THE TUGAYA BRASS INDUSTRY

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The Maranaos of Lanao, although generally literate, have not kept written records of important historical events. One such important event was the introduction of metalwork of which only traditional oral accounts are today extant.

These accounts are a mixture of fact and fancy. Where fact begins and fancy ends is difficult to ascertain. Nonetheless, these accounts are the only history of Maranao metalwork available at this time.

The Maranao metalwork centers in the town of Tugaya (1970 population: 24,682) on the western shore of Lake Lanao, Lanao del Sur. Here, crude and centuries-old foundry and casting techniques are used by about a two-thirds of the populace in the manufacture of a variety of brass and bronze articles.

The predominance of brasswork in Tugaya has given rise to the local craft's being known as the brass industry. Actually, bronze articles are also produced. For simplicity, however, the metalwork in Tugaya shall henceforth be called brasswork in this study.

Before brass casting was known in Tugaya, pottery and ceramics were the artisans' crafts. These crafts developed mainly because such raw materials as clay, sand and bees' wax were found in abundance in the town.

Origin

Traditional accounts trace the introduction of brasswork to Maruhom Maulia, son of a Tugaya sultan. With his father, Maruhom Maulia went to Tampasok in Sabah where brass articles were manufactured. Later he got married to the Tampasok sultan's daughter. To support his family and for the sheer love of it, he learned brasswork. After ten years, he returned to Tugaya, bringing with him different brass articles. These articles served as models which he copied. Maruhom Maulia passed on his knowledge of brasswork to his kins and this knowledge was subsequently handed down from generation to generation. Brass and bronze were brought through traders that frequented Tampasok. Clay, sand, wax and oil were secured locally.

Simple articles such as brass cannons, dippers, betelnut containers and jar stands were first produced. According to old folks, Datu Romondao made the first cannon, a small model he called **inoray** (golden). Datu Gomamowa fashioned the first **kabo** (dipper) which he patterned after a **boyong** (Chinese jar) and which was improved upon by Datu Pagayokan. **Tangla,** a stand or holder for a small Chinese water jar, was first made by Datu Kalaoto. Some **lotoan** (betelnut boxes) were imitations of Bornean models. One of the early makers of artistic betelnut boxes were Datu Bania, grandson of Datu Romondao, the cannon-maker.

As the Maranao metalworkers developed their skills, they turned out such brass articles as **gador** (urn), a **langowai** (pot), and the **kolintang,** a percussion instrument which consists of eight graduated and bossed gongs.

Traditional accounts may be difficult to authenticate, and may be taken with a grain of salt. But it can be safely inferred that brasswork techniques originated from Borneo and were introduced not only to Maranaos, but also to the Maguindanaos of Cotabato and the Tausugs of Sulu. Brasswork has already been abandoned by the Tausugs but it still is being done by the Maguindanaos at Datu Piang (old Dolawan) and Kampilan on the bank of the Rio Grande river.

Traditional brass foundry techniques similar to those used by the Maranaos are employed by the artisans of Bali in Sumatra and Brunei in Borneo. This tend to show that the brass industry of the traditional type is widespread in Southeast Asia, its common matrix in India and China.[1]

It can be safely surmised that the Tugaya brass industry dates back to the Metal Age (circa 1000 A.D.) in the Philippines.[2]

Brassware to this day is still an integral part of the material possessions of Muslim Filipinos, notably the Maranaos and Maguindanaos.

In Tugaya, the ancient brasswork techniques can be modified and refined to revitalize the craft and increase the industrial worth of brass and bronze products, thus assure the Maranaos a steady source of income.

Each family in Tugaya has its own metalworks shop under the house. When articles to be made are relatively big, i.e., a **kolintang,** two or more families pool their resources in producing them.

Most brass and bronze articles are decorative. However, there is now a trend in producing more utilitarian items such as ash trays and lamp stands.

Brassware patterns and designs

Stamping **(kambantak)** is the simplest process in brasswork, in the sense that it takes less time, labor and money than the lost-wax process **(kapanowang)** to produce an article. The local artisans fashion their own hand tools – very crude forming and punch tools – and have thus further reduced the cost of stamping.

Artisans use a metal compass to inscribe a series of circles on brassplates, which they make themselves. No preliminary drawings of designs are imprinted before the stamping or punching starts. The artisans are very skillful at stamping such figures as dragons, and fishes, as well as intricate designs, without the aid of preliminary sketches. The plates are tied together with a wire, in twos or fives, and with their crude hand tools, the artisans stamp the designs on the plates (Fig. 1).

Although stamping is the simplest process, only a few artisans use it. It is because there is more money in articles produced by the lost-wax process than those produced by stamping.

The lost wax process is the earliest method learned by the Maranaos from the Borneans. Through this process, artisans have been producing brass articles with very intricate designs.

Cannon bullet shells and other scrap brass or bronze are most commonly used for casting. The scarcity and relatively high prices of brass or bronze are among the major problems of the artisans. As a result, the production of brass articles has been relatively low.

Molds are made from a combination of powdered charcoal, red sand, resin, paraffin, bee's wax, kerosene and vegetable oil.

Except for the paraffin, all materials are available in Tugaya.

The charcoal comes from burnt bamboos which are crushed into powder. Because there is no temperature-control equipment, the bamboos are sometimes burned into ashes – which means the loss of much charcoal. The charcoal produced from bamboos is of low quality, hence low-heating. Because of this, much charcoal is needed to melt a small piece of metal.

Furnaces, crucibles

The brassware models are wooden, usually circular (Fig. 2-a). These are carved with such hand tools as bolos and knives. Models of big articles are usually cut up into small parts or sections (Fig. 2-b). Because the artisans do not use lathe machine, their wooden patterns tend to be uneven.

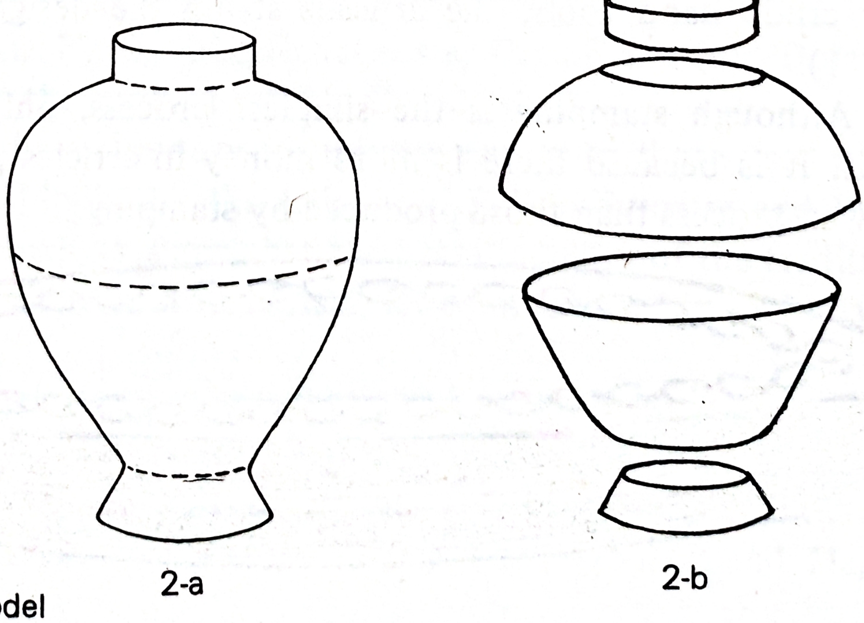


Fig. 2 Wooden Model

The pattern for the **okir** (designs) are a compound of bee's wax, paraffin and resin softened in hot water. The resin is **tigis,** which may either be taken from the sap of a local tree or bought from stores. It is crushed into powder and is sieved into fineness. The compound is about two-thirds resin to one-third paraffin, by volume, and is flattened into thin sheets. The sheets are cut into thin long strips where **okir** patterns (Fig. 3) are made without preliminary drawings.

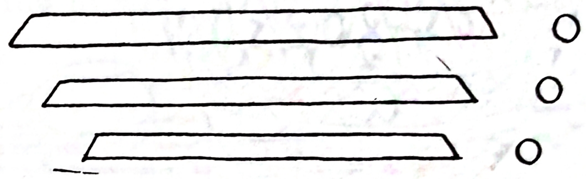


Fig. 3 The wax strips

The base sheets are also a compound of paraffin and resin. But they contain more paraffin than resin. The sheets are flattened to thickness ranging from 1/16" to 1/18", with a wooden roller. Their thickness varies according to the size of the brass article to be made. A base sheet is then dipped in hot water to soften it, then wrapped around the wooden model. The **okir** pattern are pasted to the base sheet, using kerosene as the binder (Fig. 4-a). After this, one or two sides of the base sheet is slitted very carefully and the wooden model is gently removed, leaving the wax sheet (Fig. 4-b).

The red sand, mostly silica, and clay are among the materials used for facing and backing (Fig. 5). They are found along the lake shorelines. Artisans bring them to their houses without removing impurities.

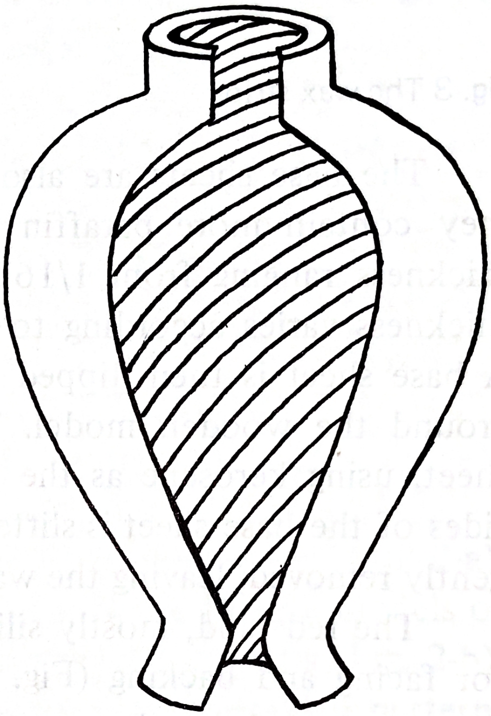
Facing refers to the layer of fine clay and charcoal powder, usually the first layer supporting the inner and outer sides of the wax shell. Facing is a wet mixture of roughly one-third clay and two-thirds charcoal powder, by volume. The average facing thickness is 1/2" to 3/4".

The backing is a mixture of fine red sand and clay that supports the facing. It varies in thickness, depending on the product size. The backing is always applied by "feel", but care is taken that in adding water, it would not become too fluid.

After the facing and backing have been applied, coarse sand and clay are poured into the shell to retain the shape of the wooden model. A vent or opening through the external facing and backing is also made, completing the mold. The vent serves as the outlet for the melted wax in the firing of the mold, and as an inlet of the molten metal during the pouring.

Fig. 4-a The **okir** designs on mold.

Fig. 4-b.



The wax mold, after the woodel model has been removed.

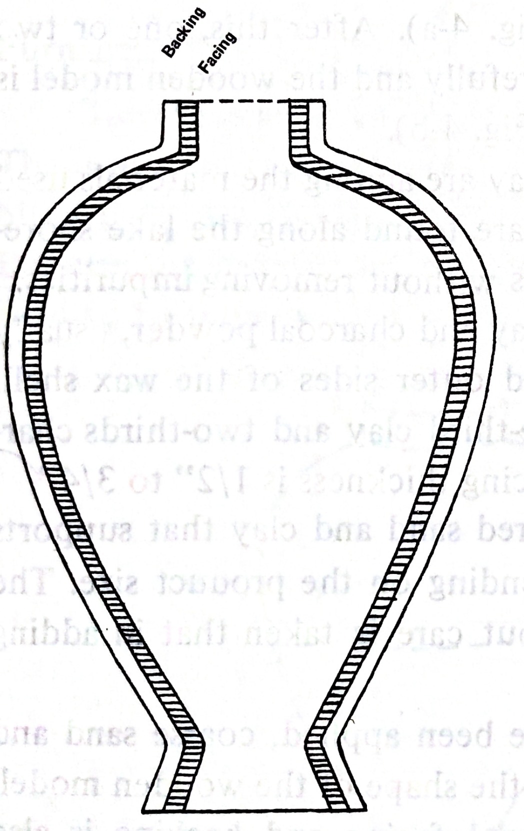


Fig. 5: Cross section of mold

In longer processes, a third layer of charcoal and clay and a fourth layer of clay and sand are also applied to strengthen the mold.

The mold is dried in the sun for about two or three days to remove excess moisture. More firewood are needed in firing molds that have excess moisture.

The molds are fired in a hole about two or three feet deep. The size of the hole depends on the number of the molds to be fired. Green hardwood in crossed rows support the molds to be fired (Fig. 6). The

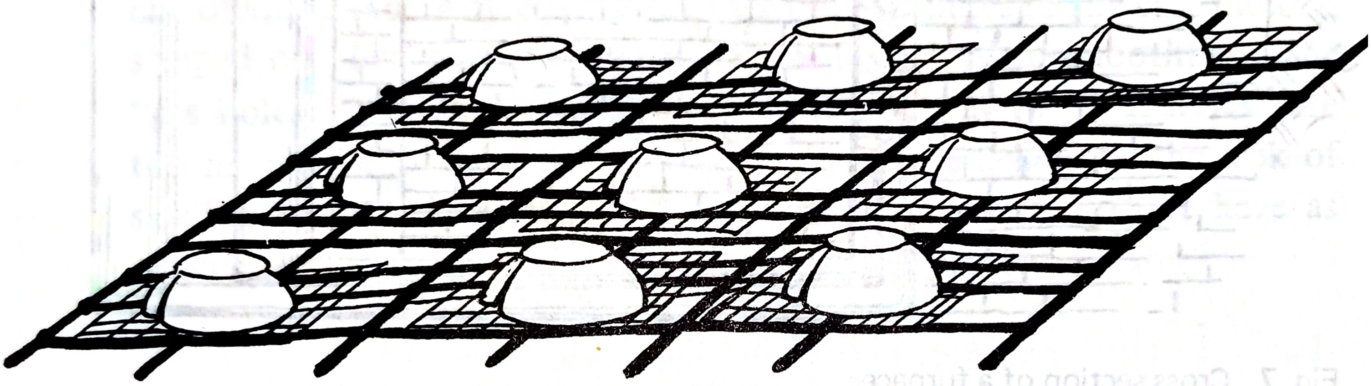


Fig. 6 The molds being fired.

firing hole is usually near the furnace so that the molds could be used while it is still warm, if not still hot. The warm or hot molds also help keep the molten metal from prematurely cooling and solidifying before it is poured into the molds. Firing starts a few hours before pouring. It melts the wax shell which oozes out of the outlet, leaving the space for the molten metal. If the wax shell is not thoroughly melted, some of it will remain in the mold and cause "gas holes" in the finished product.

Marketing: a major problem

In Tugaya, less than ten furnaces are at work. This means one furnace per 1000 families.[3]

A furnace is made up of a single compartment –actually a hole in the ground – where the fuel is placed and the metal is melted. On the base of this compartment are two holes connected to bamboo blowers. One man manually pumps air into the bamboo pipes (Fig. 7).

This part of brasswork can stand much improvement. The author noted that much heat escaped freely and were thus wasted. This means a relatively high fuel consumption. The author also noted that because

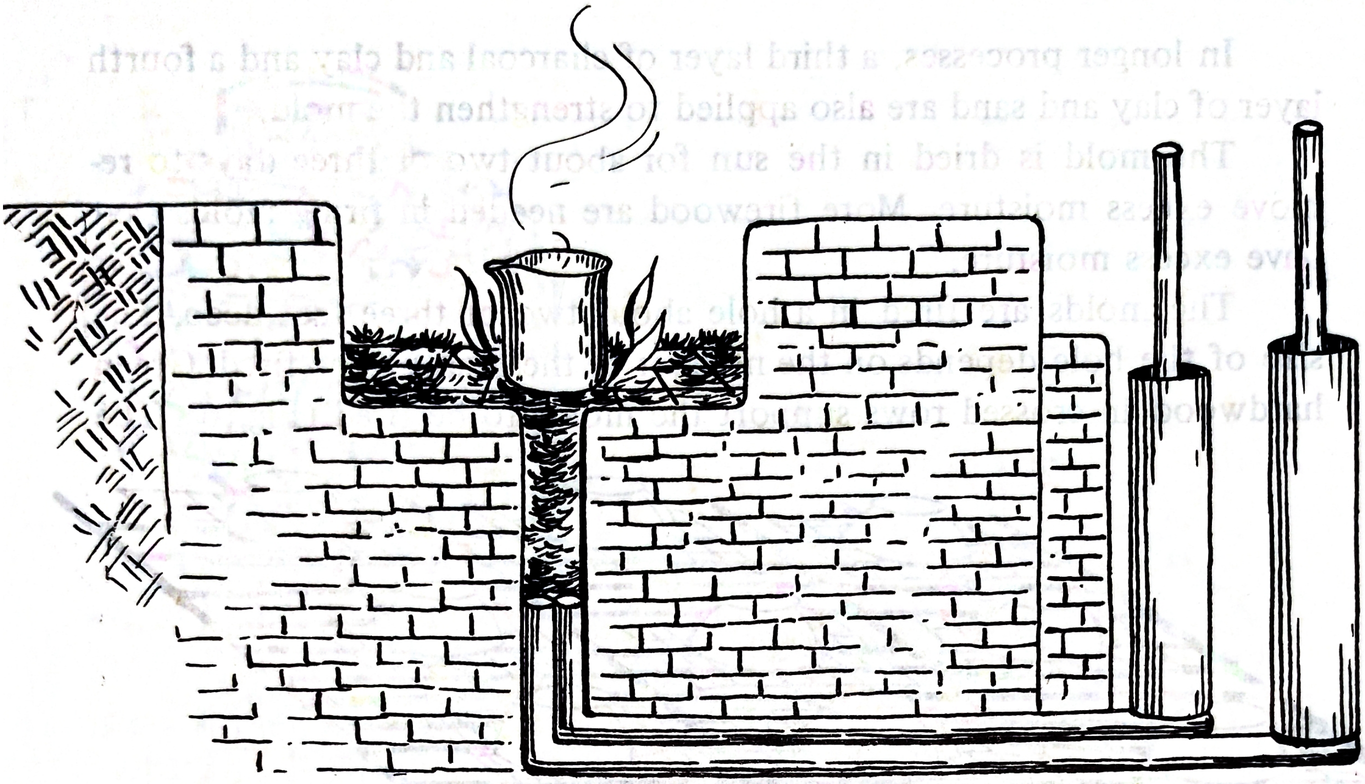


Fig. 7. Cross section of a furnace.

there was no separate fuel compartment, impurities in the form of ashes, freely mixed with the molten metal. Locally-made crucibles also give off additional impurities. The crucibles are made up of about 2/3 fine clay and 1/3 very fine charcoal powder, by volume. A small amount of water is added to thoroughly mix the components. Mixing is done by "feel" – which is acquired through experience. The crucible is sun-dried but not fired. The most common dimensions of crucibles are: base – 6 inches; top – 10 inches; and height – 12 inches, and can hold as much as five kilos of scrap brass.

Because the crucibles can only be used once, the number of crucibles needed is equal to the number of pourings to be done. Clearly, the melting and pouring stages are time- and effort-consuming, because of the use of the locally-made crucibles. Still, the local artisans prefer the locally-made crucibles to the commercial ones, which means more expense to them.

Apparently to keep the molten metal from spilling out while it is poured, a piece of rag is placed on top of the molten metal. In the process, the rag gets burned, adding to the molten metal's impurities. However, the placing of the rag on the molten metal has not been explained by the artisans, and one can only guess that the continued practice is impelled by tradition.

Because the artisans lack pyrometers, with which to determine the proper pouring temperature, they sometimes prematurely pour the molten metal which solidifies before it could fill up the molds, resulting in "gas holes" or "blow holes." The impurities and "gas holes" make for poor quality brass articles.

When the molten metal solidifies, the brass product is hammered out of the mold. Any part of the mold that adheres to the cast metal is scraped off. The newly-cast brassware is then filed to smoothness. The "gas holes" – if there are any – are filled up. If the "gas holes" are too many, the brassware is melted and repoured. Due to the lack of sanding or finishing machine, the Tugaya brassware do not have as smooth a surface as the brassware of Borneo and India.

Proposals to improve the brass industry

Marketing their products is a major problem of the Tugaya artisans. Brass articles are bought by middlemen who sell these to small shops in Marawi City, the provincial capital, or to dealers in Metro Manila, the country's commercial center, or abroad. Often the brass articles pass through several middlemen before they reach the market. Because of this, the prices of brasswares are relatively high. Yet the brassmakers realize only a small margin of profit, barely enough to cover the cost of materials. It is the middlemen who rake in more profits.

At present, the artisans are not organized into a cooperative in order to better market their products. Some of them tried to form a cooperative but failed, mainly because of factionalism. Many government agencies have also tried in vain to convince the local artisans about the importance of a cooperative.

Because of the inefficient marketing system, the artisans are often short of cash or operating capital for the purchase of scrap metals, which these days are relatively expensive. Scrap metal supply is also erratic, causing the production schedule to become erratic. Lack of operating capital often leads to production stoppage. When there are enough raw materials, as many as 20 articles can be cast in less than two weeks time.

In addition, there is the problem of the lack of technical know-how in pattern-making, molding techniques, drying and molding processes. The materials preparation is not standardized because of lack of certain equipment such as a pyrometer for temperature-control, fluxes to remove impurities, a mixer or muller machine. Designs tend to be limited and not widely varied.

To revitalize the Tugaya brass industry, improved materials preparation and casting operations must therefore be introduced to local artisans. This can be realized by establishing a Brass Foundry Center at Mindanao State University in Marawi City, or in Tugaya itself, whichever is feasible, for the training of local artisans in improved techniques. The techniques may include care box making, wax pattern making, melting, mold making, drying, cleaning and finishing, standardization, quality control and inspection. The Brass Foundry Center may also serve as a research and development center.

In addition, the government can open credit lines to enable artisans to continuously produce brass materials and supplies.

A crucible furnace with a capacity of 100 kilos, a buffing machine, a pyrometer, infrared drying oven with four sets of infrared lamps, a hand grinder, core boxes, molten wax container, design strip molds, slurry, tanks, pouring laddles, testing blocks, spatula, pallets, hand tools for melting, mallet, hand saw, crucibles, buffing wheels, refractories, adhesives, hand files, grinding paper, metal charge, wax base, sand, binder, and oil.

APPENDIX

LABORATORY ANALYSIS OF THE TUGAYA SAND[4]

Metals Industry and Research Center (MIRDC) Pilot Plant, Taguig, Rizal

Chemical analysis of Tugaya sand (red sand):

Percentage SiO_2	77.65
Percentage Fe_2O_3	8.14
Percentage Combustibles	1.56

Technical description:

The high percentage (77.65 per cent) of silica (SiO_2) in the Tugaya sand makes the sand ideal for the making of molds. Its high silica content makes it resistant to high temperatures. This means the molds can withstand high temperatures without decomposing or crumbling.

The presence of high silica content sand in Tugaya reduces the cost of hauling. Another advantage is that the Tugaya sand can be stored for sometime, yet it retains its good molding properties. The addition of a clay binder (8-14 per cent) makes the sand more cohesive, even at high temperatures. The sand itself contains 2.2-8 per cent clay. This makes it more suitable for molding since the clay in it acts as additional binder.

Because the sand is not sieved, impurities and coarse grains remain in the mold, creating a rough metal finish. The rough finish is also partly due to the expansion of the mold, mainly brought about by the combination of hematite (Fe_2O_3) in the sand and oxygen in the air when the mold is fired. In addition, the sand's combustible content is burned during the firing of the mold and leaves spaces which also contributes to the rough finish.

Due to the lack of fluxes in Tugaya, impurities are not totally removed from the molten metal. The sand's high permeability (41 per cent) permits enough gases generated by the molten metal to escape freely, thereby minimizing "gas holes."

The flowability of the Tugaya sand (62.7 per cent) makes it easier for use in molds because it can malleably be shaped into any desired form, without the excessive "settling down" of the molds during the "wet stage".

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NOTES

1. From the field notes of Dr. Mamitua Saber, Director, Aga Khan Museum of Islamic Arts, Mindanao State University, Marawi City.
2. Ibid.
3. This ratio is the author's estimate. A rough count showed about 30 per cent of the Tugaya residents – or 6,000 – were engaged in brasswork. Assuming there are six members to a family, the brassworkers would then constitute 1,000 families. Since there are about 10 furnaces, the ratio would be 1:100.
4. From the project proposal of the Metals Industry and Research Development Center (MIRDC) for the giving of technical assistance to the Tugaya brass industry.