggest that during this period it was the rule to change some detail of the design every year. The issue of D(iv) in 1899 fits in with this theory. The missing type can be explained if we regard E(iv), which is easily the commonest variety in this period, as spanning the two years 1904/5. It is equally possible that the closure of the mint during the presence of the British in Lhasa could have disrupted normal mint procedure, so that no change in design was made when production was resumed. If we now

extend this theory to the period after 1909, variety F(iv) should have been struck in the Tibetan year 15-44, but before the mint was closed by the Chinese in April 1910, that is in a period of less than two months, which would explain its relative rarity. Moreover F(v) was probably not struck until early in 1912, when the Chinese authority in Lhasa collapsed, and the rarity of this variety could be explained if the mint opened a few days before the end of the Tibetan year 15-45.

In any case the principle of a change in variety each year seems to have been abandoned with F(vi). This variety, together with F(vii), is one of the commonest of all, and its issue must have extended over several years, perhaps from 1912 to 1915. The reason for abandoning the change in design each year can only be guessed. It may have been that the authorities kept the same design so as not to draw attention to the reduction in weight standard which took place during the issue of this class. Perhaps there was a change in the method of supervision of the mint, so that the mint official responsible for the quality of coinage, who was apparently changed each year prior to 1912, was now replaced less frequently.

At this time a 2 tangka piece was struck, with identical lucky signs to those on F(vi) and F(vii). The weight standard is difficult to determine, but appears to be around 9.2 gms, so it seems likely that it was struck early in the period rather than late. It is also unlikely that a double tangka would have been struck at the same time as the fine silver 5 Sho pieces, first struck in 1913, which were the same size. 1912 is therefore the most likely date for the issue of the double tangka.

The varieties after F(vii) are the most difficult to arrange on the grounds of a gradual evolution of style and details of design. F(viii) follows smoothly from F(vii), but several changes are made at once for F(ix). Furthermore, a very wide range of styles may be found with very little change in the lucky signs. In my classification I have distinguished between the fine style pieces, F(viii) and F(ix), and the pieces of less fine style, but with little other change in design, which are designated F(x) and F(xi). Since such changes in style seem to occur in parallel, it seems likely that these varieties were issued concurrently at two different mints. This in fact appears to have been the case, as the Dode mint was organised into two sections, Upper Dode and Lower Dode, each in the charge of a different monk official. Since the two sections

of the mint were in the charge of different officials, it is likely that their products would have been distinguished by such variations. Indeed an example of this is cited by Kempf (1969), who suggested that the pellet over the denomination on the 5 sKarma pieces of 15-55 and 15-56 (1921/2) distinguished the issues of Upper Dode. Using this pellet as an indicator, it is probable that varieties F(viii) and F(x) were struck in Upper Dode, as they have a pellet by the lotus flower, while F(ix) and F(xi), which have no pellet, were probably struck in Lower Dode.

The fine style pieces, F(viii) and F(ix) are certainly the earliest in the series, as their style continues smoothly from F(vii). F(ix) is rather scarcer than F(viii), so it is probable that Lower Dode started issuing tangkas only part way through the period of issue of F(viii). It may be significant that silver 5 Sho coins stopped being struck in Dode in 15-50, which would have freed some presses, perhaps in Lower Dode, for the striking of tangkas in 1917.

In 1918, when Ser-Khang, the gold mint, opened near the Norbhu Lingka (the Dalai Lama's summer palace to the south-west of Lhasa) it is possible that the die-engraver from Dode was transferred to the new mint to work on the dies for the new gold coins. This would have left Dode without a talented engraver, and the effect is clearly visible on the dated coins. Hence the cruder style pieces, F(x) and F(xi) would have been struck from 1918 onwards. Numerous minor differences are to be found in these varieties, but although I have mentioned some of the more obvious ones in my listing it is doubtful if any of them are truly significant. Certainly the dies were produced by several different die-cutters, as there are several identifiable styles, distinguished by such features as small or large dots in the border, but I have not thought it worthwhile to do a full analysis.

The issue of tangkas at Dode seems to have continued unabated until 1922, when it suddenly ceased due to an increase in price of silver on world markets, and the consequent hoarding of even the debased silver tangka in Tibet. At the same time the issue of the rupee was suspended in India, although its minor denominations were still struck in silver there. During the year ending March 1925, however, India supplied Tibet with Rs.1,117,600 of silver, and it seems likely that a proportion of this silver was used to strike Gaden Tangkas of variety F(xii). This

variety fits happily into this period, as it is of crude style and is similar to the later issues of F(x) and F(xi), but has a number of changes in the details of the design. Although most specimens of F(xii) are a normal 27 mm in diameter, one remarkable piece is 31 mm in diameter. During this period the Gaden Tangka was known colloquially as Tangka Ghabo ie. white tangka, because of the blanching process to which the coins were subjected before striking in order to hide the poor quality of the silver.

There is only one issue which I have not discussed in chronological order, that is Class G. It is of fine style, but the design differs in many details from the main series. The most significant feature is the style of writing the word "rnam", which is identical to the style used on the gold coins. This may have been the mint designator of the gold mint, as Sir Charles Bell indicates in his diary that silver tangkas were being struck at the gold mint, when he visited it in October 1921. Similar calligraphy is also found on a series of 1 Sho coins which was probably struck at the gold mint after it ceased striking precious metal coins late in 1921 or early in 1922. Class G was, therefore, almost certainly struck in the gold mint around 1921, with its dies engraved by the same artisan who had cut the dies at Dode until 1918. The only other Gaden Tangka to have the distinctive calligraphy is F(xe), a particularly crude variety, which may be a contemporary forgery, or else the product of an inexperienced die-engraver who made an inadvertant error.

There remains only the Class H Gaden Tangka to be discussed. This is remarkable, because it was machine struck with a collar. According to a report by Weir dated 6th February 1929, the Tibetans were preparing to issue silver tangkas to "be turned out at the rate of 3000 tangkas an hour by machinery worked by electricity". A subsequent report dated 7th December 1929 indicates that tangkas were being struck in Lhasa at that time, and it is therefore clear that these must have been of Class H. The dot in the outer angles and the calligraphy are of the normal Dode pattern, and it is possible that the two varieties of conch-shell indicate that the issue was spread over two years, although the rarity of this class seems to imply that production cannot have lasted more than a few days if they really were struck at the rate of 3000 a day.

That completes the study of the Gaden Tangka. Only once after 1929 or 1930 was the old design used, when fine silver presentation pieces were struck in enormous quantities for the Dalai Lama to present to monks in the late 1940s. These pieces are easily recognisable as Yeoman (1974) No.31, and should not really be regarded as part of the normal run of tangkas.

After 1930 the Tangkas continued to circulate to a significant extent. Although their value was updated in line with their intrinsic value, this stabilised at around 8 to the rupee until 1942, when their value rose to about 4 to the rupee. Surprisingly, at no time was any selective melting of the heavier, earlier or finer silver pieces undertaken, and surviving specimens seem to be a fairly random sample of those pieces that were struck.

The Gaden Tangka

Appendix I

Description of main classes and varieties

All classes have the following types:

Obv: stylised Lotus design within circle surrounded by the eight Buddhist lucky symbols in radiating petals.

Rev: eight petalled flower within star surrounded by inscription broken up into eight oval frames. Inscription in Tibetan reading "Ga-den Pho-dang chhog-le rnam-gyal" = The Gaden Palace victorious on all sides.

Class A

Circa 1840s. Dod-pal Mint.

No water-line below lotus flower. Pellet in centre of rev.

- (i) Fine style. Lotus flower has 3 separate stems.
- (ii) Cruder style. Stems of lotus flower joined.

Numerous minor varieties in lucky signs, especially in conch shell (W). Fishes (NE) always  in (i), but  or  in (ii).

Class B

Circa 1880-1894. Dod-pal Mint.

Double water-line below lotus flower. Three crescents in centre of reverse.

- (i) S  SW  W  NW  Plain arch to l. of  on rev.
- (ii) S SW  W NW  Plain arch to l. of  on rev.
- (iii) S SW  W  NW  . to l. of ,  or  to l. of .

Class B (cont)

- (iiia) S SW W NW . to r. of  or  to r. of  .
(iv) S  SW W  NW  No secret marks.
(iva) S SW W  NW
(ivb) S SW  W  NW

Types (i) and (ii) have dot to l. and crescent to r. of lotus.
Fishes always  (NE) on (i), but  or  on other types.
On (iii), small line joins petal containing  to concave octagon on rev.

Class C

Circa 1895-6. Dod-pal Mint?

Single water-line below lotus flower. Two crescents in centre of reverse. These two features now remain unchanged for all future types. Order of lucky signs is changed, so that conch-shell is now S instead of W. Style of lotus flower changed, with 3 small leaves to l. and r.

Symbols in outer angles of petals $\therefore / \sim$ taking the lotus side first, and inscription side last.

- (i) Spokes of wheel in centre of rev. extend to octagon.
(ii) Spokes do not extend to octagon. (No spokes)

Class D

Circa 1896-9. Dod-pal Mint?

Symbols in outer angles of petals $\therefore / \therefore$. Otherwise styles as Type C, except that the lotus in Type D(iv) is similar to that used in Type E.

- (i) N  NE  E  SE  S  SW  W  NW  No spokes.
(ii) N  NE E  SE  S SW  W  NW Spokes.
(iii) N NE E SE S SW W NW  Spokes.
(iv) N NE  E SE  S SW W  NW Spokes and diff. lotus.
(v) As (iv), but machine struck.

Class E

Circa 1899-1907. Dod-pal Mint?

Symbols in outer angles of petals $\sim / \therefore$.

- (i) N  NE  E  SE  S  SW  W  NW 
(ii) N NE  E SE S SW W NW
(iii) N NE E  SE S SW W NW
(iiia) As (iii), but centre rotated 45° anti-clockwise.
(iv) N NE E SE  S SW W  NW
(v) As (iv), but style differs and small circle around lotus -
diam. 7.5 mm.
(vi) N NE E SE S  SW W NW
(vii) N NE E SE  S  SW W  NW 

All varieties have spokes.

E(v) is the only variety not to have dots left and right of the central lotus. (See main text)

A variety of E(iv) has 6 leaves issuing from water at base of lotus, instead of the usual 4.

Class F

Circa 1907-1922, 1924-5. Do-de Mint.

Symbols in outer angles of petals . / . .

1907-12

(i)	N		NE		E		SE		S		SW		W		NW		
(ii)	N		NE		E		SE		S		SW		W		NW		Solid buds.
(iia)																	Hollow buds.
(iii)	N		NE		E		SE		S		SW		W		NW		Hollow buds.
(iiia)																	Solid buds.
(iiib)	N		NE		E		SE		S		SW		W		NW		
(iv)	N		NE		E		SE		S		SW		W		NW		
(v)	N		NE		E		SE		S		SW		W		NW		
(vi)	N		NE		E		SE		S		SW		W		NW		Circle diam. c 12mm *

1912-18

(vii)	N		NE		E		SE		S		SW		W		NW		Circle diam. c 11mm *
(viii)	N		NE		E		SE		S		SW		W		NW		Dots l. & r. of lotus.
(viiia)																	No dots.
(ix)	N		NE		E		SE		S		SW		W		NW		

1918-22

(x)	N		NE		E		SE		S		SW		W		NW		Cruder style.
(xa)	N		NE		E		SE		S		SW		W		NW		
(xb)	N		NE		E		SE		S		SW		W		NW		
(xc)	N		NE		E		SE		S		SW		W		NW		
(xd)																	No dots by lotus.
(xe)																	As (x) but reads
(xi)	N		NE		E		SE		S		SW		W		NW		No dots by lotus.
(xia)																	Dots by lotus.
(xib)	N		NE		E		SE		S		SW		W		NW		No dots.
(xic)	N		NE		E		SE		S		SW		W		NW		

1924-5

(xii)	N		NE		E		SE		S		SW		W		NW		Diam. 27mm.
(xiia)																	Diam. 31mm.

Varieties (iia) and (iiia) are mules between (ii) and (iii).

(iiib) has an obv. die altered from (ii).

There is a rev. die-link between (iv) and (v).

Varieties (vii), (viii) and (ix) are in fine style.

There are numerous varieties of style in (x) and (xi), including small or large pellets in outer border etc.

(xii) has pellets to left and right of base of lotus, in water-line.

Class G

Circa 1921. Ser-khang Mint.

No symbols in outer angles. Petals on obv. joined. Fine style. No spokes or dots by lotus. Rev. reads . No varieties in lucky signs.

Class H

Circa 1929-1930. Do-de Mint.

Dot in outer angles. Petals on obv. joined. Machine struck.
Three crescents in centre of reverse.

- (i) S 
- (ii) S 

*F(vi) and F(vii) may not be significantly different types.

The Gaden Tangka

Appendix II

An Analysis of Weight Standards

On the attached table are the weights of 1637 Gaden Tangkas. All weights are given to the nearest 0.1 gm. The coins weighed are grouped according to the varieties explained in Appendix I. They are not a random sample by variety, as rarities may tend to be overrepresented, but they should not exhibit any bias by weight. In addition I give the average weight by variety of a lot of 989 coins examined by Carlo Valdetaro (not previously published). This group of coins was not weighed individually, and the varieties distinguished did not always agree with my current classification, but the results are still useful in calculating a more reliable average weight for each variety (data supplied in correspondence).

Using the given data, and assuming that the standard deviation of weights with each variety will not be significantly changed by the inclusion of the Valdetaro data, it is possible to calculate confidence intervals (i.e. the range within which most of the weights recorded will fall) for the average weight of each variety. From this it can be deduced which differences between the average weight of successive classes may only be due to random error, and which are likely to be due to changes in the theoretical weight standard used. When the difference between successive issues does not appear to be significant, the results have been combined to give more confident predictions of the average weight used for a range of varieties.

This analysis of weights has brought into question the distinction made between varieties F(vi) and F(vii). In the analysis F(vi) appear to be

as heavy as the early coins of Class F, but F(vii) seems to be significantly lighter than any other variety of tangka. Such a reduction in weight standard at this period seems intuitively unlikely, but when combined with each other, these two varieties show an average weight very similar to the later coins of Class F. As the design difference between the two varieties is very small, it is possible that there really is the only one type, and the distinction used for the analysis of weights was invalid. Certainly, when weighing coins, it is very likely that it was not always clear from the design to which variety a coin belonged, and in such cases there would be a tendency to place heavy coins in F(vi) and light coins in F(vii), which would distort the results. The values for these two varieties have, therefore, been combined and the distinction ignored when estimating the weight standards. This does not prove that no coins of this issue were struck to the earlier, higher, weight standard, but merely that there is not enough data to be certain, and no satisfactory method has been discovered for separating any such early, heavy, pieces purely on design grounds.

The results of this analysis are summarised below based on both my own data and the Valdetaro data:-

<u>Date</u>	<u>Class</u>	<u>Number of Coins</u>	<u>95% Confidence Interval for Weight Standard*</u>
c.1840s	A	25	5.084 - 5.220
c.1880-94	B	654	4.512 - 4.560
c.1895-96	C	128	4.441 - 4.529
c.1896-97	D(i)	55	4.572 - 4.708
c.1897-1901	D(ii) - E(i)	231	4.758 - 4.834
c.1901-09	E(ii) - F(iii)	483	4.627 - 4.699
c.1910-12	F(iv) - (v)	31	4.345 - 4.639
c.1912-18	F(vi) - (ix)	281	4.103 - 4.219
c.1918-25	F(x) - (xii)	275	4.204 - 4.306
c.1921	G	70	4.105 - 4.294
c.1929-30	H	29	4.002 - 4.170

* i.e. there is only a 5% chance of the weight standard of the given class falling outside the range indicated.

In a few instances, groups of varieties have been separated above where the differences are significant at the 10% level, but not at the 5% level; for example B & C, F(iv) & F(v) compared with E(ii) to F(iii) and F(vi)-(ix) compared with F(x)-(xii). An analysis of more weights would be necessary to determine if significant changes in weight standard really did take place at these times.

A remarkable feature of the coinage is the standard deviation of the weights around the weight standard. This standard deviation is extremely high compared with silver coinages in other parts of the world and shows not only that there was a lack of sophisticated equipment within the mint, but also how little importance was attached to the actual silver content of coins by the local Tibetan population. In all cases the weights exhibit a normal distribution around the mean, with no trace of the bias which would be apparent if the heaviest coins had been creamed off into the melting pot at any time.

The main conclusion is that the weight standard did not always reduce, but actually increased during the late 1890s, and there may have been another increase after about 1918. Naturally the weight standard should be analysed together with the %age silver content to determine the intrinsic value aimed for, but no such analysis has yet been attempted on a scale large enough for any significant results to be obtained. It should be mentioned, however, that Sir Charles Bell was told in 1921 that a standard of $\frac{2}{3}$ ds silver to $\frac{1}{3}$ rd copper was aimed for which, if it was achieved, would not differ greatly from the fineness of the 19th century issues. On the other hand, the few readings obtained using specific gravity methods, indicate a fineness nearer 40% around 1920, but much more work on actual fineness needs to be done.

Weight Distribution of Gaden Tangkas

Class	Weight in Grammes																	Average weight	Standard deviation	
	2.8	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.0	5.2	5.4	5.6	5.8	6.0			Total
A(i)																		17	5.15	0.17
A(ii)										1		1	2	3	6	2	2	8	5.16	0.13
B(i)						1	1	1	3	2	6	4	2	2				25	4.49	0.31
B(ii)						2	3	5	12	10	16	21	20	19	9	3	1	122	4.49	0.24
B(iii)						1	1	1	4	10	5	11	20	7	10	9	6	91	4.53	0.28
B(iv)				1	1	2	1	1	7	10	9	14	11	21	18	17	9	137	4.58	0.34
C					1	1	1	1	1	9	7	16	19	12	10	6	3	90	4.49	0.25
D(i)																		32	4.67	0.19
D(ii)							1		1	4	4	4	9	6	2	1		42	4.78	0.33
D(iii)									1	4	5	3	4	4	6	3	2	25	4.78	0.21
D(iv)										5	4	5	9	6	2	2	1	35	4.79	0.20
D(v)											1					2	1	5	5.08	0.24
E(i)																		41	4.86	0.37
E(ii)									2	2	3	3	4	4	2	2	1	23	4.61	0.35
E(iii)								3	1	1	6	2	2	2	1			55	4.74	0.25
E(iv)					1	1	1	2	1	6	3	4	8	4	6	5	1	78	4.67	0.38
E(v)					1	1	1	2	3	8	11	6	8	12	5	6	3	5	4.38	0.44
E(vi)						1	1	3	7	2	8	4	1	5	6	4	1	49	4.51	0.45
E(vii)									1	3	1	3	1	2	1	1	1	15	4.76	0.36
F(i)									1	5	5	7	2	4	6			32	4.67	0.23
F(ii)									1	2	1	2	3	2	3	2	1	27	4.77	0.52
F(iii)					1			1	2		4	2	2	5	3	3	6	33	4.74	0.39
F(iv)						1		1	2	2	6	4	1					17	4.47	0.23
F(v)																		3	4.93	0.12
F(vi)																		28	4.72	0.34
F(vii)																		103	3.99	0.42
F(viii)																		108	4.17	0.48
F(ix)																		42	4.19	0.47
F(x)																		159	4.26	0.45
F(xi)																		93	4.23	0.48
F(xii)																		25	4.28	0.35
G																		46	4.19	0.39
H																		26	4.10	0.26

Gaden Tangkas weighed by C. Valdetaro

<u>Class</u>	<u>Total Number</u>	<u>Average weight</u>	<u>Highest weight</u>	<u>Lowest weight</u>
A(i)	-			
A(ii)	-			
B(i)	25	4.37		
B(ii) }	160	4.55	5.2	3.6
&B(iii) }				
B(iv)	116	4.54	5.2	3.65
C	38	4.47	4.9	3.85
D(i)	23	4.60	5.15	4.1
D(ii)	17	4.83	5.4	4.35
D(iii)	21	4.73	5.15	4.1
D(iv)	23	4.65	5.3	3.5
D(v)	-			
E(i)	22	4.86	5.6	4.15
E(ii)	13	4.67	5.05	4.15
E(iii)	35	4.66	5.3	4.0
E(iv)	34	4.70	5.4	3.85
E(v)	-			
E(vi)	28	4.53	5.45	3.95
E(vii)	3	5.15	5.25	5.0
F(i)	7	4.84		
F(ii)	29	4.65	5.05	4.1
F(iii)	17	4.58	5.75	3.15
F(iv)	10	4.42		
F(v)	1	4.25		
F(vi) }	111	4.23	6.4	2.9
&F(vii) }				
F(viii) }	237	4.25	5.4	3.05
&F(x) }				
F(ix) }	113	4.19	5.2	2.65
&F(xi) }				
F(xii)	14	4.31	4.9	3.55
G	24	4.22	5.0	3.5
H	3	4.0		

For some varieties the highest and lowest weights were not calculated.

In some instances, the classification of varieties used did not coincide with the system used in this paper, so combined results have had to be given. In cases where the two varieties may have been struck to different weight standards, the above results have had to be ignored in the main analysis of weight standards.

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A(ii)



B(iii)



C



D(v)



E(v)



E(vi)



F(iii)



F(xi)



G



H

