# Problem of Functional Interpretation : The Need for Ethnographic Analogy in Indonesia

*by Mundardjito*

The discussion in this article is based on problems of functional interpretation often faced by archaeologists. Regarded as an "interpretive science', like all disciplines concerned with the past, archaeology bases its explanations on the data obtained. If archaeological explanation or functional interpretation in particular is not based on reliable data, it certainly will not produce a compelling clarification of knowledge. The fewer the data obtained from an artifact, the greater the problems that arise; the less the explanatory value to the artifact, the lower the quality of interpretation.

Besides a great number of unidentified artifacts mentioned in excavation reports, to this day many museums in various parts of the world still preserve artifacts whose functions are unknown or not entirely established. This is caused by several limitations. Artifacts which are found in fragmentary condition, so that their overall shape cannot be known with certainty, are difficult to identify satisfactorily solely through formal analysis. Artifacts which are donated to museums as objects of unknown provenance and without information about accompanying finds cannot be explained through contextual analysis alone. Moreover, if during an excavation an archaeologist finds an artifact of a sort he has never seen before, we can easily imagine that he will experience even greater difficulty or less certainty when answering questions such as: What is this object? What was it used for? How was it made? Why does it have a particular shape?

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*The author works in the Borobudur Restoration Project and at the Centre for Environmental Studies, University of Indonesia. His main interest is to develop the study of settlement archaeology.*

Among scientific finds of this kind are crucibles from the Banten excavations in West Java, Indonesia. These crucibles can be used as an example of the application of ethnographic analogy to solve the problem of functional interpretation. Despite the great number of written documents supporting research in Banten, a historical site of the 17th and 18th centuries, the functional interpretation problems of the artifacts still exist. They have arisen mainly because the metal smelting crucible is a type of artifact rarely mentioned in excavation in this country. In fact not a single excavation in this country ever yielded crucibles previously, hence archaeologists working in this area have never been confronted with this kind of artifact. The great number of these artifacts excavated notwithstanding, it has been impossible to produce acceptable explanations solely by working through formal and contextual analysis. Not until studies are undertaken through ethnographical analogy, which are consequently followed by imitative experimentation, have results valuable enough to use in constructing a hypothesis which could be tested in further field research emerged.

## The Problem

Among the 40,000 finds yielded by the Banten excavation carried out by the National Research Centre of Archaeology in 1976 (Mundardjito *et al,* 1978), 762 pieces could not be identified; they were only considered to be fragments of clay vessels with shiny red colored glaze. These finds were highly conspicuous among the cracks and clods of earth in the fields for besides their red

color and sparkle, several found together had clear green colored particles of copper or bronze and bits of charcoal. After the excavation, several complete vessels were seen in the wall of a well belonging to one of the villagers in rows and upside down. These complete samples were named "vessel X". This name was of a temporary nature, for the sake of taxonomy while excavation was proceeding, until the archaeologists would have become certain of the vessels' function.

**The Crucibles**

The vessels are cylindrical in form, like a drinking glass, and are made of an originally clay material. They have varying measurements (between 10 and 15 cm height) and very thick walls (about 2 or 3 cm). The outer surface of the wall is not smooth but rather pockmarked and covered by a layer of solidified flow of a dark red colored mineral, shining like glass. An open spout appears on the rim and directly opposite is an angular or a rounded projection. As the base of the vessel is not flat, since almost every base is thickly covered with solidified mineral which has melted and concentrated at the bottom, it cannot stand up on a level surface. The inner wall is paler red in color and not covered with a layer of solidified mineral. It also shows indentations due to the pressures of the fingers during manufacture.

The 762 samples that were collected comprise 744 fragments and 18 whole pieces. The assemblage of finds which contributed the most data relevant to function came from a certain square. It not only provided the greatest concentration of vessel X fragments but also an ***in situ*** brick floor measuring 2 x 2 meters, a carpet of splashes of copper or bronze over an area of about 1.5 x 1.5 meters, a large number of particles of copper or bronze and iron, metal slag, fragments of iron tools, a variety of foreign (Chinese) and local sherds, metal coins and so forth, all within an excavation square filled with black sandy soil mixed with bits of charred wood and bamboo.

By observing the very concave shape of a vessel, one might presume that it was used to contain a liquid substance. This becomes more evident in the presence of a spout on the rim of the vessel for pouring liquid and a kind of handle to make pouring easier. While classifying the X vessels, it became clear that they came in a variety of sizes and that they were probably used to contain liquids in various quantities. Their function might have been like that of a measuring-glass in a laboratory. The traces of earlier burning of the outer and inner walls of the vessels, often accompanied by charcoal stuck to the surface, indicate that these objects were perhaps used for boiling purposes over a stove or hearth. The shape of this stove or hearth would have to be such that it held vessels with highly covered base upright. The frequent occurence of a hardened liquid substance would make the base even less level. The surface of the outside wall was wrinkled and not as smooth as the surface of ordinary undecorated pottery. Virtually the whole of the body was covered with a hot liquid material which later hardened and formed wrinkles, holes and protrusions causing a rough surface. This layer showed a dark red color, often interspersed with dark green in several places, and glittered in the light.

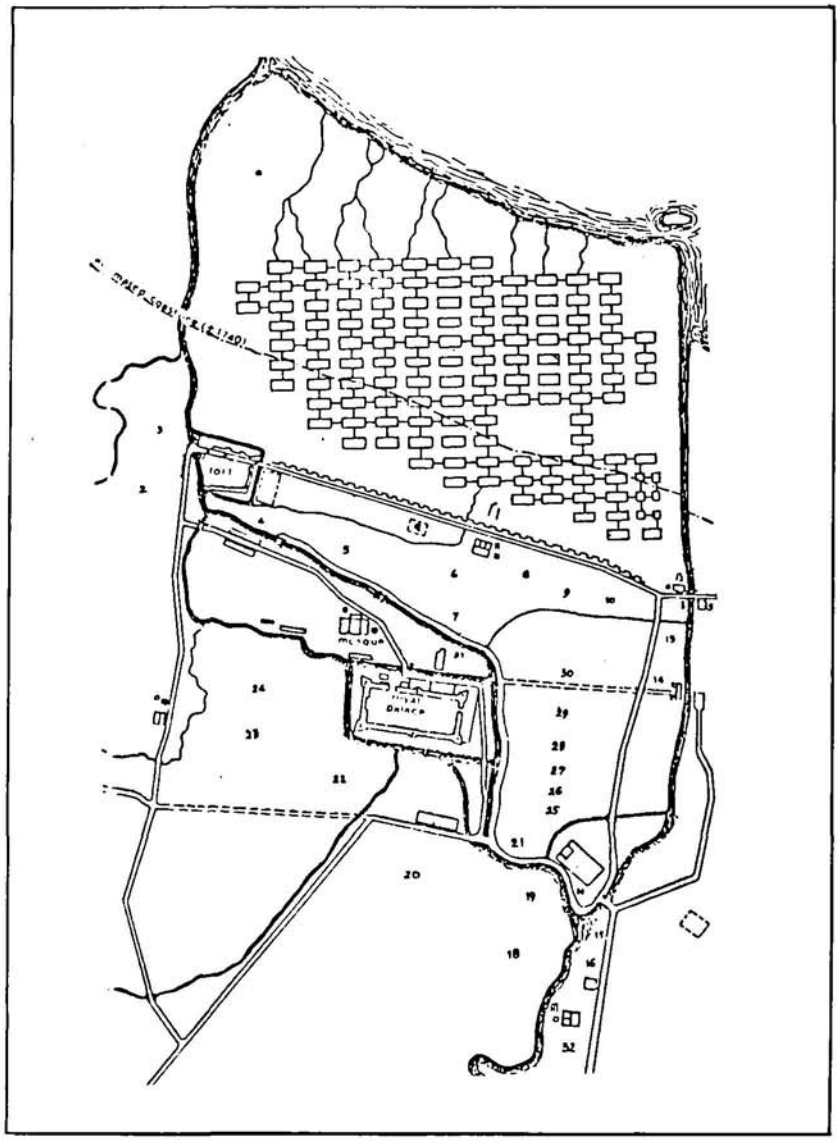

*Illustration of an excavated crucible from Banten (Excavation 1976)*

**Assumption**

All of the data mentioned above make us assume that the X vessels were used to heat a red colored liquid and that they were held above a hearth. The red material which melted on the outer wall might have been an overflow of the molten liquid that hardened after the heating process.

Judging from the ancient map without scale of the 19th century (one of the historical documents), the researcher assumes that the site excavated might have been part of an ancient quarter of a weaving area or of a metal working area. If we relate the vessel X finds with the weaving area, we may assume that these artifacts were used to heat certain liquids used for dying the cloth produced there and the red color on the outer wall was caused by spilled liquid. But this notion raises the following question: were all the cloths made colored red?

On the other hand. if the vessel were related to the metal-working area, we may assume that they were used for smelting metal. But, what kind of metal would give a red color to the outer wall without producing the same effect on the inner wall? These questions could only be answered



**Legend :**

| | | |
|---|---|---|
| 1. Kapakihan | : Moslem-scholar's compound | |
| 2. Pamarican | : Pepper's storage place | |
| 3. Pabean | : custom's house | |
| 4. Kaloran | : Pangeran (prince/lord) Lor's compound | |
| 5. Kawangsan | : Pangeran Wangsa's compound | |
| 6. Kapurban | : Pangeran Purba's compound | |
| 7. Panjaringan | : Fish-knapper's settlement | |
| 8. Pakojan | : foreigner's settlement (Bengalese, Arabian, Turkese) | |
| 9. Pratok | : handicraft's centre | |
| 10. Pasulaman | : embroidery's workshop | |
| 11. Karangantu | : foreigner's settlement (Chinese, Malayan, Portuegese, Dutch) | |
| 12. Pamaranggen | : keris-making workshop | |
| 13. Pawilahan | : bamboo's workshop | |
| 14. Pakawatan | : ? | |
| 15. Karoya | : ? | |
| 16. Kamandalikan | : Pangeran Mandalika's compound | |
| 17. Camara | : ? | |
| 18. Tambak | : ? | |
| 19. Kajoran | : ? | |
| 20. Kebalen | : Balinese compound | |
| 21. Kasemen | : ? | |
| 22. Kawiragunan | : Royal official's compound | |
| 23. Pajantran | : Weaving-mill's workshop | |
| 24. Kapandean | : metal's workshop | |
| 25. Kasatrian | : military barracks | |
| 26. Karang Kepaten | : ? | |
| 27. Keraton | : Royal official's compound | |
| 28. Pasar Anyar | : market | |
| 29. Pagebangan | : ? | |
| 30. Kabantenan | : Royal official's compound | |
| 31. Langgeng Maita | : ? | |
| 32. Kasunyatan | : saint's compound | |
| 33. Kagongan | : gong-making workshop | |

*A map without scale of old Banten made by Serrurier in 1902.*

through special analysis in a laboratory.

However, from the contextual analysis which follows, we are inclined to see the validity of the second explanation.

From the viewpoint of a manufacturing technique, it can be said that the X vessels are hand-made because of the following facts: the inner surface is indented or pitted due to the pressure of the potter's fingers; the inside wall does not show the aligned striations of wheel-turning; and the overall shape of these vessels is not symmetrical or concentric. From the inner surface, we can also observe that a potter's anvil was not used in the manufacturing process. This might be because dense walls were not needed and the working space was limited; in this case a small anvil might have been used which for technical reasons would not have been effective. If we consider the thickness of the vessel wall, which is not proportional to its height and width, we can conclude that there was no compaction with a pounder or paddle. Moreover, the porous body of the vessel also suggests that no process of compacting the walls took place. It is as if this thick paste was intended to give the X vessels a capacity for expansion and contraction, especially needed to withstand high temperatures. But, does cloth dye have to be heated to a temperature far higher than that of the boiling point of water?

## Context of finds

The context of associated finds- a number of particles of bronze and bits of charcoal sticking to the walls of X vessels, several fragments of iron tools, fragments of clay moulds for casting metal, some iron and bronze slag, a carpet of bronze splashes 1.5 x 1.5 meters wide, and a deposit of black colored soil due to a thorough mixture with charcoal—indicates that there existed a close relationship between the X vessels and matters related to metal working systems. Thus, if we are forced to make a choice, we would be more inclined to suggest a relationship between the X vessels and a metal working area rather than a weaving area. Through formal and contextual analysis, we can therefore draw a provisional

conclusion that this area was a workshop for metal workers who were carrying out casting and forging.

**The Importance of Ethnographic Analogy**

Having drawn a conclusion does not mean that the problem of interpretation is solved. All data obtained during the course of the excavation still have to be tested and supplemented with ethnographic material. Gathering ethnographic material relevant to the archaeological problem is, we feel, appropriate to our purposes. It is fortunate when researchers can simultaneously carry out an excavation studies within a nearby village to obtain information which is closely relevant to their finds. Indeed this sort of study can only be done in certain places where various social customs and behaviours are considered to be a continuation of ancient traditions. Thus, for example, in order to obtain an idea of the uses of vessels found in excavations, archaeologists usually make an effort to get comparative data from groups of potters whose villages are located within a reasonable distance. Such information can be obtained through direct observation and associated interviews.

But the problem lies in that one cannot be certain that a village which still retains the custom of making or using its own pots (without making ethnographic observations) exists near the site.

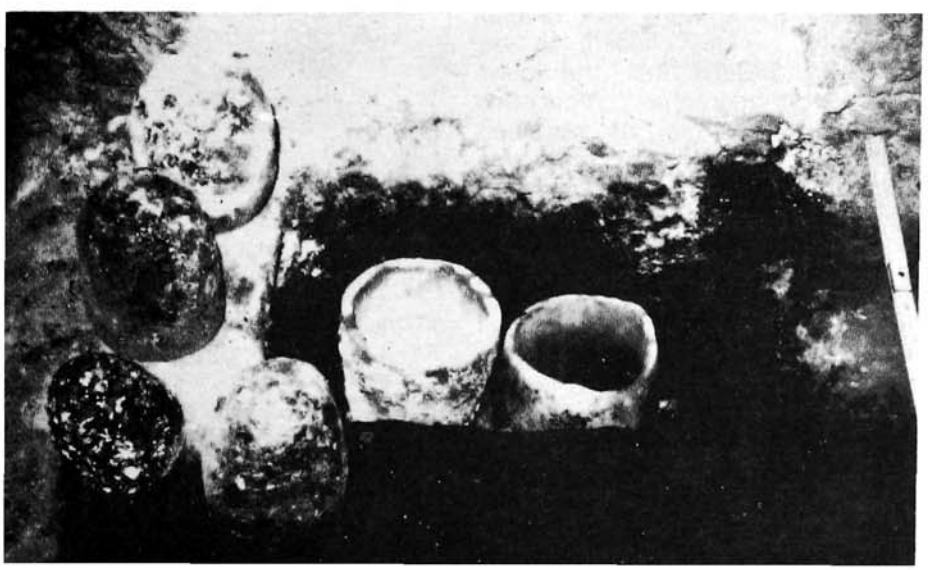
Theoretical comparisons based on the use of ethnographic analogy have attracted the attention of archaeologists and anthropologists for many years. The theoretical basis for this line of thinking is the uniformitarian outlook on natural phenomena and human behaviour. Natural phenomena of the past related to stratification, erosion, tectonic movements and so forth can be interpreted through studies of present similar phenomena. Human behaviour involving the invention and use of tool systems to cope with the natural environment can be understood through ethnographic studies of various contemporary societies which have not yet undergone great alterations. Past experience has proven that it is difficult to make archaeological interpretations before we will have seen and understood similar phenomena which take place in a living society. Stone tools which were once considered to be natural phenomena were only recognized as man-made objects in the 16th century (Fagan 1975: 24), when Michele Mercati observed their function in societies which had not yet been touched by the Industrial Revolution (19th century). It was not until long afterwards, 300 years later, that stone axes which still had handles attached were found at an archaeological site.

**Bogor Study**

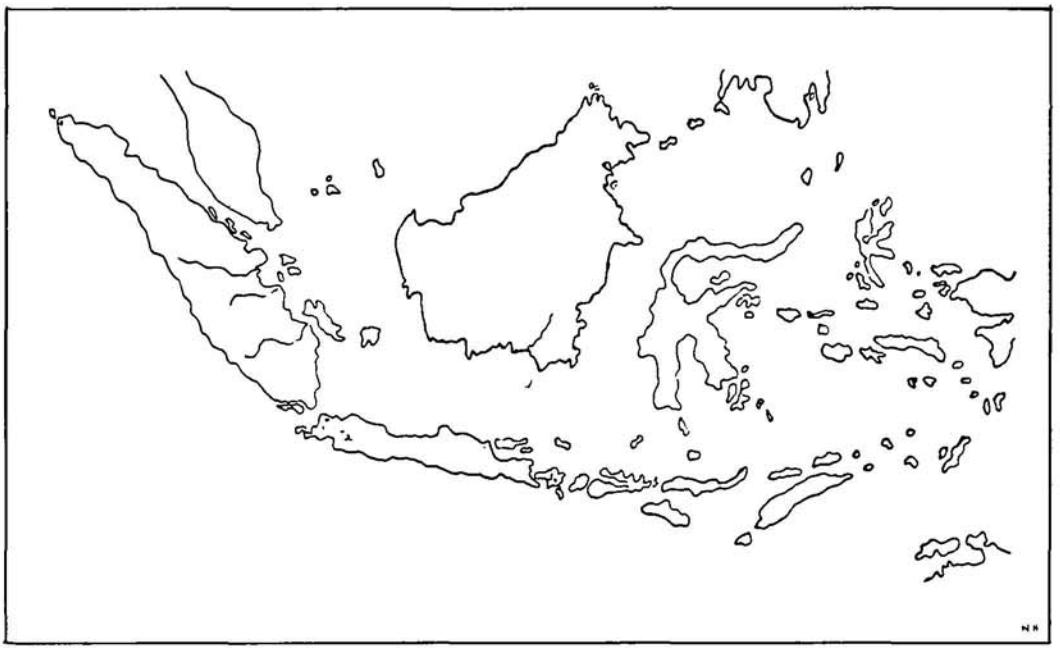
Realizing the importance of the X vessels, the archaeologists carried out further studies in the same year at a village in Bogor, West Java. The workshop there is the only place in West Java which still manufactures gongs and other gamelan instruments (traditional musical percussion instruments made of bronze or copper). The investigators were able to see the process of gong making, starting with the initial melting and mixing of copper and tin in a crucible, through casting in a clay mould and the beating out after heating over burning coals, up to the forming of a gong. The archaeologists were able to see a number of crucibles which could not be used again, jumbled together in a corner of the workshop. Several were still in one piece, but most were already broken.

The entire context was seen with great clarity including the function of these crucibles in the overall manufacturing process. The situation was as follows: a carpet of charcoal covered the whole place such that the earthen floor was black; rounded fireplaces of various sizes full of charcoal and ash; a water tank for cooling the glowing metal while it was forming; a flat stone on the floor for use as an anvil; goat-skin bellows; moulds made of clay in various shapes and sizes; and tools of iron such as hammers, tongs, pliers and lifting tools.

The surfaces of the outer walls of the Bogor crucibles were wrinkled and pitted, colored dark red and shiny enough when put in the light. It was not clear why their outer surfaces were wrinkled whereas their inner surfaces were not. From



*Unused crucibles jumbled up near the hearth.*



*Map of Indonesia*
*Legend: 1. Banten*
*2. Bogor*
*3. Tihingan*

interviews, it could only be ascertained that the wrinkling was not due to overflowing of liquid bronze; rather it was the result of heating on the hearths. Only one problem remained: was this because minerals in the clay of the crucible itself were liquefying, or because substances within the burning charcoal were adhering to the outer surface, as the informant explained?

Although the function of the X vessels was becoming more comprehensible, there were still several questions which needed to be answered. Besides this, the input data for ethnographic comparisons should, if possible, be obtained from studies of more than one research sample. This is because in the collection of empirical data, one must observe the principle that a single sample is not yet a sample. Thus further studies were carried out at the village of Tihingan, Bali, known as the only village on the whole island of Bali where people still make traditional musical instruments. The problems which especially concerned archaeologists were not matters relating to the social system like those which concerned Clifford Geertz (1964) in his study of the same village but those relating to its technological aspects.

According to the observers, 20 houses out of 180 in this village belong to bronze smiths; 4 of them have large foundries which can manufacture a complete set of gamelan instruments. In the village there are 25 experts, 75 semi-experts and about 100 assistants. Direct observations were made at one large foundry and at one small foundry which was not being used at the time. The observers requested another small foundry to make a crucible and to put it through the stages of melting bronze over a fire and of pouring the liquid into moulds. Furthermore, interviews were held with several people, including craftsmen, semi-skilled men and apprentices. Just as in Bogor, the same setting was seen in Tihingan: a carpet of charcoal, several fire places, tanks for cooling water, angular stone anvils, cylinder bellows, moulds of various sizes and assorted shapes and sizes of tools for hammering, lifting, and pinching. What was most important was the discovery of a number of crucibles, some broken, which had already been used for melting scattered in the corners, piled up beside the hearths and lying on the trash heaps.

Through a detailed formal analysis which had been applied to observe similarities and differences of the crucibles from Tihingan, Bogor and Banten, the archaeologists concluded that almost all the characteristics they possessed were similar. The similarities made the researchers assume that the Banten X vessels had a function which did not differ from that of the crucibles of the other liquid. This assumption is strongly supported by the similarity of contexts mentioned above.

**Imitative Experiments**

Although the problems of functional interpretation of the Banten X vessels was more or less solved, some problems still remained which led the archaeologists to carry out some imitative experiments. The theoretical justification for using this method of experimentation is the same as that for using ethnographic analogy: that is, uniformitarianism. By attempting to reproduce the activities of people in the past, the researcher can observe certain phenomena. Thus, for example, Iversen performed experiments, using stone axes to fell trees (1956), Outwater (1957) tried to cut and scrape wood with chipped stone tools, Jonnefeld

(1962) excavated with stone implements and Harner(1956) carried out experiments to find out the difference between man-made stone objects and natural stones. Also, Mayes imitated early methods of baking pottery in a kiln (1961) and Johnson (1957) made drawings on the walls of caves to produce lines and colors on their surfaces. The concept of imitative experiment extends even to the famous one performed by Heyardahl (1950) who copied the methods used by the people who sailed from South America to Polynesia in early times.

The researchers saw for themselves how the Tihingan crucibles were made. The raw material comprised clay and burnt rice husks. After these two materials had been thoroughly blended, a chunk of the mixture was shaped by hand into a crucible. Then the crucible was aired beneath the roof of the house so that it would become as dry or hard as leather and later dried in the house-yard exposed to direct sunlight. Afterwards, it was placed beside the hearth a little longer until considered dry and hard enough to be used to melt bronze at a high temperature. Once it had been used for melting, the outer surface became noticeably wrinkled and turned to a glassy red color unlike the inner surface which only darkened and turned slightly red.

All these data were of course most useful for the interpretation of the crucibles. They provided some answers for what the researchers had not been able to understand before: why the surface of the outer wall underwent such alterations even though no foreign material of any kind penetrated the covering layer. Observations throughout the melting process undertaken at Tihingan showed that the overflow of molten bronze, originally supposed to be the cause of the vessels' physical condition, did not occur at all. Therefore, the splashed carpet of bronze seen at the excavated site could have been formed by the broken crucibles, not by the overflow of molten bronze.

Being aware of the need for scientific clarification of this matter, the researchers undertook imitative experiments in the laboratory to observe the changes which might or might not take place in the research sample. These were used to explain the following: why do the crucibles have a surface with amorphous lumps on the outer wall but not in the inner wall? Why do the vessels have very thick porous body walls?

Imitative experiments on the Tihingan samples, supplemented by laboratory examination, were performed in the chemical-archaeology laboratory at Borobudur (Samidi 1976), Central Java. They produced the following results:

(1) In order to reach the melting point of bronze, around 1100 C, the crucible has to be heated to a higher temperature; consequently the heat outside the crucible is hotter than inside.

(2) While the bronze is melting, some of the iron (Fe) and silicon (Si) minerals in the body of the earthenware crucible also liquify, but only outside.

(3) After the heating ceases, due to the sudden temperature change, the molten Fe and Si harden and form numerous amorphous lumps and small cracks on the outer wall.

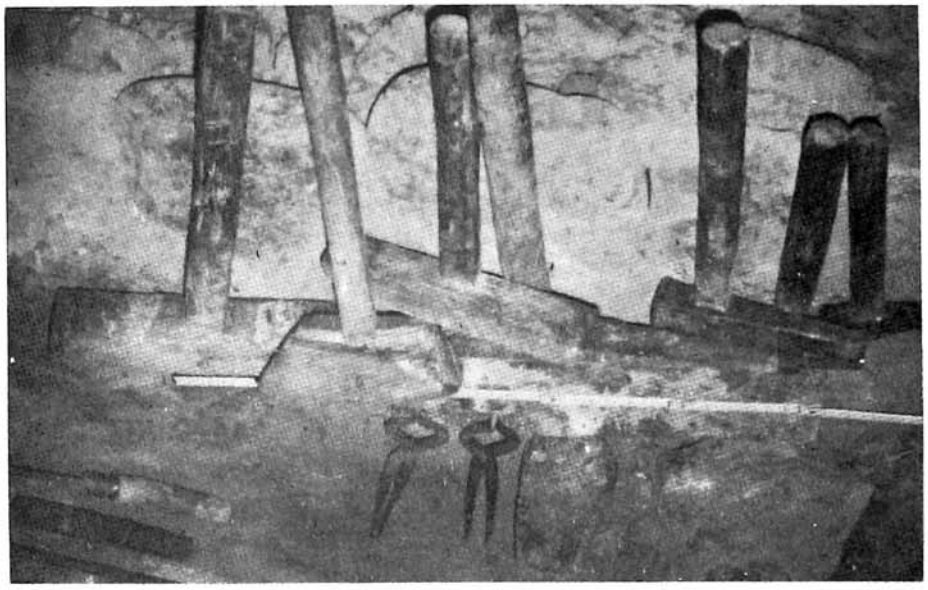
(4) The dark greenish red color of the outer wall is caused by the oxidation of the iron, while the glassy shine which reflects light is caused by the silicon mineral.

*Before use, the surface of the crucible is smooth. It becomes wrinkled and turns glassy red once it is used.*

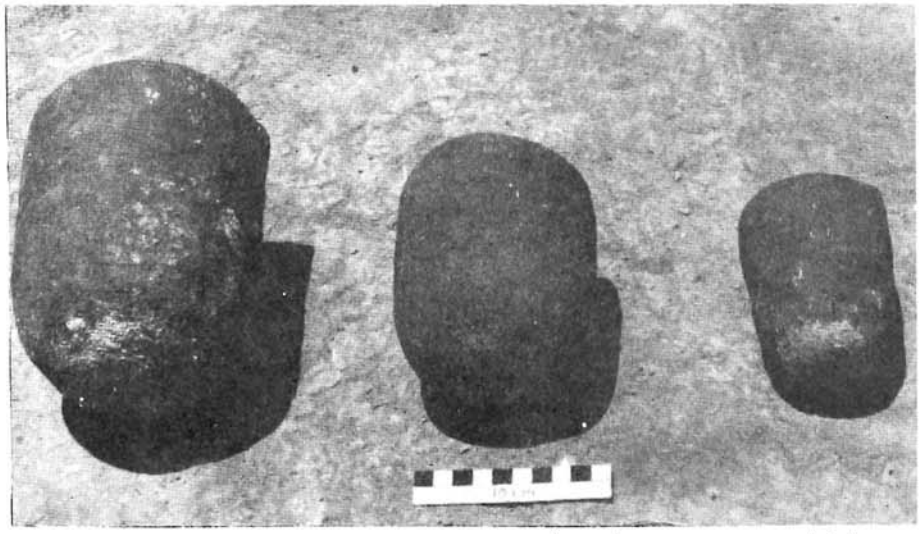
*The last stage of crucible making (hand made technique) demonstrated in Tihingan, Bali.*

(5) The temperature within the crucible is not as high as on the outside, therefore, the minerals inside the crucible do not liquify.
(6) Aside from unwanted economic factors, the molten bronze cannot boil over because the temperature does not reach its boiling point of 2336 C; otherwise, the crucible will melt first, since iron and silicon minerals liquify under a much lower temperature.
(7) The soft and very porous thick wall lends itself to greater expansion and contraction when the heating takes place.

By attempting to assemble the various data that have already been obtained through analytic methods like those described above, we can now attempt to give a plausible explanation of the X vessels from Banten in the form of a hypothesis which will be tested in later field research. The X vessels are believed to be crucibles, made of porous clay mixed with temper. They are probably used to melt bronze in the course of making traditional musical percussion instruments, since the size and form of the vessels are similar to those of Bogor and Tihigan. The bronze, melted in the crucibles at a high temperature, is poured later into open moulds through spouts on their rims with the help of long tongs to grip the lug on the crucibles' rims. Crucibles of varied sizes are used according to the amount of molten bronze required to form gamelan instruments which are also of varied sizes. Large crucibles are used to make large objects and small crucibles to make small ones. They are shaped by hand without using a potter's wheel. As the workshops are located near the homes of the workers, broken ceramic plates, coins and food remains can also be found.



*Part of the gong maker's tool kit at Tihingan workshop.*



*Modern Tihingan crucible types.*

Using this hypothesis, the researchers should do a follow up in the form of an extended excavation to make it possible to collect data which may confirm the assumptions. The knowledge of the layout of the workshops and the kind of implements used can be employed as an expedient guide in future archaeological operations.

**Conclusion**

With regard to the analytic methods employed in the case of the crucibles, it is obvious that the four methods – analysis of form, analysis of context, ethnographic analogy and imitative experiments – are inter-dependent. Among them, ethnographic analogy plays a very important role and makes a useful contribution to the formation of the research hypothesis.

By emphasizing the use of ethnographic analogy, I do not mean that

I quite agree with just any kind of analogy, such as the application of simple ideas and the incautious manner exercised by some archaeologists of the past. For ethnographic analogy, as demonstrated for example by Hill (1970), is only one phase of the interpretative process in archaeological explanatory activities.

It may be reasonable that, in choosing and making analogies, we have to consider the whole length and width of the dimensions of time and space. Thus, Dozier (1970) states that the shorter the time gap between a prehistoric site and the living site, the more likely it is that the inference will be reliable. And Gorden Childe (1956) suggests that an analogy drawn from the same region or ecological province is likely to give the most reliable hints. The ideas of Chang (1967) and Thompson (1956) limit the use of analogy in archaeology to technological problems. They believe that problems connected with ideas, beliefs, and customs can not be dealt with through analogy.

**Use of Analogy**

Simply suggesting parallels without taking into account the differences between given areas of culture will trip up any interpretation. It will not be possible to reach results through analogy like those the archaeologists hope for, unless the analogy is tested throughout by compiling as much archaeological data as possible. In the case of Banten, I feel that the real situation can be grasped through the use of analogy because (1) the artifacts being analyzed are technomic (Binford 1962) and of a universal nature; (2) the time-span separating Banten and Bogor-Tihingan is not great; (2) virtually no important technical changes took place during this time; on the contrary, Tihingan evidences are closely similar to those of Banten; and (4) the two localities are within a single Indonesian cultural area.

What has been expounded in this paper constitutes, if nothing else, further proof that archaeologists are constantly confronted by problems which can only be solved through the interdependent methods described above. All these stem from the nature of archaeological data which are greatly limited in matters of quantity and quality.

While some may be of the opinion that analogy is not the best way to archaeological interpretation, I am of the opinion that if archaeologists cannot use analogy at all, they will not be able to carry out the task of "piecing together the past"

**If archaeologists cannot use analogy...they will not be able to "piece together the past."**

With the Banten example, we can perceive that, although these artifacts were discovered in a historical site which has been only abandoned for 200 years and which is supported by a great number of historical documents, the problem concerning functional interpretation still exists. It is probable that it will be more difficult working in historical sites which can only provide a limited number of written documents, or in prehistoric sites with no records as such (telehistoric, Hawkes 1954). Working in historical sites is not as easy as people might think for the validity of the findings depend on the quality of written documents provided about the sites. For example, the writings of the Dutch and the British writers who came in contact with the Sultans of Banten would not be very helpful in the research on the crucible for they were interested in the international pepper trade, politics, social stratification and religion, rather than in the technology of that area.

**Need for Ethnoarchaeology**

In addition to the above, ethnographic data or literature do not give archaeologists supporting knowledge about metal technology of this cultural area. Should the ethnologist observe and record these data so that they might some day be of some use to an archaeologists; or should he do so in any event, or should there perhaps be a branch of archaeology (ethnoarchaeology) to take care of such things (Chang 1967:230)? Those are, I believe, questions which are very relevant to archaeological strategies in Indonesia today. Since there is no close relationship between archaeology and anthropology/ethnology (they are two separate departments in the universities in Indonesia), it is difficult for archaeologists to have ethnographic data related to archaeological problems. It is doubly so in Indonesia which consists of 3000 islands, 300 ethnic groups and 250 languages, and has still small societies, relatively isolated, where modern technologies have scarcely touched the people. Hence , Indonesia should conduct ethno-archaeological research which could help solve the various problems in Indonesian archaeology.

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