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The study of non-destructive analysis of objects excavated
at the tomb of Mich'un-ri in Ch'ung-won

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ABSTRACT

We performed the non-destructive analysis of objects excavated at the Tomb of Mich 'un-ri in Ch 'ung-won. We analysed components using of Energy Dispersive X-Ray Micro-Fluorescence Analyzer.

Glass bead inlaid with silver was classified as $K_2O-CaO-SiO_2$ type of glass. Purity of silver inlaid in the surface was verified above 97%.

All small ear-ring were made by rolling up gold broad to a bronze wick. The composition ratio of Au : Ag has significantly higher 87 : 11 than big ear-ring.

As a result of composition analysis of a welded part with big ear-ring, it contained the more Cu, Hg contents and the less Au, Ag contents than the surface of big ear-ring.

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1 , 5 , 7 , 1 ,

1 2 , 1 18 , Table 1

3.1

X (Energy Dispersive X-Ray Micro-Fluorescence

Analyzer : EDXRF, Kevex, Model OMICRON)

Table 1.

		(mm)		
1	(-99)	20()×18	- - (1.2cm) -	: :
2	(-100)	23×21×6	-	
3	(-101A)	23×22×4	-	
4	(-101B)	21×18×5		
5	(-102A)	- 25×20 - 27×18	- . 2	
6	(-102B)	- 28×26 - 25×20	- .	
7	(-103A)	18×15×3	-	
8	(-103B)	18×13×3	-	
9	(-104)	23×21×6	-	
10	(-105)	35×43×3	-	
11	(-106A)	- 25×25 - 27×20	- . 2	
12	(-106B)	- 23×23 - 28×19	- .	

		(mm)		
13	(-107)	40×6	-	
14	(-108)	24×21 18×11	- 2	
15	(-110)	10×14	- 가	
16	(-111)	96 19	- 3	
17	(-112)	144 22	-	
18	(-113)	14×12	-	

, X
 X X
 X X
 mounting 100
 2000 (:DP-Spray 6μm, 3μm, 1μm)
 (Carl Zeiss, Axiotech 100HD)
 (Carl Zeiss, KS300)

3.2

X

X

(Taylor

Multi-Element Standard)

Table 2

Table 2.

	Vacuum, 45kV, 0.4mA, 100sec, 100 μm Collimator, Si Detector, Gain 40, Shaping Index 32, Multi-channel Analyzer 40KeV 20eV/ch 2048 size	
	Vacuum, 20kV, 0.2mA, 100sec, 300 μm Collimator, Si Detector, Gain 40, Shaping Index 32, Multi-channel Analyzer 40KeV 20eV/ch 2048 size	

18

X

3 6

Table 3, 4, 5

(-99)

가

Si, Al, Ca, K, S, Fe가

(-

110) Si, Ca, K, S, Al, Fe가

(K₂O-CaO-SiO₂)

Table 3. (wt%)

	Ag	Cu	Al	Si	Fe	Zn	Sn	Au	Hg	Pb
99	97.1	0.19	0.57	0.48	0.27	-	0.58	0.56	0.14	0.08
111	97.2		0.87	0.64	0.12	-	0.58	0.21	0.03	0.15
111	0.07	95.9	-	-	0.39	0.36	0.02	-	0.10	2.83
112	97.9	0.14	0.47	0.42	0.14	-	0.60	0.19	0.04	0.06

Table 4. (wt%)

	SiO ₂	Al ₂ O ₃	K ₂ O	CaO	Fe ₂ O ₃	MgO	SO ₃	TiO ₂	MnO	CuO	Na ₂ O	PbO
99	73.3	11.7	2.04	6.32	1.38	0.57	3.90	0.20	0.13	0.13	0.20	0.05
110	59.8	5.4	4.73	12.8	2.12	0.11	14.2	0.24	0.28	0.10	-	0.06

97wt%

7 (-100, 101A,B, 103A,B, 104, 113)

Au : Ag (wt%) -100

87 : 11 가 (-103A,B) Au :

Ag 65 : 31 2

5 (-102A,B, 106A,B 108)

가

Au : Ag (wt%)

Table 5.

(wt%)

		Au	Ag	Cu	Sn	Fe	Hg	Pb	Zn	
100		86.8	10.6	0.19	0.84	0.10	1.21	0.10	-	
100		11.0	5.45	74.1	5.32	1.23	0.33	2.42	0.09	
101A		71.0	25.7	1.54	0.43	0.15	1.04	0.03	-	
101B		66.2	31.6	1.12	0.44	0.13	0.71	0.05	-	
102A		68.1	29.4	0.95	0.39	0.13	0.78	0.05	-	
102A		67.6	26.4	2.06	0.43	0.14	3.28	0.07	-	
102A		80.4	17.8	0.25	0.34	0.09	0.84	0.07	-	
102B		70.2	27.6	0.61	0.49	0.11	0.80	0.11	-	
102B		82.8	15.5	0.13	0.27	0.10	1.13	0.02	-	
103A		65.5	31.3	1.18	0.56	0.15	1.25	0.04	-	
103B		65.3	31.6	0.75	0.63	0.25	1.33	0.11	-	
104		84.6	12.7	1.31	0.29	0.12	0.90	0.07	-	
105		26.4	1.03	64.5	0.08	0.07	4.14	3.61	0.17	
105		0.11	0.5	97.2	0.11	0.44	0.04	1.30	0.31	
106A		79.9	17.5	0.42	0.28	0.17	1.64	0.08	-	
106A		73.4	19.7	0.69	0.41	2.66	3.02	0.10	-	
106B		79.8	17.3	0.41	0.43	0.28	1.75	0.09	-	
106B		73.9	21.4	0.58	0.43	0.79	2.80	0.13	-	
107		-	2.34	96.3	0.09	0.18	0.05	0.18	0.27	Si 0.42
108		79.9	17.5	0.42	0.28	0.17	1.64	0.08	-	
108		72.8	24.5	0.62	0.39	0.14	1.37	0.17	-	
113		79.9	17.0	0.43	0.39	0.21	1.94	0.04	-	

-106A, B 80 : 17

, -102B 83 :

16 (-102A)

Au 67.6wt%, Ag 26.4wt%, Cu 2.06wt%, Hg 3.28wt%

가
가
(Photo 1 4 , 0.12mm, 0.27mm)
(-105)
96wt%



Photo1.
(-102A)

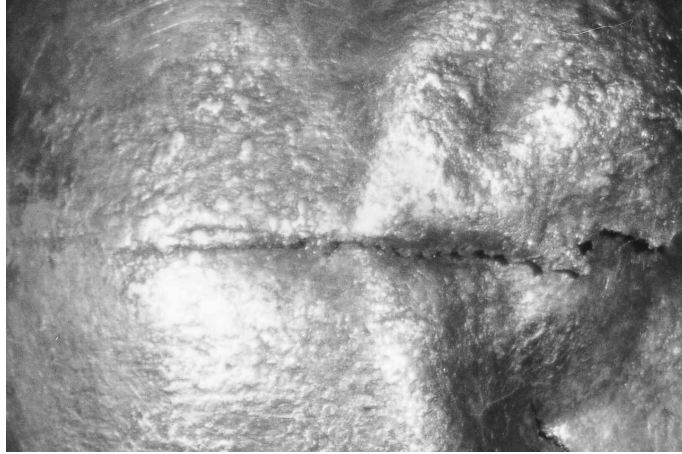


Photo 2.

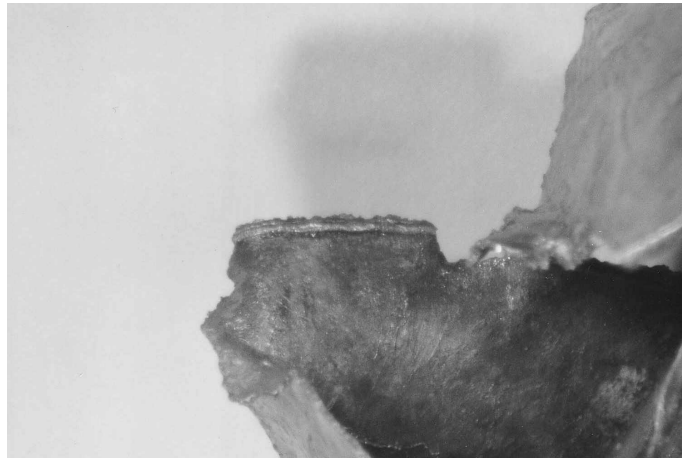


Photo 3.

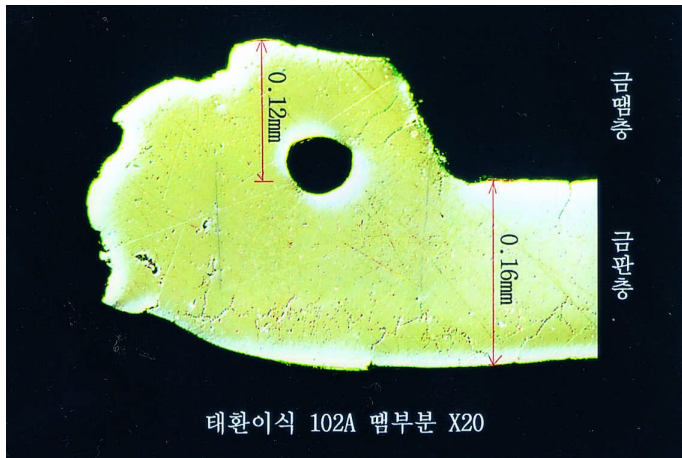


Photo 4.

(X20)

18

(-102A)

가

가

가

가