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TIN FOIL AS A DECORATION ON CHOU POTTERY

Communicated by Dr I. Newton

ONE day towards the end of January 1949 a curio dealer of Upper Lascar Row, Hong Kong, sent his foki to my office to tell me that he had another consignment of pottery coming in from Changsha and would I come and see it. I had bought a considerable number of pieces from this dealer and the arrangement had developed whereby he informed me when he was expecting a consignment.

On arrival at the shop I found a wicker basket on the floor of the inner room and standing by it, just unpacked, were the two wine jars shown in Plate 23, Fig. 1. Also on the floor were other pieces of pottery typical of what is known to dealers and collectors here as Yo Chow ware. All the pieces were covered to a varying extent with the reddish-yellowish earth of the Changsha district and I have therefore no reason to doubt the dealer's statement that they had just been dug up near Changsha and brought straight down by the railway. I learnt afterwards from him that he had two men doing this, and certainly, at that time, consignments were arriving regularly about once a fortnight.

The two jars were of somewhat dilapidated appearance as can be seen in the photograph and both had lost a handle but both had lids. The lids did not fit well and may have belonged originally to other similar but broken jars. They were undoubtedly genuine pieces of perhaps early Han or late Chou period. We reached an agreement the next day on the price and I took them home.

Two months later the dealer had a consignment from Changsha containing the food vessel shown in the centre of Plate 23, Fig.1. This is identical in style with the two jars. Technically, the latter are to be called *hu* and the food vessel *kuei*. The following description applies equally to all three pieces:—

The vessels are wheel-made. The wall is fairly thin, ranging from about four to seven millimetres in thickness. The jars were removed from the rotating wheel with the help of a piece of string as the streaks under the bottom clearly show (Plate 23, Fig. 2). The height of the jars including the lid is 33 cms. and that of the " kuei " 19 cms.

The body is made of soft light-greyish paste, moderately fine in texture, and covered with what might be a black slip. Over this can be seen, in patches, the remains of a very dark greenish-brown thin " glaze." This " glaze " shows a wrinkled and creased appearance and in places straight edges (see Plate 23, Fig. 3 which is an enlargement of one area). This " glaze " is absent from the " kuei " although its general appearance is similar to the jars in other respects. The lids of the jars contain a simple groove to fit the top of the jar as can be seen in Plate 23, Fig. 2 and the bottom half of the

" kuei " has a rudimentary ledge to prevent the top half sliding off. The general style of all three pieces is so similar that they have clearly originated from the same source. Fingerprints are clearly visible on one of the jars and on the " kuei " and for a time I entertained the pleasing thought of the possibility of the prints on both pieces having been made by the same potter. Unfortunately the fingerprint expert of the Criminal Investigation Department was unable to prove this.

All three pieces had a considerable amount of red earth attached to them. Much of it was too closely adherent to be removed without damaging the surface but it could be removed from the areas covered by the " glaze."

The more the " glaze " was exposed the more puzzling did it become. It was unlike anything I had seen before and although I showed it to a number of collectors and two dealers no one was able to identify it. Eventually, my curiosity persisting, on the suggestion of a friend I asked Mr Richard Terry one of the Government chemists to analyse it for me. His report is as follows:—

REPORT ON THE EXTERNAL COATING OF TWO CHOU JARS FROM CHANGSHA

1 *General*

I have examined flakes of the coating material detached from two Chou jars, and sent to me by Dr Newton. This material, which was at first supposed to be a brown or black glaze, gave on examination somewhat surprising results.

A rather detailed account of the technical examination has been given, for the sake of completeness, but may be omitted if desired; the conclusions therefrom are stated at a later point in this report.

2 *Details of Examination*

(a) *Preliminary*

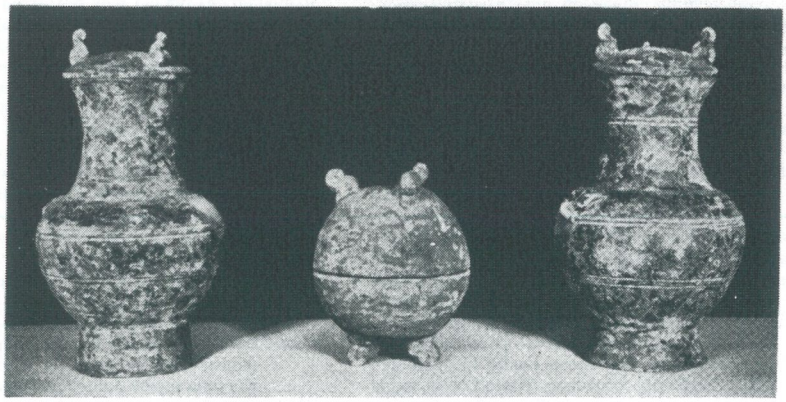
The detached flakes are flat, about 0.05 mm. thick, dull grey powdered with white on the inside (*i.e.*, next the jar) and with a brown to grey patina on the outside. They are not brittle, but are somewhat flexible and malleable. Some appear to consist of two layers.

Preliminary chemical analysis showed that the material was mainly acid-soluble and contained tin (about 80%), combined sulphur, some organic matter, and a residue of clay or earth.

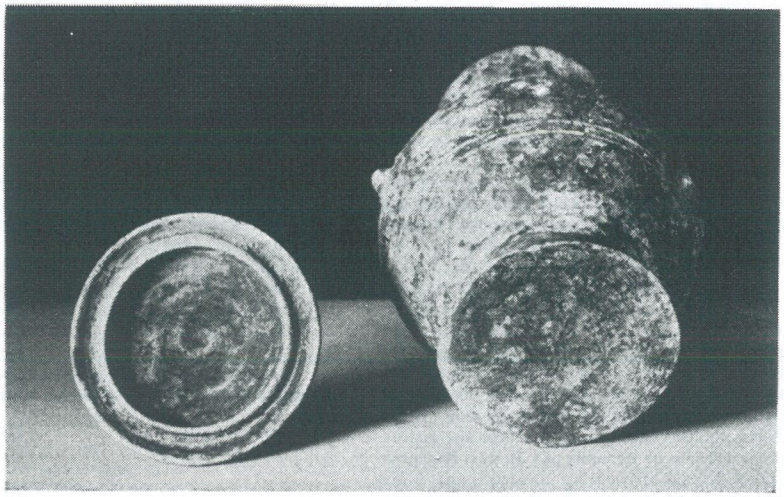
(b) *Physical and Metallographic*

Transverse sections, ground from flakes mounted in sealing-wax or balsam, showed the cross-section of a layer of metallic tin, generally rather flat on the outside, but very irregular on the inside (jar side), and much contorted. In some places the section showed three definite layers.

The thickness of this tin coating varied from 20 to 70μ (0.020-0.070 mm.), the average being about 50μ.



1 *Wine jars and food vessel.*



2 *Bottom of jar and lid.*

3 *Enlargement of one area.*

see page 65.

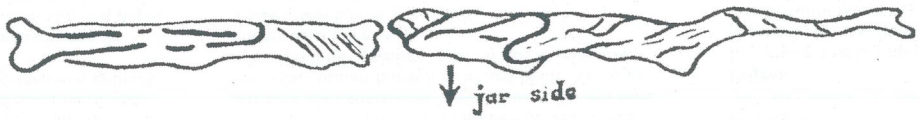


Fig. 1. Transverse section of bright tin layer. (x 100)

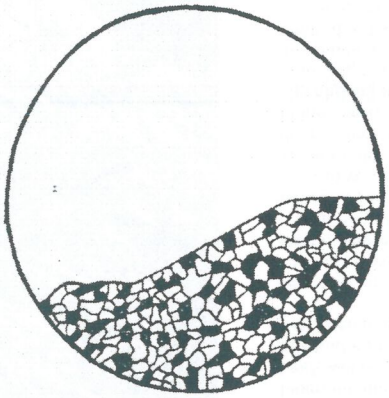


Fig. 2. Leaf detached from jar, etched & polished.

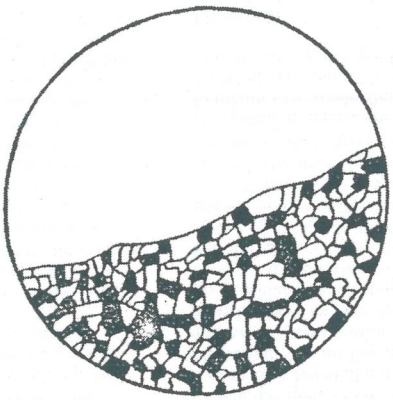


Fig. 3. Commercial tinfoil, etched & polished.

(x 200)

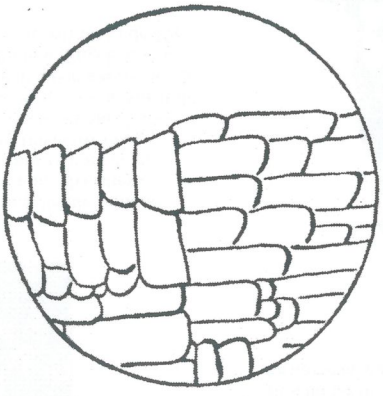


Fig. 4. Tin ingot, etched & polished.

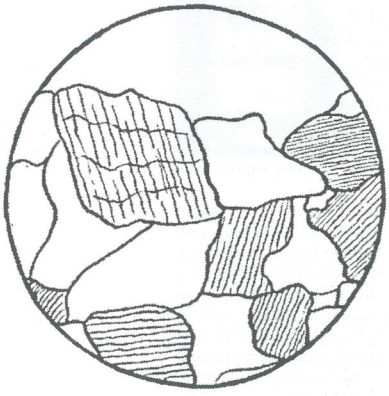


Fig. 5. Tin coating on tinplate, etched & polished.

(x 200)

The general appearance of the transverse section is shown in Fig. 1.

The patina was ground off another flake, and the bright tin surface thus exposed and etched in order to show its crystalline form. The microscopical appearance is shewn in Fig. 2, which is essentially a pattern of broken tin crystals 10-25μ in diameter. Now this is characteristic of tinfoil, in which the crystals have been broken by hammering and rolling, and is quite different from the large crystals to be seen in etched specimens of other forms of tin.

Fig. 3 shows an etched specimen of ordinary tinfoil for comparison, while Figs. 4 and 5 demonstrate the larger crystal structure of block tin and of the tin layer on tinplate.

It is thus clear that the flakes in question are essentially small pieces of tinfoil.

(c) *Further Chemical Work*

On heating the flakes to 250-300° C. with exclusion of air, the tin layer melts to globules, leaving a residue which seems to consist largely of tin sulphide; there is also some organic matter of an ill-defined nature.

Insufficient material could be obtained for a full quantitative analysis of the melted globules, but it is believed that they consist of tin of at least 95% purity. About 1% of antimony is present.

The patinated outside layer gives a strong sulphide reaction, and probably consists of tin sulphide. The colour, together with other considerations, suggests that the surface of the tin was stained to a bronze colour by the use of a sulphide solution.

(d) *The Adhesive*

Identification of the adhesive used to stick the tinfoil to the jar proved extremely difficult, owing to decay and changes in the material. Extraction with water, saline solution, dilute alkali and various fat solvents removed nothing from the flakes, and microchemical tests for such materials as protein, gums, starch, dextrins, etc., gave negative results.

Alcohol extracted from the specimen a small quantity of rather characterless material, which gave a faint positive reaction for resin. On the strength of this, it may be conjectured that the original adhesive was perhaps of a resinous nature; but the evidence on this point is far from conclusive.

It was at one time thought that no adhesive had been used, and that the tinfoil had been affixed with the aid of mercury, in the manner of the old-fashioned mirrors; but a practical trial showed that the foil could not be made to adhere by this method.

3 *Conclusions*

From the above results, it appears that these jars were covered with a layer of thin (one-twentieth mm.) tinfoil, which was stuck on with a kind of varnish or resinous adhesive, and rubbed or lightly burnished to eliminate the wrinkles. The surface was then treated with a sulphide solution (see below) in order to give it the colour of bronze.

4 *Discussion*

(a) *Tinfoil*

There seems to be no reason why tinfoil should not have been known to Chinese of the Chou period; the ancient bronzes imply a knowledge of tin, and the latter metal, if pure, can be beaten into a foil with the exercise of a little skill.

The foil may also well have been used to imitate silver inlay.

(b) *Staining of Tinplate to Imitate Bronze*

This may be achieved by the use of solutions of arsenic, antimony, or sulphides. There is no reason why the latter should not have been known, as such a solution can be made from sulphur boiled with slaked lime and water.

(c) *Application of the Foil*

After the foil had been applied to the jar, it would be essential to remove the wrinkles. A practical trial shows that this process is easy (owing to the great malleability of tin) and can be achieved by gentle rubbing, followed by light burnishing with a piece of metal, ivory or horn.

It is during this process that the foil acquires the contorted appearance, with overfolded layers here and there, which was observed in the specimen (Fig. 1).

(d) *Preservation*

Tin is not a very permanent metal, and in the course of time disintegrates to a hydrated oxide. If stored without access to oxygen, it is, however, stable in a moderately warm climate. These conditions seem to have been fulfilled in the Chou tombs, which are said frequently to contain marsh-gas.

Many known specimens of plain earthenware may, therefore, originally also have been covered in this manner. A process such as this, so ingeniously imitating the expensive bronzes, must, it is felt, have been very widely used.

(Signed) RICHARD C. TERRY, M.SC.(LOND.), A.R.I.C.
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HONG KONG.
1st September, 1949.

This report fully explains the strange appearance of the " glaze " with its wrinkles and peculiar straight lines which are presumably the edges of the tin foil.

It is very unfortunate that no accurate information is available as to where the pots were found or the circumstances of their finding. All attempts of mine to interview the finder during a later visit of his to Hong Kong failed. I understand that road-making was going on in the Changsha area at the time, presumably in preparation for the Chinese Communist drive southward, and this is probably the explanation for the considerable amount of tomb pottery that was arriving in Hong Kong then, the supply of which has ceased now, November, 1949.

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