"The Analyses of Plain and Red-painted Polished Korean Pottery Sherds Excavated at Yangp'yŏng-ni, Chewŏn-gun County, Ch'ungch'ŏng Pukto Province"

—A Study of the Nam-Han River Valley Culture (2)—

Mong-Lyong Choi*

I. Preface

The Five samples analyzed here can be divided into two groups of pottery sherds; one is a traditional plain (or plain coarse) pottery and the other is a red-painted polished pottery (traditionally called 'Tandomayŏn Togi', but now called 'Hongdo', a term coined by Wŏn-yong Kim). Both types of pottery came from the subterranean settlement excavated at Yangp'yŏng-ni, Chewŏn-gun county, Ch'ungch'ŏng Pukto province, and they are believed to be included within the same period of the Plain pottery culture (Kim, C.H., 1978:53), or the Bronze Age I (1,000 or around 700 B.C. to 300 B.C.) in terms of the Prehistoric chronology of Korea established by Wŏn-yong Kim (1977):

"... from around 1,000 B.C. new types of pottery emerged in northwestern Korea. They vary in details, but a common feature is the plain surface without ornamentation, and accordingly they are collectively called as the Plain pottery." (Kim, W.Y., 1981:30)

* Assistant Professor, Department of Archaeology and Fine Arts, Seoul National University

이 논문은 1983년도 문교부 학문연구 조성비에 의해 연구된 것이다.
According to Chŏng-hak Kim, this association of these types of pottery is common on sites such as Yŏksam-dong and Karak-ni from the north to the south of the Korean peninsula. During the Middle of the Plain pottery culture the Karak-ni type of pottery with 'the doubled over rim' is characteristic (Kim, C.H., 1978:113-114).

The red-painted polished pottery (*Hongdo*) is believed to be fired with fine paste and oxidized iron pigment on the surface for the red colored surface treatment. This characteristic pottery during the Plain pottery culture or Bronze Age in Korea is believed to have been used as a ceremonial vessel or as a burial good in the dolmen burial system because of its unusual feature, but recently these concepts are changing because it has been discovered not only from the inside of dolmen but also from settlements such as Hŭnam-ni in Kyŏnggi-do province (Kim, W.Y. et al, 1977:98) and Daep’yŏng-ni in Chingyang-gun county (An, 1977:52).

In this small paper, I am going to analyse those five samples with the mentioned historical background using such scientific methods as Petrographic analysis, X-ray diffraction, Emission spectrographic analysis and the Scanning Electron Microscope, and then, to compare some results gained from these analyses with the previous one done by author to the samples from Yŏngsan River Valley region (Choi, 1981); finally, I am going to conclude that there was a hypothesis about common technique of pottery making in the Bronze Age I and Bronze Age II (300 B.C.–0).

The samples analyzed here are as follows:

<table>
<thead>
<tr>
<th>Sample Nos.</th>
<th>Kind</th>
<th>Color</th>
<th>Part</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>red-painted polished pottery</td>
<td>red</td>
<td>body</td>
</tr>
<tr>
<td>2.</td>
<td>plain pottery</td>
<td>reddish brown</td>
<td>body</td>
</tr>
</tbody>
</table>
The Analyses of Plain and Red-painted Polished Pottery… [157]

3. red-painted polished pottery red body
4. plain pottery reddish brown body
5. plain pottery reddish brown body

II. Dating of the excavated settlement

This subterranean settlement (dwelling pit) had been excavated during the Summer season of 1982 by the Seoul National University under the auspices of Ch'ungch'ŏng Pukto provincial office (Choi and Im, 1982). This excavation had been held at the flat alluvial place formed near Nam-Han (South-Han) River located at Yangp'yŏng-ni, Cheon- gun county which will be submerged by 1985 with the construction of dam (Fig. 1).

This settlement is 6×4m forming a long oval shape and having one fireplace inside the wall (Fig. 2). This house has produced a lot of utensils such as stone arrowheads, net-sinkers and other stone implements in addition to plain pottery and red-painted polished pottery sherds. According to the typology of pottery and stone implements, authors had assumed that the date of this house will be around 7-5 century B.C., namely during the Bronze Age I period (Choi and Im, 1983).

The most important thing is the charcoal collected from the inside of fireplace located near the southern wall. As shown on the carbon age determination done by Geochron Laboratories Divison of Krueger Enterprises, Inc. in Cambridge Massachusetts (see Radiocarbon Age Determination), the charcoal sample produces the date of 2,785±165 B.P. (835±165 B.C. 1000−670 B.C.) which means that this house has existed around 7 century B.C. at least.
Fig. 1. Settlement site (mark × on the map) excavated at
Yangp'yŏng-ni Chewŏn-gun county, Ch'ungch'ŏng Pukto province.

This figure supports our estimation of the date of this house and the artefacts found inside this house.

III. Analyses

a. Petrographic analysis

This analysis is based on standard petrographic investigation of a suite of thin sections of pottery fragments. All sections are composed
of an assemblage of mineral grains and rock fragments, enclosed in a matrix of clay minerals such as montmollionite, small mineral fragments and black organic material. The following table (Table 1) shows that quartz, microlite, plagioclase, feldspar, oxybiotite, mafic minerals,
RADIOCARBON AGE DETERMINATION

Our Sample No.: CA-9079
Your Reference: Hand-delivered on 09-23-82
Submitted by: Hong-Iyang Choi
Apt. #2
373 Somerville Ave.
Somerville, MA 02143

Sample Name: Young-yong-nil, Ch'o-on-gun county, Ch'ungch'ong provin.
Korea. Charcoal from "Fireplace"

AGE = 2785 +/- 135 C-14 years B.P.

Description: Sample of wood charcoal.

Pretreatment: The charcoal fragments were separated from any sand, silt, roots, or other foreign matter. The sample was then treated with hot dilute HCl and with hot dilute NaOH to remove carbonates and organic contaminants. After washing and drying, the charcoal was then combusted to carbon dioxide for the analysis.

Comment:

$\delta^{13}C_{PDB}$

Notes: This date is based upon the Libby half life (6570 years) for C$^{14}$. The error stated is \pm 1 $\sigma$ as judged by the analytical data alone. Our modern standard is 95% of the activity of N.B.S. Oxalic Acid.

The age is referenced to the year A.D. 1950.
mica and zircon are major constituents among which quartz and feldspar are the most important. According to this analysis, the most interesting result is that the proportion of quartz to feldspar in the plain pottery is 59:41 (no. 2), 34:64 (no. 4), but the unusual proportion of 94:6 (no. 1) and 93:7 (no. 3). These results can be supported by the proportion of plain pottery discovered from the Yongsan River Valley Region (Choi, 1981:264). They are 60:40, 35:65, 40:60, 75:25, 60:40 and 65:35 (Table 2). In terms of this results, I am able to get an idea about the making of pottery. In case of making plain pottery, the

### Table 1. The results of Petrographic analysis

<table>
<thead>
<tr>
<th></th>
<th>Red-painted polished pottery</th>
<th>Plain Pottery</th>
<th>Red-painted polished pottery</th>
<th>Plain pottery</th>
<th>Plain Pottery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matrix %</td>
<td>80</td>
<td>75</td>
<td>90</td>
<td>95</td>
<td>70</td>
</tr>
<tr>
<td>Other constituents</td>
<td>20</td>
<td>25</td>
<td>10</td>
<td>5</td>
<td>30</td>
</tr>
<tr>
<td>Grain size of other constituents</td>
<td>fine</td>
<td>coarse</td>
<td>fine</td>
<td>medium</td>
<td>coarse</td>
</tr>
<tr>
<td>All Rock Fragments</td>
<td>9</td>
<td>2</td>
<td>55</td>
<td>40</td>
<td>29</td>
</tr>
<tr>
<td>Volcanic</td>
<td>3</td>
<td>2</td>
<td>tr</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Sedimentary/Metamorphic</td>
<td>6</td>
<td>tr</td>
<td>55</td>
<td>35</td>
<td>9</td>
</tr>
<tr>
<td>All Mineral Grains</td>
<td>91</td>
<td>98</td>
<td>45</td>
<td>60</td>
<td>71</td>
</tr>
<tr>
<td>Quartz</td>
<td>80</td>
<td>55</td>
<td>40</td>
<td>50</td>
<td>25</td>
</tr>
<tr>
<td>Microcline</td>
<td>—</td>
<td>40</td>
<td>—</td>
<td>—</td>
<td>40</td>
</tr>
<tr>
<td>Plagioclase</td>
<td>5</td>
<td>3</td>
<td>—</td>
<td>—</td>
<td>5</td>
</tr>
<tr>
<td>Undifferentiated feldspars</td>
<td>—</td>
<td>—</td>
<td>3</td>
<td>5</td>
<td>—</td>
</tr>
<tr>
<td>Oxybiotite</td>
<td>tr</td>
<td>tr</td>
<td>—</td>
<td>tr</td>
<td>1</td>
</tr>
<tr>
<td>Mafic minerals</td>
<td>3</td>
<td>—</td>
<td>2</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>White mica</td>
<td>3</td>
<td>—</td>
<td>2</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Zircon</td>
<td>tr</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>tr</td>
</tr>
<tr>
<td>Proportion of Quartz to Feldspar</td>
<td>94:6</td>
<td>59:41</td>
<td>93:7</td>
<td>91:9</td>
<td>36:64</td>
</tr>
</tbody>
</table>
Table 2. The Results of Petrographic Analysis (From Choi M.L., 1981: 264):
Songam-dong, Uch'-i-dong and Ch'ungbyo-dong are all included in
Kwangju city.

<table>
<thead>
<tr>
<th></th>
<th>Kŏnsan-ni (bottom)</th>
<th>Songam-dong (body)</th>
<th>Uch'-i-dong (bottom)</th>
<th>Ch'ungbyo-dong (body)</th>
<th>Ch'ungbyo-dong (bottom)</th>
<th>Songam-dong (bottom)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartzite</td>
<td>trace</td>
<td>trace</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Pegmatite</td>
<td>check</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Rutile</td>
<td>large oval streamers</td>
<td>trace</td>
<td>—</td>
<td>trace</td>
<td>trace</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>3 small</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graphic</td>
<td>20%</td>
<td>9%</td>
<td>1%</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Plagioclase</td>
<td>2%</td>
<td>10%</td>
<td>15%</td>
<td>5%</td>
<td>15%</td>
<td>15%</td>
</tr>
<tr>
<td>Perthite</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Twin with Quartz</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>replace</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Pyroxene</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>10%</td>
</tr>
<tr>
<td>Pyroxene window twin</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Quartz</td>
<td>60%</td>
<td>35%</td>
<td>40%</td>
<td>75%</td>
<td>60%</td>
<td>55%</td>
</tr>
<tr>
<td>Alkaline Feldspar</td>
<td>35%</td>
<td>50%</td>
<td>45%</td>
<td>15%</td>
<td>25%</td>
<td>5%</td>
</tr>
<tr>
<td>Nephline</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>2%</td>
</tr>
<tr>
<td>Muscovite</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>2%</td>
</tr>
<tr>
<td>Serpentine</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>5%</td>
</tr>
<tr>
<td>Microcline</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

| Proportion of Quartz to Feldspar | 60:40 | 35:65 | 40:60 | 75:25 | 60:40 | 63:35 |

A reasonable proportion of quartz to feldspar should be kept in general, but quartz is a dominant constituent in the making of red-painted polished pottery when compared proportion of plain pottery.

Another result gained from the petrographic analysis is to confirm of the existence of the undulose quartz or alpha-quartz among the major constituents which means that both types of pottery were fired below the 573°C at most, similar to the firing condition of the plain from the
The Analyses of Plain and Red-painted Polished Pottery...

Yongsan River Valley.

b. X-ray diffraction

Three samples were analyzed by the X-ray (powder) diffraction method. The results are as follows;

No. 1. red-painted polished pottery: Only lines for alpha-quartz (SiO₂) were present in the pattern.

No. 4. plain pottery: Most of the lines in the film are due to alpha-quartz (SiO₂). The two other relatively strong lines in the film (at 4.45 Å and 2.58 Å) are probably due to montmorillonite. Unoriented mounts of montmorillonite frequently give only one line at about 4.5 Å. A few additional very weak lines in the film could not be assigned to specific mineral phases.

No. 5. plain pottery: Most of the lines are due to alpha-quartz (SiO₂). Some of the other generally weak and diffused lines in the pattern may be due to a muscovite 1M type mica mineral (such as illite). A few other very weak lines could not be assigned to specific phases. Montmorillonite does not appear to be present in the sample.

In terms of these results, we can recognize again that both types of pottery were fired below 573°C at most. The existence of alpha-quartz supports this firing condition well. And next the paste used for making plain pottery was a montmorillonite like the one of the plain pottery from the Yongsan River Valley.

c. Emission spectrographic analyses

No differences were found in the qualitative elemental analyses between the three samples. Elements detected and their estimated ranges of concentration are as follows:

Si, Al: much greater than 0.2% by weight
Fe, Ca: greater than 0.2% by weight
Ti : approximately 0.2% by weight
The analyses show that 16 elements existed in each sample as major and minor trace elements similar to the one from the Yongsan River Valley Region (Choi, 1981:366)

d. Scanning Electron Microscope

It is necessary to use Scanning Electron Microscope to check out surface topography of pottery sherds and firing condition. Recently Kingery's method of reheating pottery samples is well used for finding firing condition (Kingery, 1974, Kingery and Friedman, 1974). As shown on the plates No. 1-5, there were no need for reheating samples because I had already known the firing condition below 573°C in terms of petrographic analysis and X-ray diffraction. There was no great differences among the surface topography themselves of the samples pictured by Scanning Electron Microscope, which means that there existed a common technique in making pottery at those times.

IV. Results

a. Firing condition

In terms of the petrographic analysis and X-ray diffraction, we can confirm the existence of alpha-quartz(SiO₂) in both the plain and red-painted polished pottery. They were fired below the 573°C which is the melting point of alpha-quartz into beta quartz when fired.

I presume that pottery, regardless of its paste and pigment on its surface, were fired under the low firing condition during the Plain pottery culture (Bronze Age) in general.
b. Clay

As the sample no. 4, clay used for making pottery is believed to be montmollionite, the same clay as used in the plain pottery discovered from the Yongsan River Valley. However, sometimes another kind of clay is used as a paste for the making pottery as shown on the sample no. 5, because of the difficulty in obtaining montmollionite, and geographic distance.

c. Function

From the results analyzed, we can recognize the low firing condition of making both types of pottery during the Bronze Age in general, which means that the pottery itself is too weak and too porous to store liquid material. This suggests that wooden vessels or leather bag was used instead of those types of pottery whose function was limited to store dried seeds or materials.

V. Conclusion

From these analyses, we can assume that there was a common technique in making pottery during the Bronze Age in general, although a little variance in the paste of pottery because of geographic distance and difficulty in obtaining resources. This result can be supported by the similar results of the plain pottery from the Yongsan River Valley, although the latter one is included in the Later Bronze Age (300 B.C. -O). Comparison of plain pottery with the comb-pattern type pottery during the previous period in Korean prehistory will be needed for the general understanding for the Plain pottery culture (1983).
Plate. 1. Red-painted polished pottery (×1,000 and ×5,000)
Plate 2. Plain pottery (×1,000 and ×5,000)
Plate 3. Red-painted polished pottery ($\times 1,000$ and $\times 5,000$)
Plate. 4. Plain pottery ($\times1,000$ and $\times5,000$)
Plate 5. Plain pottery (×1,000 and ×5,000)
The Analyses of Plain and Red-painted Polished Pottery - [171]

Acknowledgement

I wish to express my gratitude to Mr. Richard Newman and Eugene Farrel, conservation scientists in Fogg Arts Museum of Harvard University for the X-ray diffraction and Emission spectrographic analysis, to Mr. Jim Parker, Geology Department of Harvard University for the Spectrographic analysis, and to Mr. Ed Selling, Comparative Zoology of Harvard University for the Scanning Electron Microscope. Finally, I wish also to thank especially Mr. Richard S. Lanier (Director) and Ralph Samuelson (Program Associate) of Asian Cultural Council and Ministry of Education of Korea whose encouragement and financial support was able to finish this small paper during my stay at Cambridge and Seoul, and finally to express my special gratitude to my friend, Mr. Jeffrey Kao, Dept. of Anthropology of Harvard Univ. for reading this small paper and correcting errors (1983).

Bibliography

An Ch' un-bae


Choi(Ch'oe), Mong-Lyong


Choi Mong-Lyong and Im Yông-jin

1982 "Excavation Report on the prehistoric site at Yangp'yông-ni, Chewôn,
Ch’ungch’öng proviece” Ch’ungju Dam Sunol Chiku Mühwa Yuchök Palgul Chosa Pogosö (Excavation Report on the sites in the Ch’ungju Dam area), Ch’ungch’öng Pukto and Ch’ungpuk Univ. Museum; 91-138.

Kim Ch’ông-hak


Kim Wŏn-yong


Kim Wŏn-yong et al.


Kingery, W.D.


Kingery, W.D. and Friedman, Jay D.

"충청북도 제원군 양평리 주거지에서 발굴된 무문토기와 홍토의 과학적 분석"

南漢江流域의 先史文化研究(2)

서울대학교 인문대학 고고미술사학과 조교수

崔夢龍

1981년 필자는 영산강유역에서 발굴된 무문토기와의 과학적인 분석을 통해 당시의 문화를 복원하고자 시도한 바 있다. 결과 충청북도 제원군 양평리 주거지에서 발굴된 무문토기와 홍토를 다시 하와야대학 관계연구소에서 과학적인 분석을 해 본 결과,

1) 주거지의 연대는 적어도 서기전 7세기경 이전이며,
2) 무문토기와 홍도 모두 573°C 이하에서 구워졌으며,
3) 무문토기의 경우 석영과 장석이 균형이 있게 섞여진 반면 홍도의 경우 석면이 장석에 비해 약도적으로 많이 섞여졌으며,
4) 분석된 영산강유역의 무문토기와 남한강유역의 무문토기는 서기적으로 약간 다르게 구워졌다고 하나 대체로 있어서 본본으로 비슷한 것으로 나타났다.
따라서 이는 무문토기시대에 도기를 제작하는데 있어 전형적으로 공통의 기술을 가지고 있었음을 알 수 있게 되었으며,
5) 이상의 결과로 인한용기로서 무문토기 대신 가죽이나 나무로 만들어진 용기의 사용이 경력히 시사될을 알 수 있다(1983).