

Supplementary materials

These supplementary materials include a catalogue of high-resolution images illustrating details of the manufacturing and decorative techniques of each vessel, obtained using digital microscopy, scanning electron microscopy (SEM), and X-radiography. Additionally, tables presenting the SEM-EDS measurements used in the paper are provided.

List of the vessels investigated

This section presents photographs of all objects examined in the study, accompanied by detailed images illustrating the identified manufacturing and decorative techniques. Each entry includes the registration number, a brief description, cultural period (TD = Tang Dynasty; LD = Liao Dynasty), and dimensions (\varnothing = diameter; L = length; W = width; H = height).

1) 1938,0524.706.

Circular cup with handle.

Period: TD, LD

Dimensions:

\varnothing = 5 cm,

H = 5.1 cm



Fig. 1 X-radiographs of the handled circular cup 1938,0524.706, one presented with inverted black and white contrast (bottom), showcasing minor thickness variations in the metal, and detail of the ring handle.

2) 1968,0422.11
Lotus-shaped bowl

Period: TD, LD

Dimensions:
Ø = 18.00 cm,
H = 5.50 cm



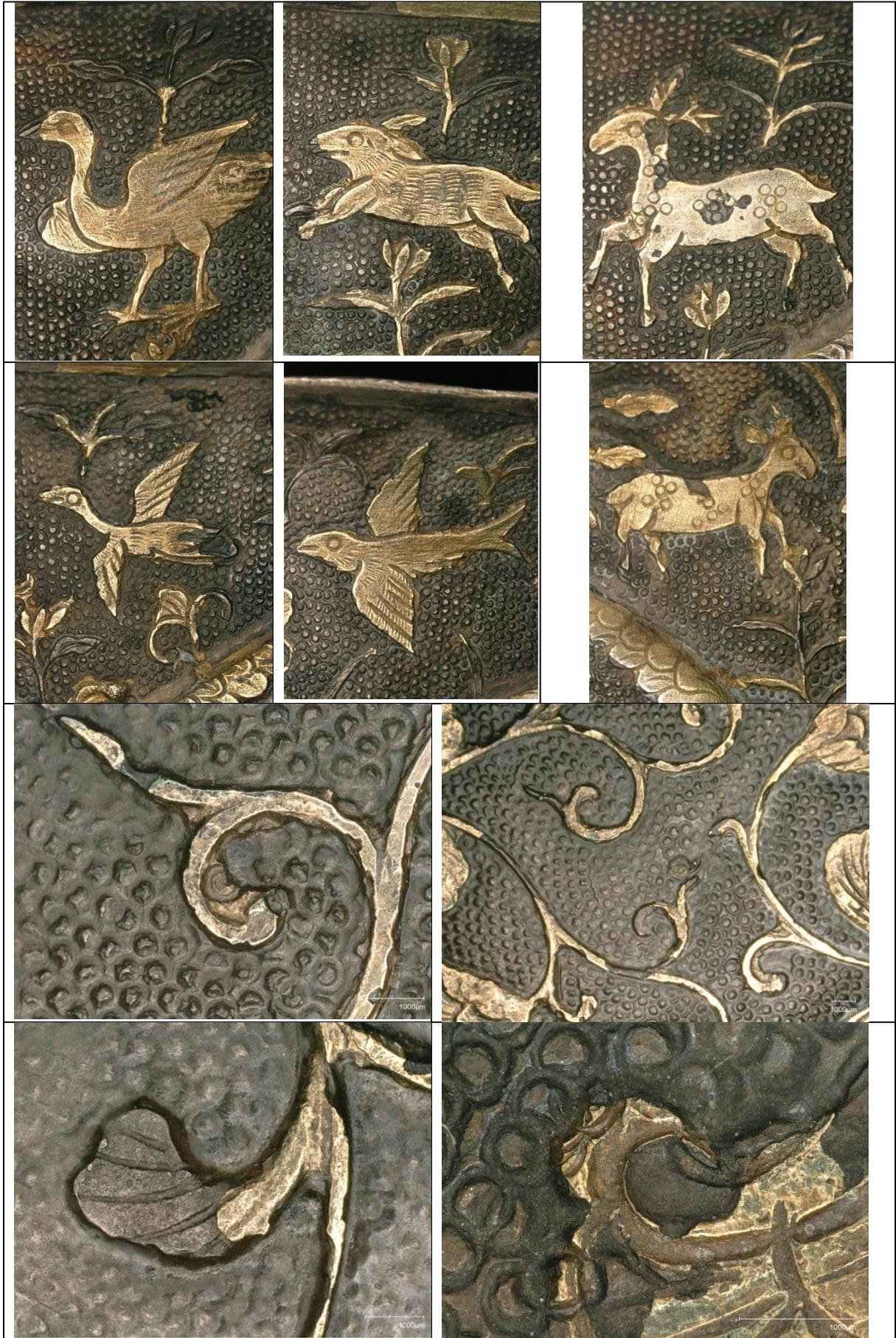




Fig. 2 Details of the decoration on bowl 1968,0422.11, executed using repoussé, chasing, punching and gilding techniques.

3) 1968,0422.10
Stemware/goblet/cup

Period: TD, LD

Dimensions:
Ø = 7.70 cm,
H = 9.80 cm



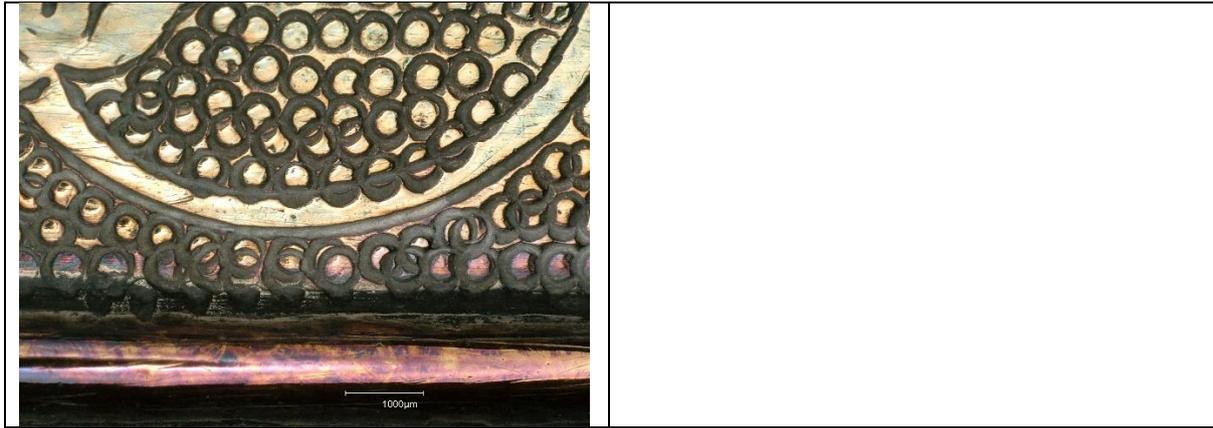


Fig. 3 Details of the decoration on cup 1926,0319.10, executed using repoussé, chasing and punching techniques.

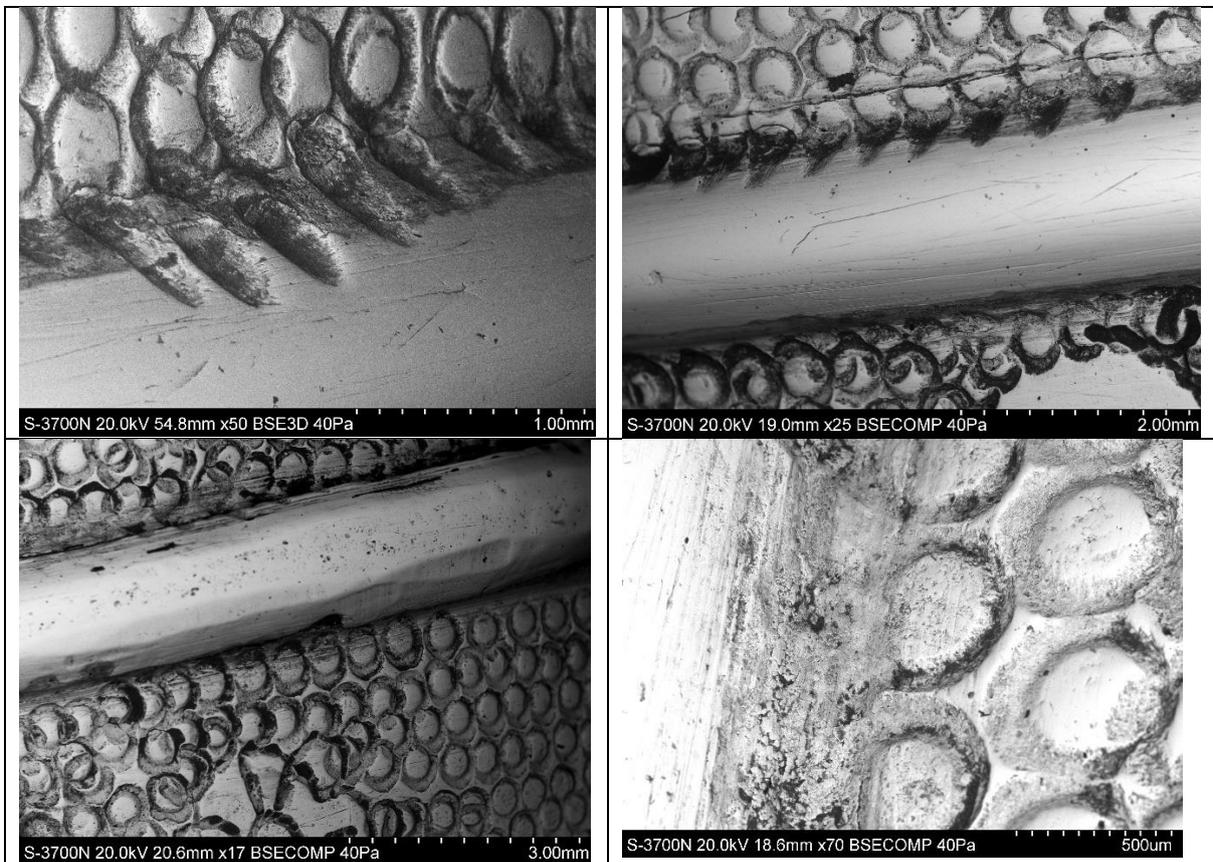


Fig. 4 SEM-BSE (Back Scattered Electron) images showing details of the decoration on cup 1926,0319.10, executed using repoussé, chasing, punching and gilding techniques.

4)1937,0416.212
Stemware/goblet/cup

Period: TD, LD

Dimensions:
Ø = 6.80 cm,
H = 4.30 cm



Fig. 5 Details of the decoration of stemware/goblet/cup 1937,0416.212, executed using repoussé, chasing and punching techniques.

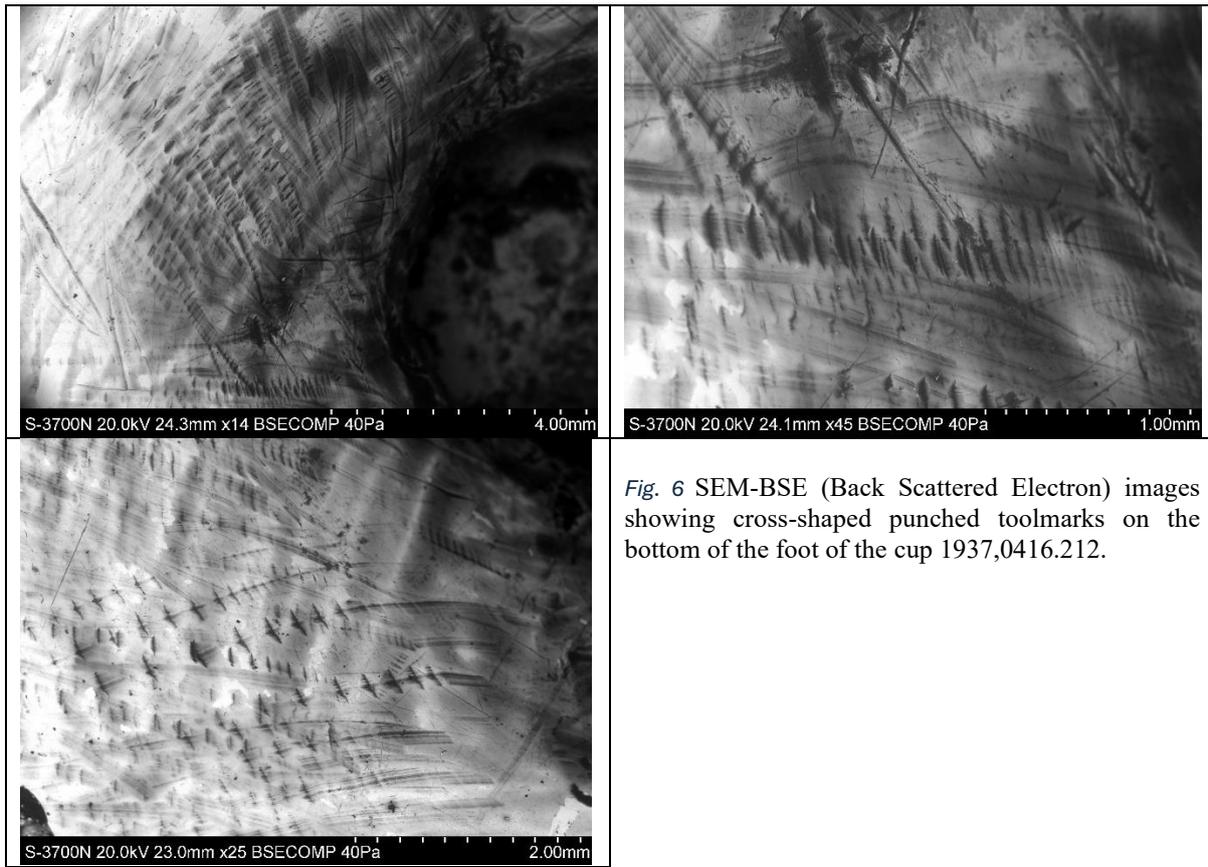


Fig. 6 SEM-BSE (Back Scattered Electron) images showing cross-shaped punched toolmarks on the bottom of the foot of the cup 1937,0416.212.

5) 1938,0524.704

Small bowl

Period: TD, LD

Dimensions:

$\text{Ø} = 8.6 \text{ cm}$,

$H = 4.50 \text{ cm}$



Fig. 7 Detail of lathe-turning bands on the bottom and a defect on the foot rim of the bowl 1938,0524.704.

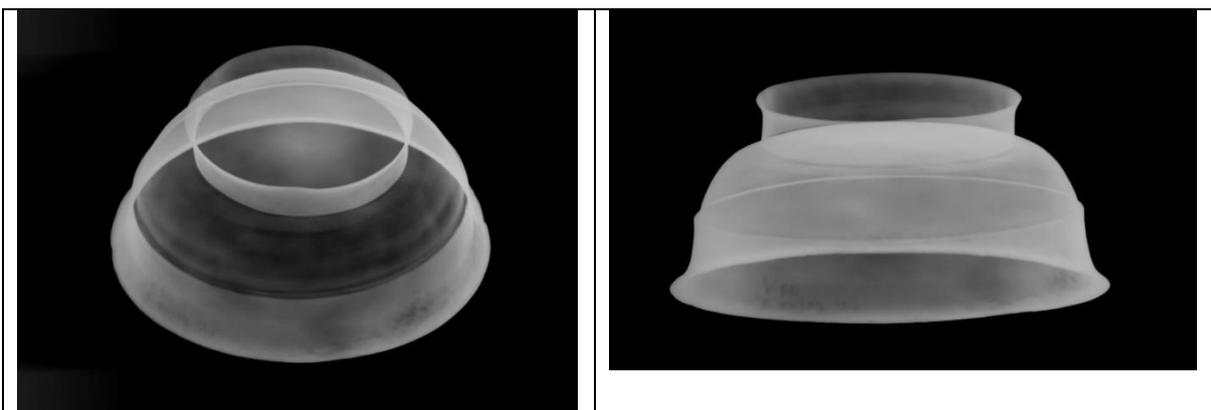


Fig. 8 Different views of X-radiographs of the bowl 1938,0524.704 shown upside down, highlighting the lathe-turning bands on the body and hammer blows on the foot.

6) 1938,0524.704

Small bowl

Period: TD, LD

Dimensions:

Ø = 10.9 cm,

H = 4 cm

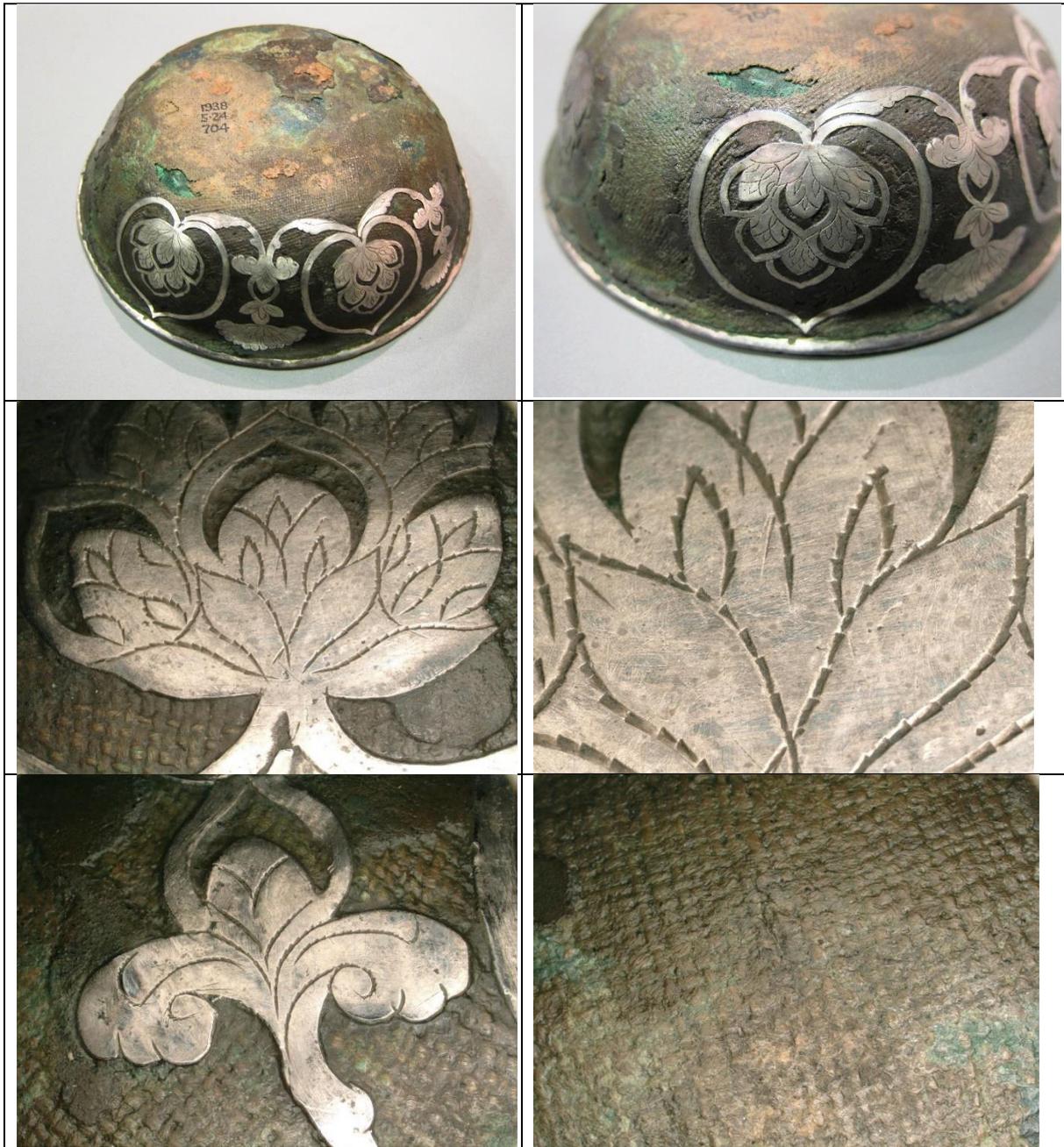


Fig. 9 Details of the *jinyin pingtuo* technique and decoration of the inlays executed using chasing on bowl 1938,0524.704.

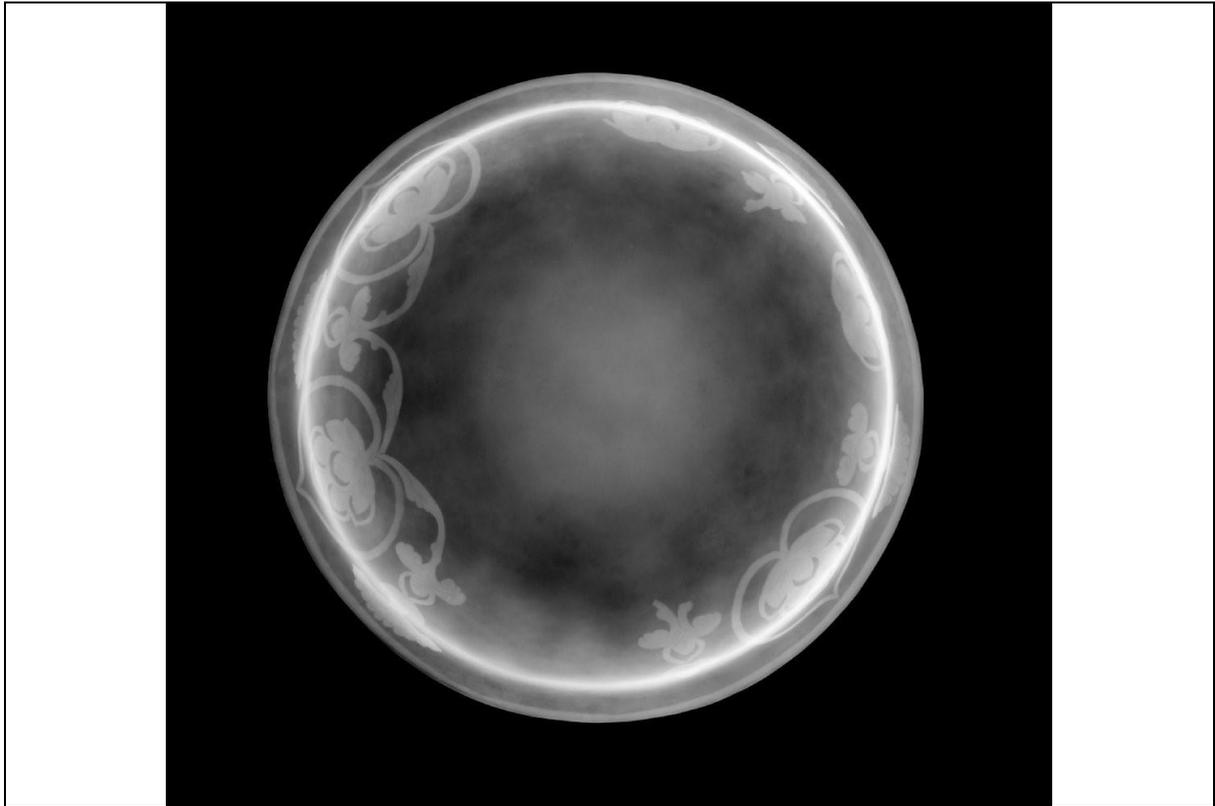


Fig. 10 X-radiograph of the bowl 1938,0524.704, showing higher thickness at the centre. This may indicate that the starting silver disc was hammered into shape, causing the sides to thin as the metal stretched during forming.

7) 1926,0319.9

Lobed bowl

Period: TD, LD

Dimensions:

Ø = 18 cm,

H = 12 cm





Fig. 11 Details of the decoration of bowl 1926,0319.9, executed using repoussé, chasing, punching and gilding techniques.

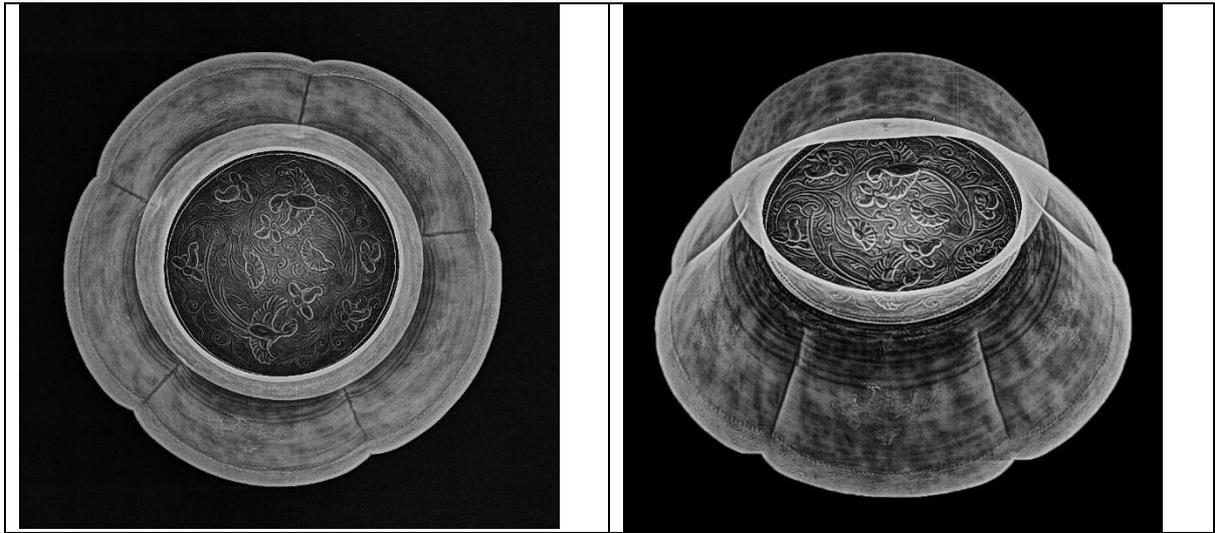


Fig. 12 Different views of X-radiographs of the bowl 1926,0319.9 showcasing the manufacturing techniques (lathe turning bands on the bowl and hammer blows) present on both the foot and the bowl (max diameter 18 cm)

8) 1926,0319.10. Foliated dish

Period: TD, LD

Dimensions:
L = 22.50 cm



Fig. 13 3D reconstructions of a defect on the rim of the foliated dish 1926,0319.10.



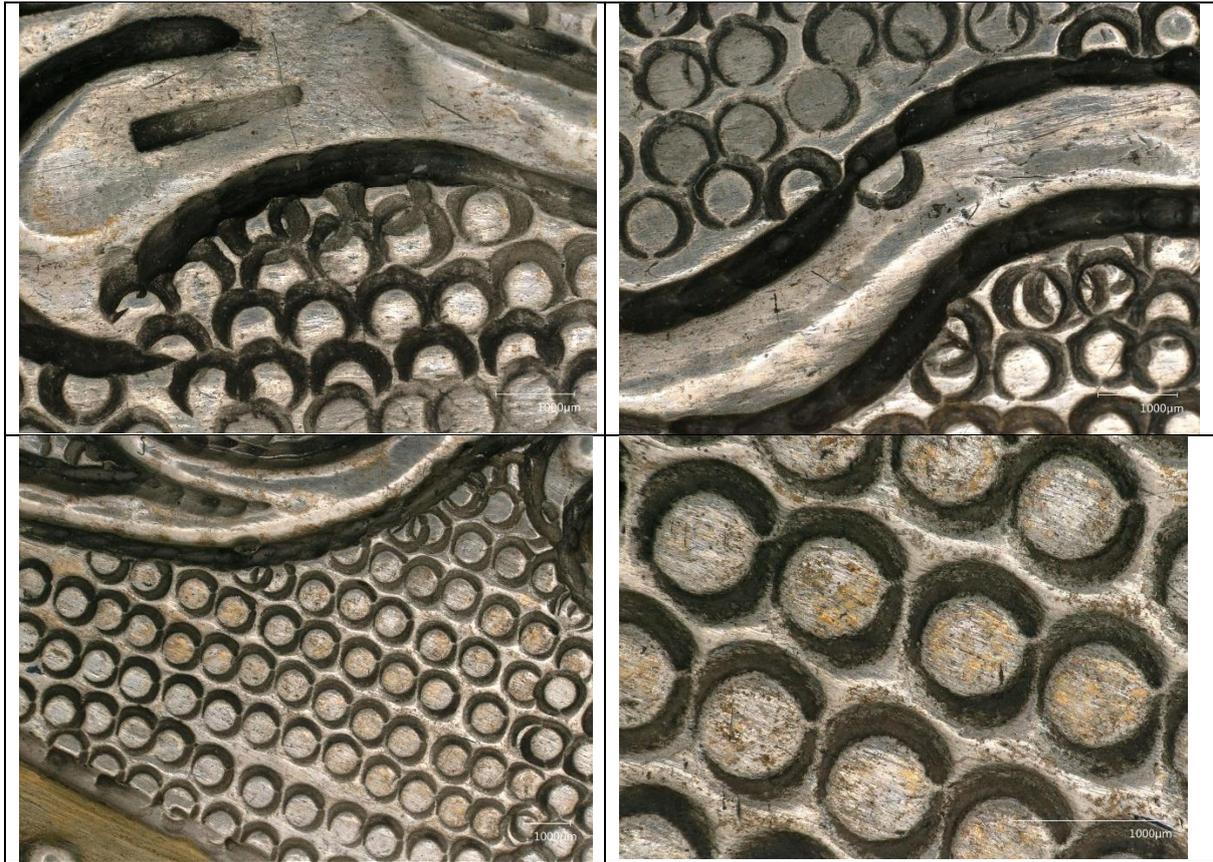


Fig. 14 Details of the decoration on the main body of foliated dish 1926,0319.10, executed using repoussé, chasing, punching and gilding techniques.

9) 1926,0319.8

Foliated dish

Period: TD, LD

Dimensions:
L = 21.50 cm



Fig. 15 Details of the decoration and defects on the rim of vessel 1926,0319.8, executed using chasing, and punching techniques.



Fig. 16 Details of the decoration on the main body of vessel 1926,0319.8, executed using repoussé, chasing, and punching techniques.

10) 1926,0319.6
Oblong and polylobate cups

Period: TD, LD

Dimensions:
L = 12 cm,
W = 7.00 cm,
H = 5.00 cm

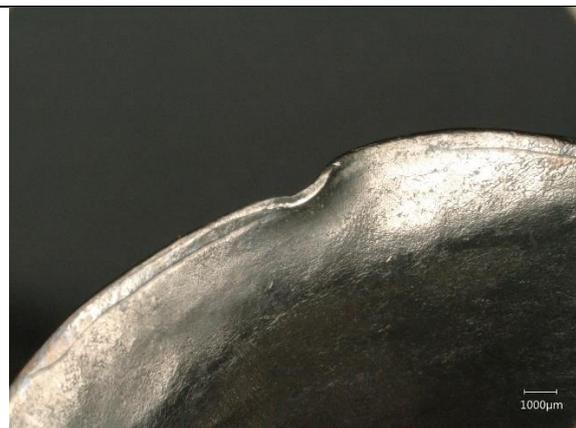
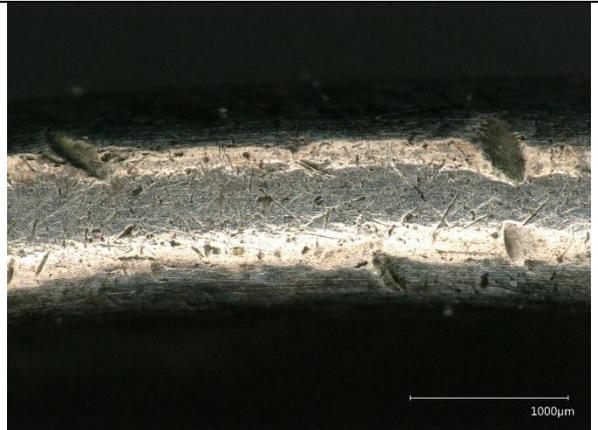


Fig. 17 Detail of hammering marks on the inner rim, along with defects on the oblong and polylobate cup 1926,0319.6

11) 1926,0319.4
Oblong and polylobate cups

Period: TD, LD

Dimensions:
L = 12 cm,
W = 7.00 cm,
H = 5.00 cm





Fig. 18 Details of the decoration on vessel 1926,0319.4, executed using repoussé, chasing, and punching techniques.

12) 1926,0319.7
Oblong and polylobate cups

Period: TD, LD

Dimensions:
L = 13.20 cm,
W = 7.80 cm,
H = 5.10 cm

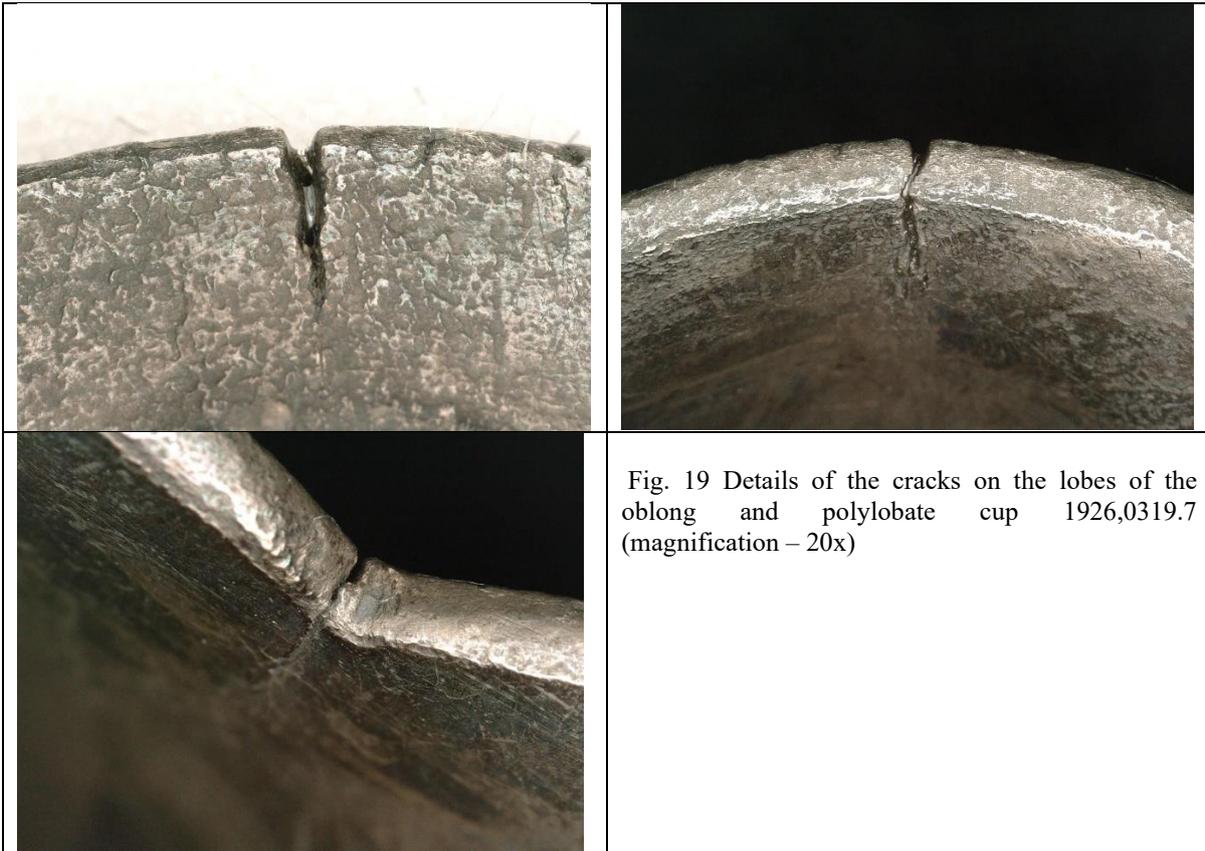


Fig. 19 Details of the cracks on the lobes of the oblong and polylobate cup 1926,0319.7 (magnification – 20x)

13) 1926,0319.11
Oblong and polylobate cup

Period: TD, LD

Dimensions:
L = 12 cm,
W = 7.00 cm,
H = 4.00 cm



Fig. 20 Detail of the inscription on the foot of the oblong and polylobate cup : 乾符四年王大夫置造鎮司公廩重二兩半分, “Made to the order of the grand master Wang in the fourth year of the Qianfu reign”

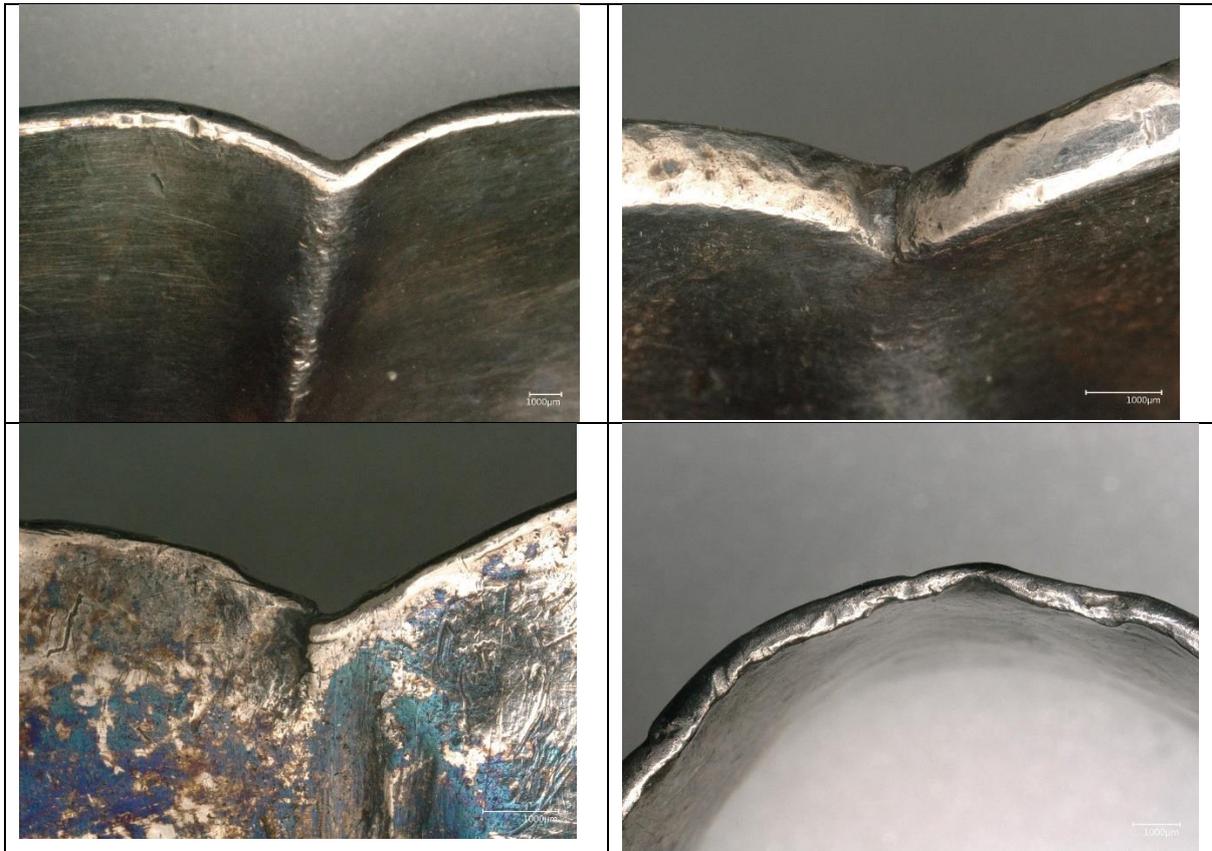


Fig. 21 Details of the lobes and of the foot of the oblong and polylobate cup 1926,0319.11.

14) 2022,3034.22

Small bowl

Period: LD (?)

Dimensions:

Ø = 11 cm

H = 2 cm

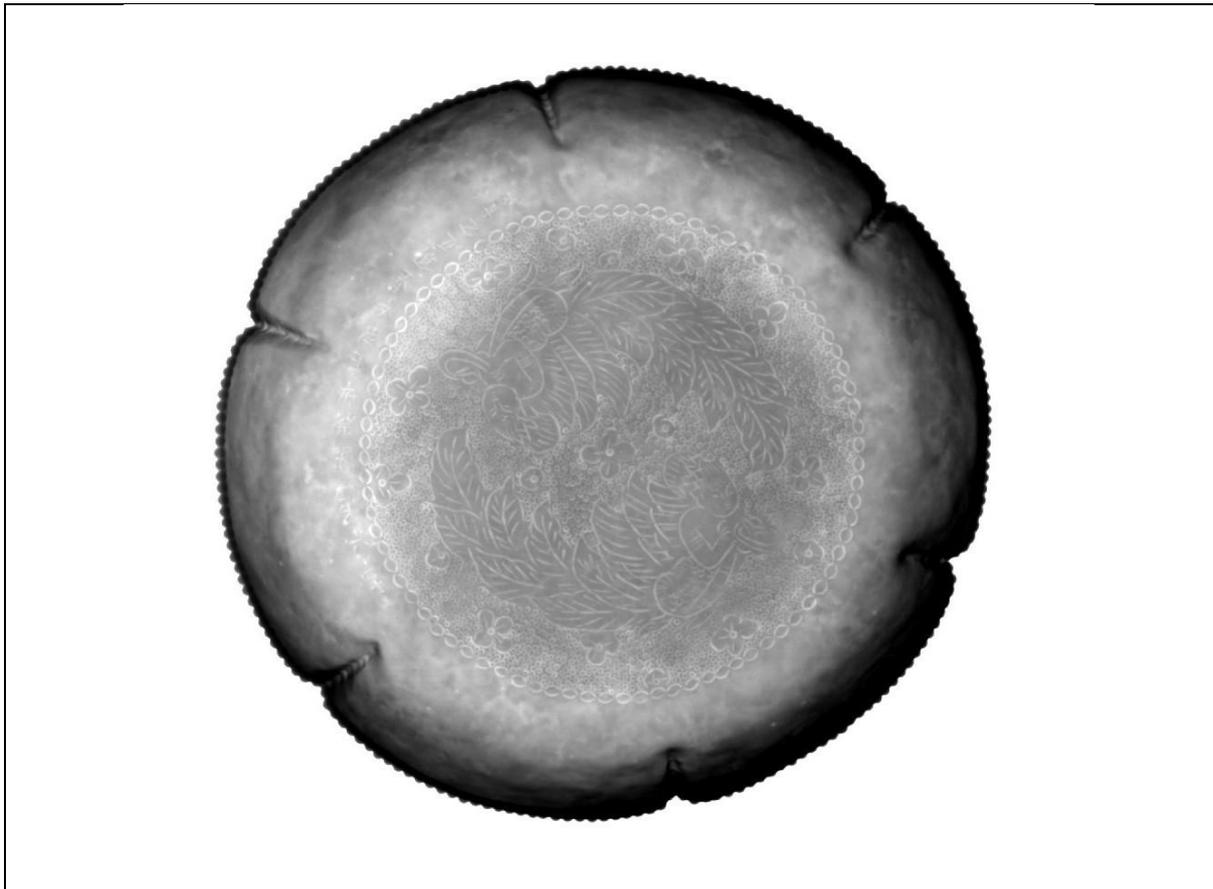


Fig. 22 X-radiograph of the bowl 2022,3034.22, showcasing the hammer blows present on the walls of the bowl.



Fig. 24 Details of the beaded rim of bowl 2022,3034.22



Fig. 25 Details of the decoration on bowl 2022,3034.22, executed using chasing and punching techniques. Magnifications: upper left – 20x; upper right – 20x; bottom left – 30x; bottom right – 100x.



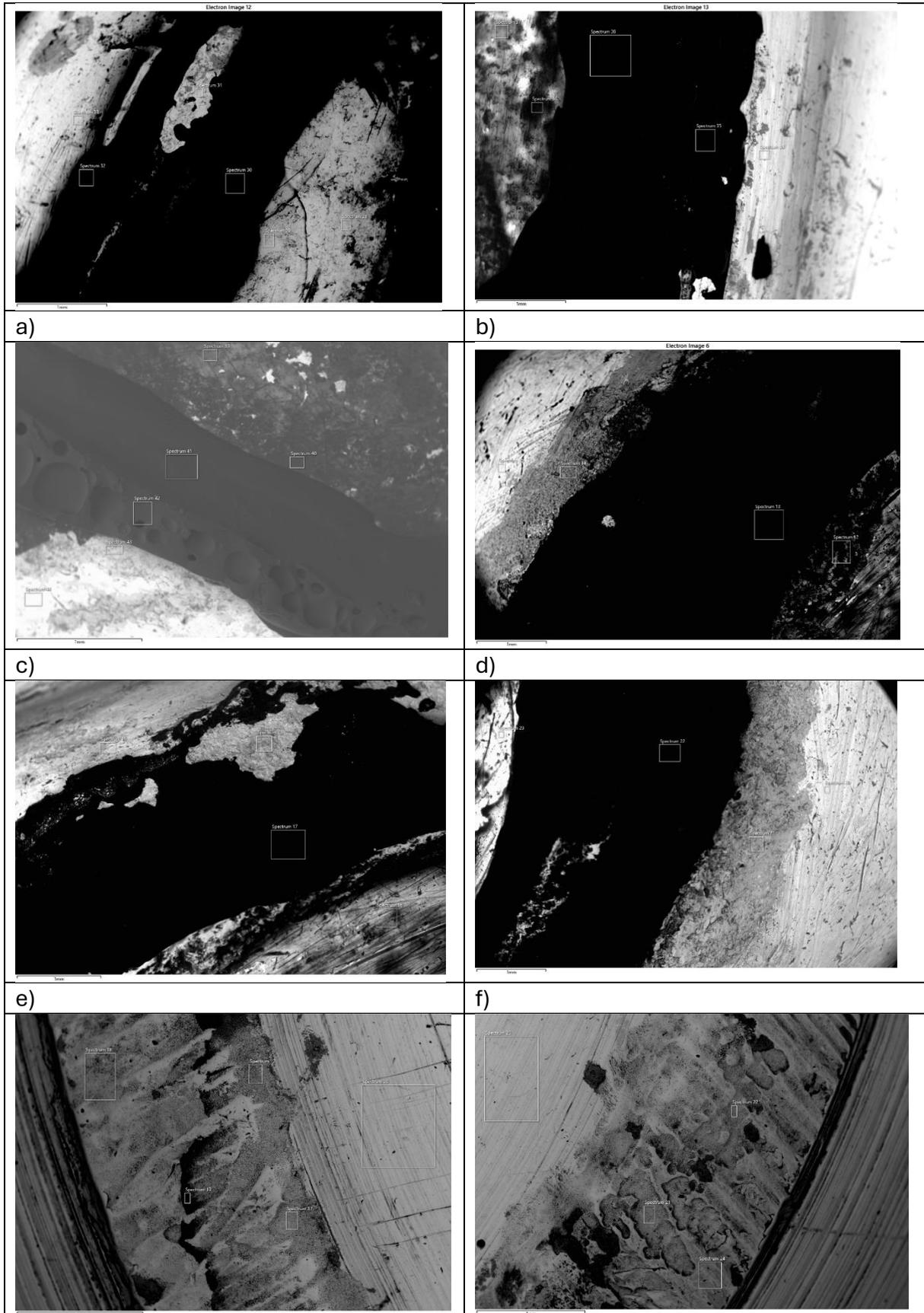


Fig. 26 Typical crystallised whiskers identified on the surface suggesting the presence of ammonium sulphide ((NH₄)₂S). Magnification – 200x

Table 1 SEM-EDX analyses of different areas at the joins between the foot and upper part of vessels 1926,0319.4, 1926,0319.6, 1938,0524.706. Analyses are shown in wt% normalised to 100% (b.d.l.: below detection limit)

Reg. no.	Description	Spectrum	Si	P	S	Cl	Cu	As	Br	Ag	Sn	Au	Pb	
1926,0319.4	Oblong polylobate cup	28	0.3		0.6	0.3	8.9		0.2	87.6		1.7	0.3	
		29	0.2		0.3	0.2	5.8		0.2	91.0		1.8	0.5	
		30	1.6		1.7	0.8	10.7		2.2	74.7	5.2	2.3	0.9	
		31	0.2		0.6	0.2	6.1		0.1	89.8	0.5	2.1	0.4	
		32	1.5		1.0	0.4	5.0		1.0	86.7	1.3	2.9	0.3	
		33	0.5		0.6	0.3	4.8		0.6	89.2	0.8	3.1	0.1	
		34	0.4		0.9	0.2	3.8		0.5	91.2		3.0	0.1	
		35	2.5		1.2	0.9	6.8		1.2	79.3	5.6	1.3	1.1	
		36	1.3		0.8	0.3	6.0		0.7	87.2	1.1	2.3	0.4	
		37	0.6	0.5	1.2	0.3	6.8		0.8	50.2	37.4	1.5	0.7	
		38	1.8		0.0	3.0	13.8		6.7	60.3	12.0	0.0	2.4	
		39	0.5		0.6	0.2	7.5		0.5	85.6	3.6	1.5		
		40	1.3		1.5	0.0	5.0		0.4	85.5	4.1	2.3		
		41	4.6		0.0	6.2	2.5		13.1	37.1	12.1	0.0	24.4	
		42	0.7		6.2	0.0	13.1		9.1	31.1	36.9	3.0		
43	0.4		1.2	0.2	28.7		0.0	25.7	39.2	2.5	2.1			
44	0.3		0.6	0.0	7.3		0.7	72.0	16.6	1.8	0.7			
1926,0319.6	Oblong polylobate cup	12	11.9	0.4	1.9	0.7	15.1	0.6	4.4	17.8	46.3	0.7	0.2	
		13	7.8	0.0	0.0	3.2	26.1		3.2	28.7	28.4	0.0	2.7	
		14	5.0	0.8	1.7	0.4	4.5	2.6	2.8	9.8	71.2	0.7	0.7	
		15	0.9	0.1	0.7	0.4	2.1	0.0	0.6	89.2	4.7	1.3	0.1	
		16	1.3		0.5	0.3	3.4		0.6	89.4	3.0	1.5	0.1	
		17	4.8		1.8	1.7	11.6	1.9	4.5	47.1	24.7	2.1		
		18	0.9	0.5	0.3	0.3	43.7	0.6	0.4	9.3	43.9	0.2	0.1	
		19	1.6		0.5	0.4	4.2		0.8	87.4	3.3	1.8		
		20	0.4		0.4	0.2	3.2		0.3	92.1	2.2	1.2		
		21	2.9		1.6	0.3	14.1	0.2	1.8	15.3	63.5	0.1		
22	6.4		2.4	2.5	13.2	4.0	0.0	30.9	37.6	3.1				
23	0.6		0.3	0.3	2.8		0.3	93.3	1.2	1.2	0.1			
1938,0524.706	Handled circular cup	12	2.2		0.2	0.2	0.9		1.1	87.8	6.6	0.5	0.7	
		17	0.7		0.3	0.2	1.1		0.6	89.0	6.8	0.5	0.8	
		18	2.3		0.4	0.4	0.9		1.0	88.6	5.3	0.6	0.5	
		19	1.1		0.3	0.2	0.6		0.4	90.4	5.8	0.7	0.6	
		20	0.3		0.3	0.2	1.2		0.1	96.9	0.0	0.9	0.3	
		21	1.7		0.5	0.2	0.9		1.8	84.8	9.0	0.4	0.8	
		22	1.2		0.6	0.2	0.3		1.0	88.8	7.3	0.4	0.2	
23	0.3		0.2	0.5	1.0		0.1	97.0	0.0	0.8	0.1			

		24	0.4	0.3	0.2	0.5	0.3	91.1	6.1	0.6	0.6
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g)	h)
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Fig. 27 Locations of the analyses on the soldered areas carried out on the oblong polylobate cups 1926,0319.4 (a–c) and 1926,0319.6 (d–f), and the handled circular cup 1938,0524.706 (g–h). The darker areas indicate the presence of glue. The corresponding analytical results are presented in Table 1 above.

Table 2 Selected artefacts sourced from Tan et al.¹. Only plates, dishes, ewers, cups, boxes, and foils with well-defined chronological attribution (n = 18) were included to ensure comparability with the vessels analysed in this study. Other object types were excluded, and average values were used where multiple analyses were available for a single component.

No.	Description	Date	Findspot	Cu	Ag	Au	Pb	Tot
1	Silver plate	Late 7th	Tomb of Li Xian, Shaanxi	1.0	97.7	0.9	0.4	100.5
2	Silver plate	Late 7th	Tomb of Li Xian, Shaanxi	2.7	96.8	0.2	0.3	100.23
3	Silver plate	Early 8th	Joint tomb of Yan Zhi and his wife	0.3	99.3	0.2	0.2	101.76
9	Gilded silver dish (front)	650-755	Kuancheng county, Hebei	11.0	87.0	0.0	0.0	98
13	Gilded silver dish (foot)	650-755	Kuancheng county, Hebei	20.2	77.8	0.0	0.0	98
16	Gilded silver ewer (body)	650-755	Kuancheng county, Hebei	11.7	87.3	0.0	0.0	99
19	Gilded silver ewer (ring foot)	650-755	Kuancheng county, Hebei	13.3	85.7	0.0	0.0	99.01
22	Silver cup a)	Early 8th	Wei family Cemetery, Shaanxi	0.6	98.9	0.0	0.0	99.72
24	Gilded silver box (lid)	Early 8th	Wei family Cemetery, Shaanxi	0.9	97.8	0.7	0.0	99.66
25	Gilded silver box (body)	Early 8th	Wei family Cemetery, Shaanxi	0.7	98.4	0.1	0.0	99.54
26	Gilded silver circle box (lid)	Early 8th	Wei family Cemetery, Shaanxi	0.3	98.6	0.3	0.0	99.43
27	Gilded silver circle box (body)	Early 8th	Wei family Cemetery, Shaanxi	1.4	96.9	0.7	0.0	99.4
28	Silver plate	Early 8th	Tomb of Li Chui, Shaanxi	2.9	95.5	1.0	0.2	100.33
29	Silver foil	Early 8th	Tomb of Li Chui, Shaanxi	2.3	97.0	0.3	0.3	100.47
30	Silver plate	Early 8th	Tomb of Li Xian, Shaanxi	1.0	97.7	0.9	0.0	99.6
31	Silver plate	Early 8th	Tomb of Li Xian, Shaanxi	2.7	96.8	0.2	0.0	99.7
40	Gilded silver box	713-741	Baofengxiaoidan site, Henan	1.9	96.4	1.6	0.0	100
60	Silver plate	9th	Famen Monastery, Shaanxi	2.5	95.5	1.7	0.2	99.874

Reference List

1. Tan, P., Yang, J. & Ren, X. Technical features of a ninth-century silver vessel of southern China uncovered from Famen Monastery, Shaanxi province. *Herit Sci* **9**, 55 (2021).

