CASTING OF DEVOTIONAL IMAGES IN THE HIMĀLAYAS: HISTORY, TRADITION AND MODERN TECHNIQUES

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Both solid- and hollow-casting by the lost wax process have a long history in Northern India. According to Reeves (1962:29), the earliest literary evidence for the process is the description contained in the *Madhūcchiṣṭavidhāna*, as recorded in chapter 68 of the *Mānasāra*, which is believed to have been compiled in the Gupta period (Shukla, 1958, II:108). Unfortunately, surviving cast metal statuary from this period is rare, and Bhattacharya (1979:62) suggests that the extensive use of metal for sculpture in northern India may not be earlier than the late Gupta period. From the early medieval period (7th to 12th century AD), more texts are found containing references to metal casting techniques. Of particular importance is the *Viṣṇudharmottarapurāṇa* (III:43-4), which mentions both hollow- and solid-casting by the *cire-perdue* method (Reeves 1962:32). This text is well-known in Nepal (Pal, 1970:13; Lévi, 1905, III:133). However, the best medieval description which gives detailed instructions is contained in the *Abhilāṣitārtha-cintāmaṇi* (a text also known as *Mānasollāsa* or *Mānasollāsa-śāstra*) which was written in c. AD 1131 by king Someśvara Bhūlokamalla of the late Cālukya dynasty of the Deccan (Saraswati, 1936:139; Reeves, 1962:32; Ruelius, 1974:2.1.2). The verses on the lost-wax process, as translated by Saraswati (1936:143), also specify that the ratio of brass and copper to wax should be 10:1 (or, according to a variant reading, 8:1). By this time, hollow-casting had reached a degree of perfection which enabled sculptors to attempt very large images, for which the repoussé technique is otherwise generally preferred. The 2.225 m. high Sultanganj copper Buddha (in Birmingham City Museum) was cast in more than one piece by the hollow-casting method and it is very likely that the 1.86 m. high Devsar brass backplate (in Srinagar Museum, Kashmir) was cast by the same method.

The History of Buddhism in India, written in AD 1608 by the Tibetan scholar Tāranātha (b.1575) states that during Devapāla's rule (c. AD 821-861) the work of two outstanding Bengali painters and sculptors, father and son named Dhīmān and Bitpalo respectively, gave rise to new schools of painting and metal statuary (Chattopadhyaya, 1970:348). Reeves (1962:23) suggests that the resultant "widespread use of the *cire-perdue* process was to influence the manufacture of copper icons in Nepal and Tibet at the turn of the 10th century AD, particularly with respect to copper gilt images which are still produced there today". As in the past (Khandalavala, 1950:22), both solid and hollow lost-wax casting methods are still used by Newar sculptors, the former for medium size (15 cm to 45 cm) to large (from 45 cm) images, the latter for small (15 cm or below) and sometimes medium size images. The use of the two methods overlaps for medium size images ranging from 30 to 45 cm. There is no evidence to support Dagyab's claim that in Tibet permanent moulds for solid-casting were more widely used than the method of lost-wax casting (Dagyab, 1977, I:50). Ronge (1980:269) also appears to overlook the use of the lost-wax process in Tibetan statuary: "in Tibet bells as well as statues were made by the sand-casting method which requires the mould to be destroyed after casting". However, Pal (1969:29) accepts that the "bronzes in Tibet were usually cast by the *cire-perdue* method". A careful visual examination by Craddock (personal communication) of the 121 objects of flash lines, failed to show any evidence especially on the underside of the bases. It seems probable that both techniques of casting were used in Tibet. The earliest evidence for the introduction of the lost-wax process into Tibet is probably provided by a western Tibetan Vajrapāṇi at the Musée Guimet in Paris (MA.3546). This statue was hollow cast in brass (11.7% zinc and 1% lead) by the lost- wax process, as is shown by radiography which revealed the presence of a core held together by a metal armature (Hours, 1980:95-98). This image, attributed by Pal (1969:22, Figure 6) to the 11th-12th century and regarded by Béguin (1977:89) as a copy of an 11th century Kashmiri "original", appears to provide the earliest evidence for the introduction of the lost-wax process into western Tibet.

The continuous presence of Newar sculptors in Tibet is attested in Tibetan and Western sources from the 7th (Norbu and Turnbull, 1972:143; Dagyab, 1977, I:36) to the 20th century (Huc, 1924, II:244; Bista, 1978:196 and 202-3). The career of Aniko, a Newar artist who was sent to Tibet at the head of a team of eighty artists in AD 1260 (Lévi, 1905, III:187; Petech, 1958:59; but see Tucci and others who give the figure twenty-four, probably mistranslating Lévi's French "quatre-vingts") is only one example. Aniko was subsequently invited to the Mongol court in China, where he was put in charge of the imperial metal-works, and received posthumous honours. Beeswax and copper are listed by the *Yuandai huasu ji* (see below, p.82) amongst the materials used by Aniko (Karmay, 1975:23). For every subsequent century, the presence of Newar sculptors is documented in various parts of Tibet. Newar communities existed at Lhasa, Shigatse, Gyantse, Sa-skya and Tsetang. Although the figure of 20,000 Nepalese residents in Tibet (Nepali, 1965:25) is certainly exaggerated, what matters rather than their numbers are their social and anthropological features. They all belonged to the three Newar castes among which metal sculptors are still to be found: Vajrācārya, Śākya and Uda. During the early 17th century in particular, their activities extended from Guge (Pereira, 1926:96-7; see Lévi, 1905, I:79-80) to Bhutan (Ardussi, 1977:245-6), which is still supplied by the Newar metal sculptors of Pātan. The number of Nepalese metal images in Tibetan temples was legion and Newar sculptors have also been active producing statues in Tibetan style (Lo Bue, 1978 and 1981). There is, however, no historical evidence that Tibetan metal sculptors ever worked in Nepal. Furthermore, the current absence of local lost-wax statuary manufacture from Bhutan, Ladakh, and the Tibetan areas of Nepal, including the Tibetan refugee settlements where there are quite a few outstanding painters, suggests that Tibetan lost-wax metal statuary depended heavily upon Newar sculptors well into the 20th century (Lo Bue, 1978 and 1981). For these reasons, and in the absence of living Tibetan lost-wax metal sculptors to act as informants, I have thought it acceptable to base the following sections on fieldwork which I carried out in 1977 and 1978 among Newar sculptors working for Tibetans in Nepal.

A pioneering study by M-L de Labriffe (Mrs Anthony Aris) on lost-wax metal casting in the workshop of Jagat Man Sakya in Oku Bahal, Pātan, was published in *Kailash* in 1973. Another study by Alsop and Charlton was published in *Contributions to Nepalese Studies* later the same year. The following sections are intended to sum up the knowledge of the contemporary technique of Newar lost-wax casting and aim chiefly at supplementing these earlier studies with more detailed information, especially with regard to the timing of investing and casting.

Wax model

The composition of the wax used in modelling varies according to season in the Nepal Valley. The light "summer" wax is made with a mixture of 50% beeswax, bought from Tamangs living in the hills surrounding the Nepal Valley, and 50% *sila*, a tree resin imported from India. Reeves (1962:30) restating, perhaps with the aid of a Tamil translation, the defective (Saraswati, 1936: 140; Krishnan, 1976:7-8) Sanskrit text of the 68th chapter of the *Mānasāra*, defines the dammar used to manufacture statuary wax as the resinous sap of the *sāl* tree. Now the *sāl*, or *Shorea robusta*, abounds in the sub-Himalayan regions, including the Nepalese Terai. The dark "winter" wax is made with a mixture of one *dhāmī* (= 216 *tolās*. One *tolā* = 11.663 gm. Regmi, 1961:21) of beeswax, 1.5 to 2 *pāos* (27 to 36 *tōlās*) of *sila* and about 0.5 *pāo* (9 *tōlās*) of vegetable ghee extracted from the seeds of the tree *Madhuca butyracea* (Roxb.) Macbride (*sive Bassia butyracea* Roxb.; Nep. *cyurī*), a Sapotacea attaining 21 m. in height which is distributed in the sub-Himalayan tract from 300 to 1500 m. altitude and grows also in the Kathmandu district (Suwal, 1970: 52). We thus have the proportion 24:3 (or 4):1 for beeswax:resin:vegetable oil. Krishnan (1976:30) mentions mustard seed oil instead of vegetable ghee and gives the following proportions: sixteen parts of beeswax, eight parts of resin and one part of oil. To manufacture the modelling wax, small pieces of beeswax are first melted in a brass or aluminium pan over a low flame on a charcoal brazier and then the powdered resin is added and stirred well. Finally, the vegetable fat is added and stirred vigorously.

The round wax sheets (Plate 1) used by sculptors for modelling their images are prepared by beating a cake of wax with a mallet and by spreading it uniformly on a stone slab with a roller. The thickness of the wax used varies according to the size of the statue to be cast and the type of metal to be used. Hollow copper images require a thicker wax model than brass ones. The chief tool used in wax-modelling is the *silatu*, a buffalo-horn spatula rounded at both ends, one end being wider than the other, and with one side slightly rounded and the other almost flat, so that its edges are not sharp (Plate 2c). Labriffe gives the spelling *silāyakū*. The outline of this spatula is reminiscent of the shape of a fountain pen. *Silatus* vary slightly in size, but they usually measure between 14 cm and 18 cm in length and are about 5 mm thick. A larger type of *silatu*, keeping the shape of the horn from which it is made, but cut at both ends (Plate 2a), is used to roll wax rods, which are employed to make attributes, necklaces, etc. The importance of the smaller *silatu* in modelling the wax is such that Kalu Kuma, one of the leading sculptors in Pātan who specialises in the manufacture of tantric deities in Tibetan style, regards it as a sixth "finger". Other tools, such as the scissors (Plate 2e) used to cut wax, are made of metal or wood.

The sculptor models the parts of his image, whether hollow or solid, without a core, by skilful manipulation of portions of wax sheet and use of the *silatu* (which is frequently moistened with saliva to avoid sticking) near a portable charcoal stove (Plate 1), (*ou cha*; Labriffe, 1973: caption opp. p. 187 has *milācā*) made of clay called *ghoti cha* (Labriffe, 1973:189, n.13c has *gathi*), and provided with a door to admit the draught in the lower section and a perforated fuel receptacle in the upper. The stove used by Kalu Kuma measures 18 cm in height and has an external diameter of 28 cm. The various sections of a wax figure or of its component parts are joined by evening out and heating their edges before attaching them (Plate 3). Once the wax model is completed, the artist wets the surface with water and presses on pieces of slightly heated thicker wax in order to obtain the *thāsā* ("key") (Plate 4) or "female" sections of a mould which will allow him to duplicate the same image, or parts of it, in future. The *thāsā* also ensures that in case of mis-casting the time employed to remodel the image will be reduced. In order to model from a *thāsā* the sculptor or his apprentices wet the insides of the sections and press the slightly heated thinner sheets of modelling wax against them. The various sections obtained from the *thāsā* are then jointed together following the original model to form a complete figure or parts of it. The method of casting images in several parts with separate attributes which are subsequently joined together is a traditional feature of Tibetan and Himālayan sculpture (see below, p.78, and Khandalavala, 1950:22).

Although apprentices may be involved in all modelling operations connected with the *thāsā*, the modelling of the prototype is carried out by the sculptor alone. Finally, ornaments, jewellery and attributes to be cast with the figure are modelled and fitted to the assembled wax figure. Kalu Kuma makes use of a black stone obtained from Tibet, carved in low relief with the "female" moulds of a number of religious attributes and ornaments which are part of the accoutrements of his tantric deities. Once a wax model or its parts are complete, a wax tripod is fitted to their bottom edge; its rods will become sprues when the wax is melted away.

During the whole process, the artist makes use of a basin filled with water to cool and harden the wax as necessary, and of a small pot filled with molten wax for retouching and joining. It should be noted that he does not use cores at any stage of the modelling, although a core is automatically formed when investing the wax of hollow models.

Investing the wax

The investment of the wax is carried out by the sculptor or an apprentice, or by a specially hired clay worker, as was the case with the investing of a number of small and medium size wax images which I observed in one of Kalu Kuma's workshops in the summer of 1978. The investment of Kalu Kuma's models by this artisan was carried out during four days of sunshine. This account follows a chronological sequence to give an idea of the time involved in the various operations.

5 September 1978

A paste made of fine clay (Nep. *mashinõ mãtõ*; New. *mashin cha*), water and cow dung in equal proportions is applied to all the less accessible parts of the model. Immediately afterwards, a more liquid, creamy solution of the same composition is splashed and poured over and, where appropriate, inside the wax model or its parts (Plate 5). To improve access to the interior of a hollow model a small window may be cut in the wax and the paste pushed through to form a core. The window may be replaced before smearing the outer surface with subsequent layers, or may be filled with clay and only closed with a piece of copper sheet after casting is complete. The excess creamy solution is then shaken off and the clay left to dry in the workshop for about twenty-four hours.

6 September 1978

A thick paste made of yellow clay (Nep. *pahenlõ mãtõ*; New. *masu cha*), water and rice husks is applied on top of the first layer. The resulting moulds are then put on a roof terrace to dry in the sun for a couple of days. Clay and rice husks are kept separately and mixed with water in a large clay pot as required.

8 September 1978

One or more iron nails are driven through the outer layers into the wax and the inner layers of clay to act as chaplets, so that during the melting of the wax the core of hollow models will not be displaced and thus hinder the molten metal from reaching all parts of the mould. A thicker layer of thick clay paste is subsequently patted onto the moulds, which are finally left to dry completely (Plate 6).

Removing the Wax

Dewaxing and the subsequent operations will be described here in a time-sequence referring to the casting in copper of the images whose investment has been described above. They took place in the small courtyard (320 cm x 210 cm) and porch of Kalu Kuma's old house, on the evening of 13 September, 1978. The evening was chosen because casting is obviously more bearable in cooler conditions. Kalu's son, Rajesh, directed the operations, which involved four other workers, including his own brother-in-law, two other assistants of Kalu, and one of another sculptor's apprentices.

Although some workshops are provided with a dewaxing stove (Plate 7) and firing kiln (Plate 8) besides the furnace for melting the metal (Plate 9), the Kumas use a dual-purpose yellow clay kiln measuring 68 cm x 48 cm x 56 cm and built on a similar principle to the stove described above (p.72). Here, however, the lower compartment has a larger door for admitting the draught, and the top compartment is a chamber built with a temporary front wall of loose bricks. The kiln is not moveable, being built against one of the walls of the courtyard.

5.00 p.m. The moulds are placed on a charcoal fire resting on the receptacle separating the lower from the upper compartment of the kiln. They are turned with tongs until thoroughly heated, but not baked, for a period varying from 2 to 5 minutes according to the size of the mould. They are then removed, the head of the tripod is pierced and the wax flows out through the sprues into an earthenware bowl. It takes a few minutes for all the wax to escape, and eventually the sprues are cleared with metal tools in order to ensure a passage for the molten metal to be poured in later. The wax will be re-used for modelling, after replacement of its vegetable ghee.

5.15 p.m. Copper sheets and scraps (including wire and a variety of bits and pieces) are hammered to the smallest possible size and jammed into an open glazed ceramic crucible 20 cm high and 16 cm in external diameter. These crucibles are imported from India and are used especially for casting copper.

Firing the mould and melting the copper

5.40 p.m. The fire in the kiln is reactivated with paper, dry corn-cobs and small bits of wood,and then the draught from an electric fan is directed into the door. Charcoal is added and once it is burning well the fan is switched off.

5.45 p.m. Coal is placed in the hearth of a furnace built like the stove and the kiln from bricks and yellow clay, and located in the corner opposite the kiln. Its measurements are 79 cm x 79 cm x 66 cm. Coal is not found in Nepal (Imperial Gazetteer of India, 1908:119) and is now imported from India, but it does not appear to have been imported in the past. As a fuel it has probably replaced charcoal for casting, whereas wood is still used for firing moulds (Alsop and Charlton, 1973:38). In Tibet, coal was available in the eastern part of the country (Cooper, 1871:463; Saunders, in Turner, 1800:406; Duncan, 1964:19). Combustion is aided by directing an electric blower into a pipe protruding 15 cm from an opening in the lower compartment of the furnace. The blower is luted to the pipe with clay.

5.50 p.m. Cross-armed crucible tongs are brought into the courtyard (Plate 10). Their length varies from 117 cm to 142 cm and their fulcrum is located so as to allow maximum grip when holding the crucible. Their ends are semicircular so as to fit almost all the way round the crucible. Glowing coal is transferred from the furnace to the kiln in order to reach a higher firing temperature.

5.55 p.m. The coal in the furnace is burning with a flame 60 cm high, undoubtedly because of the draught from the electric blower.

6.00 p.m. The crucible containing the metal is placed directly on the coal in the furnace and a brick chamber is built around it. The chamber is one brick thick and leaves the upper portion of the crucible visible. Pieces of copper stick out of the crucible to a length of 15 cm. The crucible is not fixed in position, but rests on the coals which are continually topped up.

6.10 p.m. A convex iron lid is placed over the furnace chamber. Charcoal is added to the receptacle of the kiln and moulds are placed on it for firing. They will have to be brought to a temperature close enough to the melting point of copper (1083°C) to prevent the metal from starting to solidify before the mould is completely filled, and the mould itself from cracking

during pouring. No thermometer or other form of temperature control or measurement is used by Newar sculptors even today.
6.12 p.m. Blue flames 15 cm long spit horizontally from beneath the furnace lid.
6.17 p.m. The lid is red hot and four sheets of scrap copper hammered to equal size are put around it, leaning partly on the temporary brickwork of the chamber. More copper scraps, mostly sprues recovered from previous castings, are beaten, and coal is hammered into fragments.
6.20 p.m. The kiln receptacle is filled with coal and a slate is put as a roof over its three walls, while a temporary wall of bricks and clay is raised in front of it to seal off the moulds in a chamber. The scrap copper sheets which were being heated on the top of the furnace are hammered while hot to a size to fit the crucible.
6.28 p.m. The furnace lid is so red as to appear almost transparent. A large ceramic bowl, measuring 18 cm in height and 51 cm in diameter, is filled with water in preparation for cooling the moulds after casting.
6.35 p.m. The position of the crucible is adjusted with a long iron bar through an opening in the temporary chamber wall, and the lid lifted. The copper in the bottom of the crucible must have started melting because the level of the red hot copper scraps visible above the rim has dropped. They are further pressed down with an iron bar. Small copper scraps are poured into the crucible from a ladle, 9 cm in diameter and 27 cm long, provided with a wooden handle.
6.37 p.m. The crucible is red hot and more coal is added to the chamber by hand. Both coal and scrap copper are carried in metal buckets.
6.45 p.m. The furnace lid is lifted to add more scrap copper to the crucible. After removing part of the temporary front wall, Rajesh puts five more moulds into the kiln chamber and adds charcoal.
6.50 p.m. The bricks are put back and the flames in the kiln chamber are fanned with a piece of straw matting.
7.10 p.m. The furnace lid is lifted again to add more bits of scrap copper.
7.20 p.m. More charcoal is added to the kiln chamber.
7.35 p.m. The coal level in the furnace chamber is topped up. The kiln is fanned again.
7.40 p.m. A wall two bricks high is built on the ground in the porch to support the fired moulds during casting.
7.45 p.m. The temporary front brick wall of the kiln chamber is dismantled and the fired clay moulds are placed on the ground, leaning against the two-layer brick wall. They are red hot and stand upside down with the opening (i.e. the head of the tripod) pointing upwards, ready to receive the molten metal.
7.50 p.m. The copper is molten and casting begins. Rajesh stirs the molten copper with an iron bar to check that melting is complete before pouring it into the opening of the mould. A certain amount of spilling occurs, probably because the open glazed crucibles are difficult to handle. No precaution is taken to ensure that the air escapes from the moulds. Consequently mis-castings are not rare, as I saw the following day, when the tripod-shaped sprues were sawn off the bottom of the copper statues and parts of statues.

The above time-table shows that it took one hour and fifty minutes for the copper in the crucible to melt and one hour and thirty-five minutes for the clay moulds to be fired. The copper castings are allowed "to cool and harden for about fifteen to thirty minutes. The cooling is speeded by pouring cold water over the mould, which emits huge amounts of steam. Finally the entire mould is placed in a large jug of water to complete the cooling process" (Alsop and Charlton, 1973:39).

The casting operations for copper were not very different from those for casting brass, as I had observed them in the house of the sculptor Sanu Kaji Sakya on 12 September, 1978. Preparations started there at 4 p.m. Both his kiln (71 cm x 71 cm x 120 cm) and his furnace (94 cm x 91 cm x 132 cm) are located in the porch adjacent to the courtyard. Sanu Kaji's furnace is larger than Kalu Kuma's and has a 14 cm x 14 cm window to admit the draught located 25 cm from the floor. The sculptor and his assistants were casting medium size images of Vajrapāṇi, Amitāyus and a Burmese style Śākyamuni. Lotus bases, bodies and head-dresses were cast separately. The crucibles were oval and 24 cm high with a short spout near the bottom. They were completely sealed to prevent loss of zinc from the alloy. These crucibles are made by the artists themselves and, according to Krishnan (1976:31), withstand only one melting operation. After the crucibles had been sufficiently heated for the brass to melt, they were removed from the furnace and their spouts perforated with an iron rod. Brass melts at a lower temperature than copper and appears more fluid and easier to cast; the molten alloy was poured into the moulds without the spilling noticed in Rajesh's workshop.

After casting, Sanu Kaji dropped each hot clay mould into a brass basin full of water, with considerable steaming and bubbling. The moulds remained in the water for a few minutes and were then taken out to be broken with an iron bar (Plate 11). The fired clay came off the metal statues easily and, as is to be expected with brass, Sanu Kaji's casting had a higher rate of success than Rajesh's in copper.

Cleaning up and assembling the cast

After removing the clay from the casts, the sprues are sawn off and the statues are then cleaned and polished for hours with the help of files (Plate 12), sandpaper and rags. None of the operations described above has to be performed by the artist, although most sculptors do their own casting.

Finally the statues are assembled, mostly by means of crimping and riveting although in the past split pins were also occasionally used. The backs of the neck, shoulders and wing attachments of Kalu Kuma's 44 cm high copper Garuḍa, made in c. 1971, provide a good example of crimping combined with riveting and dovetailing; the head is held in place by fitting it between the shoulders and driving a rivet between the shoulder-blades into the neck. The neck ornaments conceal the junction and the continuation of the neck into the shoulders so that the rivet is hardly noticeable. A crack in the dovetail joining the right wing and shoulder-blade of the Aniko Collection Garuḍa (Inv. no. 119; on loan to the Victoria and Albert Museum) reveals that the wing is also provided with a tenon inserted into a corresponding hole in the shoulder-blade (Plate 13). The latter type of fitting is always used to join medium or large size figures to their base or vehicle. The bottom of the figures and their backplates are provided with tenons which fit into corresponding sockets in the base or vehicle (Plate 14 a-c).

The casting of an image in several parts has the advantage of reducing to a minimum wastage due to mis-casting, besides allowing the sculptor to model wax surfaces which, being smaller, are relatively easy to handle. Newar and Tibetan sculptors adopted this technique from an early date, as may be seen from a c. 13th century gilded copper image of Maitreya, cast in four pieces by the lost-wax process and regarded by von Schroeder as an example of the Sino-Newar school of Aniko (Uhlig, 1979:168-9, no.95). Separate casting is favoured for both medium size and large images, but is also frequently used to cast components such as the base, backplate and attributes of smaller statues, sometimes in different alloys or metals, according to circumstances and taste. Although specialists in Tibetan and Himalayan art tend to be suspicious of figures where analysis has revealed a different composition from that of the base, backplate or halo, it should be noted that such differences are not necessarily evidence of forgery or restoration work. Bases and backplates may be cast, or even hammered, several weeks after the figure to which they belong, for a number of reasons, such as division of labour, availability of metal, delays due to weather conditions, time of year (Newar metalworkers are extremely reluctant to work during the numerous festivals of the Newar calendar), and mis-casting. Because of the use of scrap in the alloy, it is not surprising that brass castings of different parts of an image made only a few days apart in the same workshop may give significantly different results in the composition of the alloy. Furthermore, availability of metal and taste may also account for the use of different alloys for different parts of the same image, as is the case for a c. 17th century Tibetan copper image of Na-ro-mkha'-spyod -ma dancing on a brass base (British Museum: 1905.5-19.11; p.105, no.38) and for an 18th-19th century Ṣaḍakṣari (Werner, 1972: Figure 31). The same applies to other pieces, like a Tibetan copper statue of Sitatārā sitting on a brass base (British Museum: 1880:126; p.103, no. 4), the 15th century 25 cm high Tibetan statue of Padmasambhava illustrated in Christie's catalogue of their sale on 19 February, 1980 (p. 19, no. 79), and various other pieces. Although the possibility of later restoration work cannot be excluded as an explanation of the use of different metals in the same image, it is important to stress the role played by chance and taste in composite metal statuary from Tibet and the Himālayas. The same observations apply to original restoration work, where different metallurgical data from the same statue only prove that time has elapsed between the first and second casting, but cannot quantify it, whether in terms of days or centuries, unless other evidence is available.

With the polishing of the casting, the task of the sculptor is completed; for chasing, engraving and inlaying are carried out by the chaser, who also seals the underside of the statue with a sheet of hammered copper after the consecration of the image, and may inlay semi-precious stones where necessary. Although the first two operations are decisive for the final appearance of a metal image, the techniques and tools of the chaser (Dagyab, 1977, II:51-2, pls. 67-69 and 71) are rather different from those of the sculptor, and chasing, engraving and inlaying, as well as statuary embossing, deserve separate treatment. Suffice it to say that the chaser gently beats the surface of the casting with the aid of a little hammer and punch, before engraving it with a hammer and chisel. Copper is soft and relatively easy to chase and engrave, whereas brass is hard and brittle and few chasers challenge that medium with more than an average performance, though such was the case for a brass Tārā (Victoria and Albert Museum, I.S.21-1980; no. 121 on p.109 below). Copper is also more suitable for mercury-gilding than brass, particularly the leaded brass commonly used by Newar metalworkers (see p. 59). The materials used for inlay work in copper are usually silver and gold, but copper is used for inlaying brass. Gilding is seldom associated with inlay work, although I have seen one example of gold and silver inlay in a partially gilded copper statue of Dīpaṅkara. This combination of techniques finds an antecedent in at least one example of a post-Gupta gilded metal image, whose eyes are inlaid with silver (Majumdar, 1926:425). According to Khandalavala (1950: 24-25) "the practice in Nepal of setting ornaments and crowns of images with semi-precious stones was .... derived from late Pala art .... . The practice of gilding Nepalese copper images is also borrowed from Pala metal sculpture where gilded images are frequently met with". Even earlier, however, "stones and pearls" are reported to have decorated statues in the four pavilions of a building in the ancient capital of the Nepal Valley at the time of the missions of Wang Hiuen-ts'e in AD 647/8 and 657 (Lévi, 1905, I:157 and 159 and II:164-5). Tibetans traditionally prefer turquoise and coral for inlaying their metal images.

Gilding

Fire-gilding or mercury-gilding, that is gilding by means of a mixture of mercury and gold, is mentioned by Padma-dkar-po as being used in Tibet from the 7th century (see p.58). However, textual references are scanty and the technique is not described in detail by any of the Tibetan sources used for this introductory study. Ray (1956:115) refers to a text of the *Kubjikā Tantra* "in the valuable manuscript collections of the Maharaja of Nepal. This was written in Gupta character and copied about the 6th century AD. In this Tantra we find allusions to the transmutation of copper into gold with the aid of mercury". It is possible that mention of such a transmutation in Indian and Tibetan alchemical literature is merely descriptive of fire-gilding. Mercury is referred to in connection with copper in the *Rasāyanaśāstroddhṛti*, a text which was translated and included in the Tenjur, and is therefore earlier than AD 1335. The translation by Suniti Kumar Pathak (Ray, 1956: 469) of the Tibetan version of verses 17 and 18 concerning copper and mercury interprets it as hinting at fire-gilding on copper, but is, to say the least, excessively free. The word for "gold" does not appear once in the corresponding Tibetan verses. On p. 30 of the *Yuandai huasu ji*, a record of the materials used by artists of the Mongol court between AD 1295 and 1330 at a time when Aniko was active there, mention is made of an image being "adorned with Tibetan liquid gilding" (Karmay, 1975:23), which is perhaps a reference to mercury-gilding. In the Nepal Valley, mercury-gilding has been used from the 10th century (see p.88) and Newar artists have always preferred this gilding technique on metal statuary almost to the exclusion of any other, even after 1979 when electro-plating was first introduced. The Newars probably derived that gilding technique from India, although few examples of gilded northern Indian statuary have survived. Majumdar (1926:427) assumes that the 84 cm tall standing Mañjuśrī from the ancient city at Mahasthan (Bogra District, Bangladesh) was mercury-gilded. However, he contradicts himself in regarding the image first as "not earlier than the Pala period" (Majumdar, 1926:425), then ascribing it to the Gupta period (ibid.:426-7). S K Saraswati, who knew the piece well, calls it "of definitely Gupta workmanship" and "gold-plated" (Saraswati, 1962:26), by which he seems to have understood fire-gilding. He describes its "fine plating, thinner even than an egg shell" and, in explanation, briefly quotes an account of contemporary Newar fire-gilding (Saraswati, 1962:30). Antiquities found at Mahasthan indicate that the city continued to flourish after the Gupta period and, since very few surviving metal images can be unquestionably given a Gupta date, it may be safer to assign the statue to the post-Gupta period. This view finds support in Dani (1959) and Asher (1980:94).

Although the method of fire-gilding became very popular in the Nepal Valley for the gilding of cast or repoussé Buddhist and Hindu copper images (Pal, 1974:33), there is no evidence that all copper statues from Nepal were gilded or were meant to be gilded. Parcel-gilding appears in Newar statuary from at least the 17th century, perhaps less for aesthetic reasons than as an economy measure, as the back of the image often remained ungilded (Khandalavala, 1950:22) and was painted red. This kind of parcel-gilding became very common in Nepal in subsequent centuries. The front of the statues, with the exception of the hair, was always entirely gilded and polished. Sometimes the main figure was gilded and its accessories left ungilded. Waldschmidt (1969: no. 39) and Werner (1972:211, Figure 31) illustrate an 18th-19th century Newar gilded image of Ṣaḍakṣarī seated on an ungilded throne with an ungilded ornamental back and canopy. This statue and all its parts were cast in brass (Werner, 1972:184-5, no. 173 a-c). Examples of mercury-gilded brass from an early period are less common,but brass was being used in Newar statuary from the 10th-11th century Since 1959, parcel-gilding for aesthetic purposes has occasionally been carried out on copper statues meant for the Western and Tibetan markets. This was also a common feature in eastern Tibetan and Sino-Tibetan brass statuary from at least the 18th century onwards. Usually the jewellery and naked parts of a figure, with the exception of the hair, were gilded, and the garments, or parts of them, were left ungilded, or vice versa. This applied to both the front and back of the statue. Parcel-gilding has also been used on repoussé metal work from at least the 18th century and is still very common, particularly on domestic and ritual objects meant for Tibetan customers.

Newar artists are aware nowadays of the difficulty of fire-gilding brass and of the impossibility of fire-gilding leaded brass (pp.92-4), but it is uncertain how far they were acquainted with the problem from an early period. Tibetans probably learnt from them, as is suggested by a fire-gilded brass Śākyamuni dated to c. 1500 (Uhlig, 1979:180 and 183, no. 107). The alloy of that image contains only 0.16% lead and 8.40% zinc, the percentage of these two elements probably having been kept low in order to avoid any adverse behaviour of the alloy when exposed to heat during the fire-gilding process.

Cold gilding is mentioned by Padma-dkar-po as being used to gild the statues of Tibetan kings during a period corresponding to the 8th century (Padma-dkar-po, 1973, I:301,1.3). Cold gilding may be done by the application of gold leaf to the surface of the statue, either by burnishing it on, or by using an adhesive. It seems, however, that the most common technique for cold gilding statues is painting. Traditionally, gold paint is prepared by binding ready-made lentil-shaped drops of gold dust with glue. The exact method of preparation of these drops is still a secret known only to the Newars, and in Tibet only a few Newar goldsmiths residing in Lhasa possessed the technique, the names of their establishments being "well known to the painters of Central Tibet" (Jackson, 1976:232). However, one way of making finely powdered gold is by cutting sheets of gold leaf into small ribbon-like strips, mixing them with powdered stone and glass and grinding them with a little water (Dagyab, 1977,I:45).

Cold gilding is particularly suitable for statues made of materials other than metal, and the 14th century clay groups of Srong-brtsan-sgam-po and his two wives preserved in the Potala (Snellgrove and Richardson, 1968: 154; Stein, 1962:247 and pl. opp. p. 246) and the Jo-khang (Sís and Vaniš: [1957] 133 and 147-9 are certainly gilded by that technique. Gold paint is still used by Tibetan and Newar artists to give the faces and necks of Tibetan images their charscteristically matt golden colour. This practice is very common in Tibetan metal statuary, whether fire-gilded or not, and in the former case the gold paint is applied over the mercury-gilded surface of the face.

Finally, mention should be made of the use of gold as an offering in the alloy of statuary metals, as is revealed by Himalayan copper and brass images with a gold percentage higher than about 0.01%, although Werner suggests a lower limit of 0.05% (Werner, 1972:146-7, table 9.6, nos. 167, 173 and 208) The 25 cm high brass statuette of Ṣaḍakṣarī (Werner, 1972:184-5 no. 173 a-c; see above p. 82) has a gold content of 0.13%, although it is not clear whether the result of the analysis may have been biased by the fact that the main image is actually gilt, because its backplate and base have only 0.012% and 0.008% of gold in the alloy. However, the detection of pieces of gold leaf beneath the surface of a few *thang-kas* (Bruce-Gardner, 1975) by means of an infra-red viewer, suggests that gold may have been similarly added to statuary metals for purely religious reasons. It is possible that this circumstance contributed to the creation of the myth of the "octo-alloy" (see above, p. 33).

The surfaces of ungilded copper images made nowadays by Newar sculptors are often finished by smearing them with mustard seed oil or even shoe polish in order to give them a patina. The aim of this is not necessarily to make them look antique. The tradition of waxing metal images is very ancient in Tibet and may be due to aesthetic reasons or to the realization that it was a good method of preventing oxidation. The fire-gilded images made at the time of king Srong-brtsan-sgam-po were smeared with *byo rtsi* (for "*byo rtse*") (Padma-dkar-po, 1973, I:300, 1.6) a term translated by Tucci (1959:185) as "resin or greasy material". Similarly, the statues made during the reign of Khri-srong-lde-brtsan "were smeared with *byo rtsi*" (Padma-dkar-po, 1973, I: 301,1.2)and Chinese statues made during the Ming dynasty "were actually smeared with *zho rtsi*" (Padma-dkar-po, 1973, I:304,1.5). This literally means "curds varnish", although Tucci (1959:186-7) translates the corresponding expression from his anonymous manuscript as "red".

Antiquing

The antiquing of images in the Nepal Valley started in the nineteen-sixties as a result of the growing demand for Tibetan and Himalayan antiques in the Western art market, and it is now carried out by a few specialists in Pātan and Kathmandu. The artificial ageing of works of art is forbidden in Nepal and this makes it very difficult for the researcher to get in touch with professional forgers who, in any case, are not ready to disclose their trade secrets. Some artists, like Kalu Kuma, mark their images in order to avoid trouble with the Department of Archaeology of Nepal, which issues the permits and seals necessary for the legal export of all works of art, the export of items over one hundred years old being now forbidden. However, that does not prevent some Newar and Western dealers from having artificially aged a large number of the statues bought from modern artists. Various methods of antiquing have evolved during the last two decades. In the nineteen-sixties, dealers were generally happy with darkening brass images by heating them at a high temperature, thus obtaining a black patina on the metal surface. Labriffe (1973:192) mentions heating over oil lamps, but it is doubtful whether such a method was ever popular, for the soot would come off the metal surface easily and stain the hands of any potential customer, thus defeating its purpose. I understand, however, that a similar method was used to age paintings. Occasionally oxidation is induced by smearing the statue with acids and Labriffe (1973:192) says that some statues were smeared with a mixture of lemon and salt and kept in a damp place surrounded by cloth for a period varying from six to twelve months. She also mentions another method, consisting of smearing the statue with liquid manure, ashes, salt and cow-dung and burying it in the ground for a year, in order to obtain a corroded surface. However, such relatively primitive methods of oxidation are now seldom used, perhaps because collectors have realized that ancient Newar and Tibetan metal images are never excavated from archaeological sites, but come from temples and shrines where they are reasonably well protected and corrosion is minimal. A green patina on any Himalayan statue is almost certainly the result of forgery (Pal, 1974:32-33).

During my visits to the Nepal Valley in the nineteen-seventies, I made several cautious attempts to get in touch with professional forgers, but only managed to create suspicion and fear amongst my informants. Although antiquing methods vary, they can be reduced to two basic techniques: rubbing and heating with a chemical agent. Rubbing is carried out for many days with cloth which may be imbued with any kind of greasy material, including milk, and incense. The heating of mercury-gilded images smeared with sal-ammoniac (ammonium chloride, which was, according to Buchanan Hamilton (1819:212) an item imported from China to Nepal in the 18th century) partially destroys the gilding, but gives the effect of mild corrosion which successfully dupes many buyers of Tibetan and Himalayan antiques. Finally vermilion and other ritual substances may be smeared on the forehead or other sacred parts of the statue to add the final touch of "authenticity" to the image, as if it had just been snatched from the altar. In some cases forgeries are left incomplete to simulate loss due to age. The most sophisticated methods of antiquing are used for statues which are especially commissioned from sculptors by Western dealers, on the understanding that no other images will be produced from the same *thāsā*. A model produced in only one or two copies is obviously more expensive and I understand that the professional artificial ageing of a statue may cost up to 100 U.S. dollars, but the investment must be worthwhile for some dealers are ready to pay.

Western collectors should be particulsrly supicious of black or green corroded "Tibetan" metal images, for anyone who is familiar with the way they are kept ought to be aware of the generally good state of preservation of their surface. Tibetans have a less physical contact with their images than Newars and seem to regard the direct application of offerings to their surface as not far short of sacrilege. A good example of the contrasting Tibetan and Newar attitudes towards Buddhist images kept in Tibetan monasteries of the Nepal Valley is provided by Kuber Singh Sakya's 360 cm high fire-gilded copper repoussé Sha-kya-thub-pa (plate 15) which in about 1975 had to be protected by glass panels from the offerings thrown at it by Newar devotees. Drier climatic conditions in Tibet, where precipitation is generally less than 25 cm per year, also contribute to the better preservation of metal images there than is the case in the Nepal Valley, where they are exposed to the intense dampness of the monsoon; from July to September the Valley receives most of the annual rainfall of 127 cm to 140 cm. Thus, as a rule, Tibetan antiques are in a better state of preservation than forgers would have us believe.

The problem of establishing whether Newar metal images are ancient or modern is sometimes difficult. Newar statues are quickly worn by worshipping and the organic ritual substances deposited on them do not provide a clue to dating by chemical or carbon-14 analysis because their application is perfectly compatible with contemporary worship. Furthermore, it is doubtful whether antiqued gilded images will retain sufficient traces of ammonium chloride on their surface to be detected by chemical analysis. It is likely that the considerable demand for Himalayan antiques will lead to the perfecting of artificial ageing methods, particularly as far as Newar statuary is concerned, and especially where those methods are encouraged and supervised, if not actually practised, by Western dealers.

Conclusions

Apart from the methods of forgery, it appears that very few technological innovations have occurred in the statuary techniques used by Tibetan and Himalayan sculptors to this day. They still manufacture their own modelling tools and they model clay and wax in a traditional manner. Their investment techniques find a parallel in the use of different grades of clay as described in various Indian texts (Reeves, 1962:31), including the *Mānasollāsa*. Apart from the use of coal, the only improvement made in firing the mould and melting the metal is the modern use of electric fans and blowers by some sculptors, instead of hand-operated bellows. No innovation has been applied to the seemingly difficult problem of measuring the temperature of the clay mould before pouring the molten metal into it. Artists obviously feel confident enough to rely exclusively on their own experience.

Casting of separate parts of the same statue is not a novelty, as is shown by the instance of the Sultanganj Buddha. Occasionally medium size statues, whether hollow or solid, may still be cast in one piece (Alsop and Charlton, 1973:38). A few minor changes have occurred in the fitting techniques; tenons tend to be bigger than in the past and can no longer be bent, and split-pins are no longer used. However, examples of unsecured base in ancient statuettes are not rare. Brazing and silver-soldering are nowadays used to repair minor mis-castings and both techniques appear to have been introduced in Newar statuary after 1975. However, chasing, engraving, inlaying and gilding are still carried out with the traditional techniques, and it may thus be concluded that Himalayan metal statuary has undergone few technical changes since it was introduced into Tibet from India and Nepal and that it is still practised by ancient methods by Newar sculptors in Pātan.

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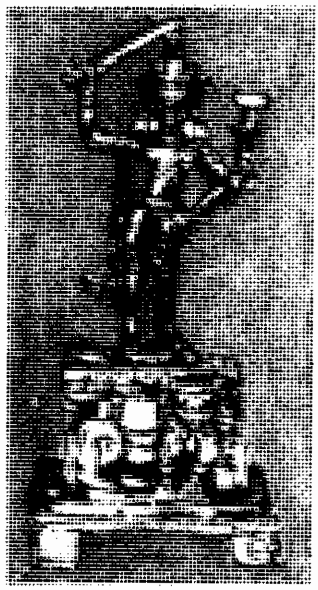

MAÑJUŚRĪ

Western Tibet. 11th-12th century A.D. Brass image and arsenical copper base. Ht. 12.5 cm. Pub.: von Schroeder, 1981 O.A. 1905. 5-19.15.

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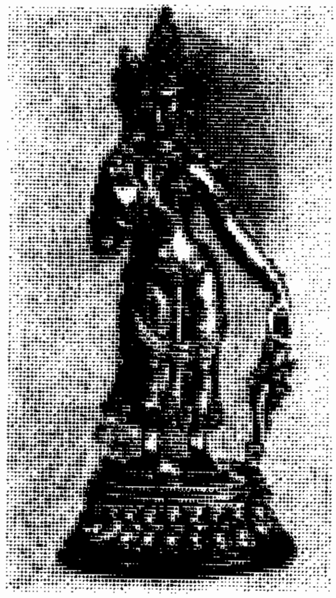
MAITREYA (?)

18th-19tn century A.D. Brass with red pigment on lips; imitation gold paint on front of figure. Ht. 8.6 cm. 0.A. 1924.6-20.10.



TĀRĀ

Nepal. A.D. 1975. Brass. Modelled by Babu Kaji Vajracarya; engraved by Rudra Bahadur Sakya. Ht. 16.5 cm Victoria and Albert Museum. I.S. 21-1980

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