THE DEVELOPMENT OF THE MARE POTTERY TRADITION IN THE NORTHERN MOLUCCAS

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ABSTRACT

The island of Mare, near Ternate in the northern Moluccas, has the sole surviving earthenware pottery industry in the northern Moluccas. Mare pots are still traded widely throughout Halmahera and adjacent areas. This paper presents the results of an archaeological investigation into the development of Mare pottery, especially its style and technology. Possible outside sources of stylistic change are also investigated. This paper correlates Mare pottery within a wider Northern Moluccas pottery context.

RESEARCH BACKGROUND

Mare Island in the Northern Moluccas (Figure1) is famous for its pottery production. It is unique in being the only earthenware pottery producing area remaining in the whole region. At present, there are two villages on Mare: Mare Kofo and Mare Gam. Almost all women in Mare Gam make pottery for a living. It is sold by the men. In Mare Kofo, on the other hand, only a few elderly women still produce pottery, with men no longer selling it.

The first description of Mare pottery was in the 17th and 18th centuries by Dutch travellers (Corney 1855; Andaya 1993; Great Britain Naval Intelligence Division 1920). However, no detailed study of Mare pottery technology and trade had been undertaken before mine, except for a preliminary study by Hieriej (1984) on recent Mare pottery technology.

This paper has arisen out of research carried out in 1995 on Mare Island. Fieldwork involved both ethnographic (interview and observation) and archaeological research (survey and a series of test pit excavations).

SURVEY AND EXCAVATION RESULTS

Survey and excavation were carried out on Bukit Fato (252 m above sea level), situated 1 km northeast of the present Mare Kofo village. The Bukit Fato site is an abandoned village where foundations of former houses, a large stone pestle and mortar, a rectangular stone arrangement and some stone enclosures (possibly ancient tombs) were found (Figure 2). The surface collection was carried out over an area approximately 100 x 100 m from south to north. Collection was done selectively and only sherds showing aspects of form and style were collected. In total, 20 kg of surface sherds were collected for analysis.

Three test pits (coded Mare Kofo I, II and III) were located on the open site of Bukit Fato. Each measured 1 x 1 m and

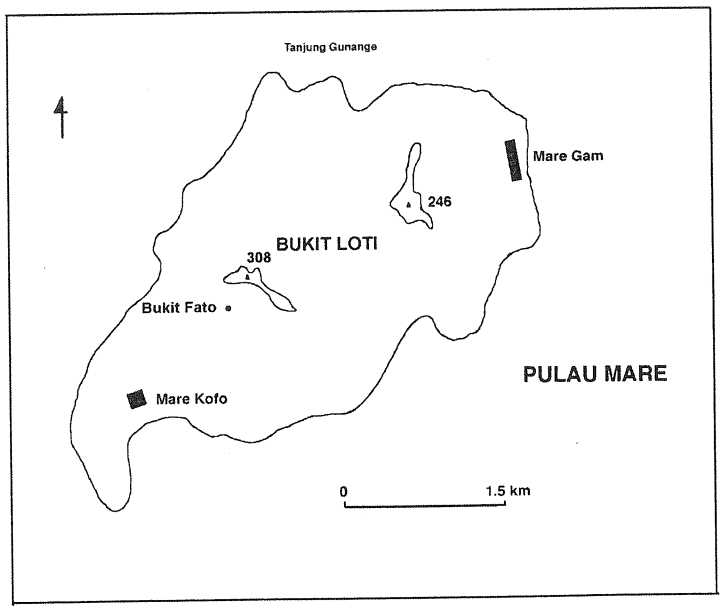

Figure 1: Map of Mare Island (Source: Army Map service, US Army, Washington, DC 1945).

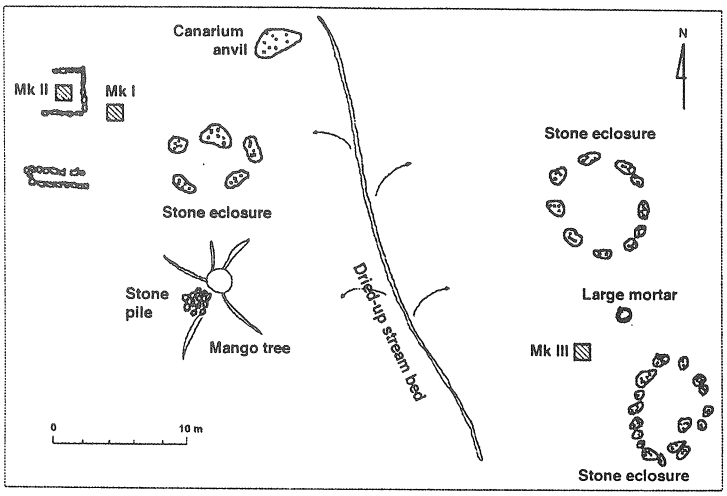

Figure 2: Plan of Bukit Fato site.

reached a depth of 0.6 m. The excavations uncovered three stratigraphic layers. Artefacts found on the surface and in the upper layer consist of several stone flakes, one bifacial tool, as well as red burnished sherds with a light brown paste. In the second layer, plain and incised sherds with a light brown paste were found. The third layer contained only one very small red plain sherd that represents an intrusion from the upper layer. Apart from this sherd, no artefacts were recovered in the third layer. In total, 485 sherds (1120 g) were obtained from layer I and 125 sherds (1510 g) were obtained from layer II.

Shell remains were only found in Mare Kofu III. They consist of *Hippopus* sp., *Tridacna* sp., *Rhinoclavis* sp. and *Nerita* sp. The distribution of shell was not even throughout the test pit and gradually decreased from the surface toward the bottom, where only seven marine shells and one small obsidian flake were found. Shells from the same context as the incised pottery have been radiocarbon dated to 990±110 BP (ANU 9726). As red burnished sherds similar to the present Mare pottery were found only in the upper layer and on the surface, it can be inferred that the pottery with the light brown paste is older than the red burnished pottery which still dominates the tradition today.

THE PRODUCTION AND TRADE OF RECENT MARE POTTERY

Generally, recent Mare pottery (Figure 3) has been and still is formed by the paddle and anvil method, except for the slab-construction of *forno* (square or rectangular slotted sago-cooking griddles). There is a standardised manufacturing sequence. Potters prepare batches of up to 20-25 pots which progress at the same time through each manufacturing stage. The process is sequential. When the first step is finished they start the second step, and so forth, until the batch has passed through all stages and is completed. For instance, while one batch of partly finished pots is drying in the shade, work begins on another batch.

The formation of *forno* basically consists of forming a square base, followed by building up the walls of the *forno* slots. Unfinished *forno* are left to dry for one or two days before the potter adds the final walls. When the form is completed, it is then dried for two to four days before being decorated.

Decoration of pottery is done in two steps. First, the liquid red clay which will form the red slip is smeared over the pot surface with a cloth. Then, when the slip is dry a pattern of decoration is burnished on. The vessel then goes for firing. The varieties of pattern burnished decoration are illustrated in Figure 4.

When a designated number of pots have been produced they are traded by the potter's male relatives to one of three destinations: markets on Tidore and Ternate; villages on Halmahera and Morotai; and villages along the way to Sorong on the Bird's Head of Irian Jaya.

On their trading trips to village destinations, men barter pots for village products such as fruit and vegetables. They resell these products in other villages, while some commodities such as spices, shark fins, deer antlers, *Trochus* shells and mother of pearl are resold in Ternate, in order to maximise profits.

TECHNOLOGICAL ANALYSIS

Scanning Electron Microscopy (SEM) was used to investigate technological aspects of the pottery. This included paste characteristics such as the occurrences of voids and the nature of non-plastic inclusions, including sizes, densities and degrees of sorting (Hunt 1988; Kirch 1988; Orton *et al.* 1993).

Void analysis, along with temper analysis, enables the identification of the development of the technology of paste preparation and vessel formation. For instance, the presence of various-sized voids indicates that kneading was not intensive, whereas a limited number of fine voids indicates thorough kneading (Rye 1981:40). Thus, identifying voids is useful for identifying the standard of paste preparation, particularly the kneading process. The size of inclusions is also an important variable. A limited size range of inclusions is an indicator of more controlled selection or preparation of the material used as temper.

Chemical analysis was also performed on selected sherd samples in order to determine whether the ancient pottery found in archaeological contexts was also produced on Mare. Each sample to be analysed had its clay and temper components separated by a crushing and settling process. These samples were then analysed by the SEM for their

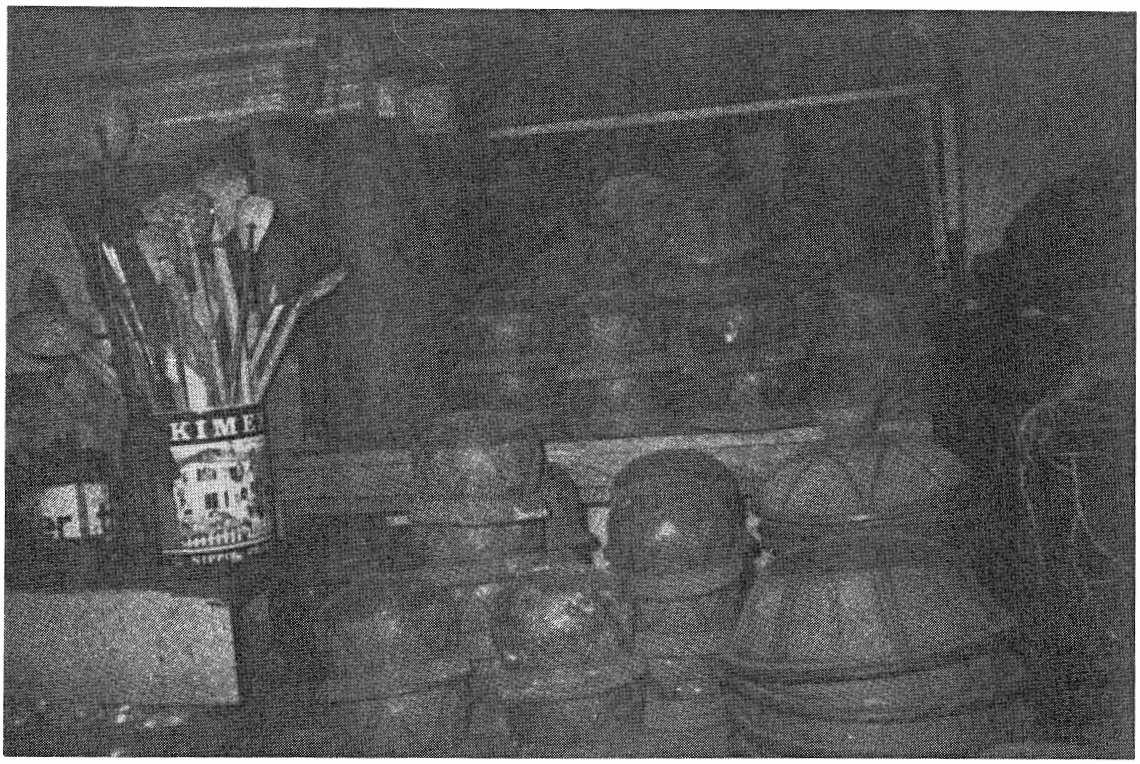

Figure 3: Mare red pattern-burnished pottery on sale in Ternate market.

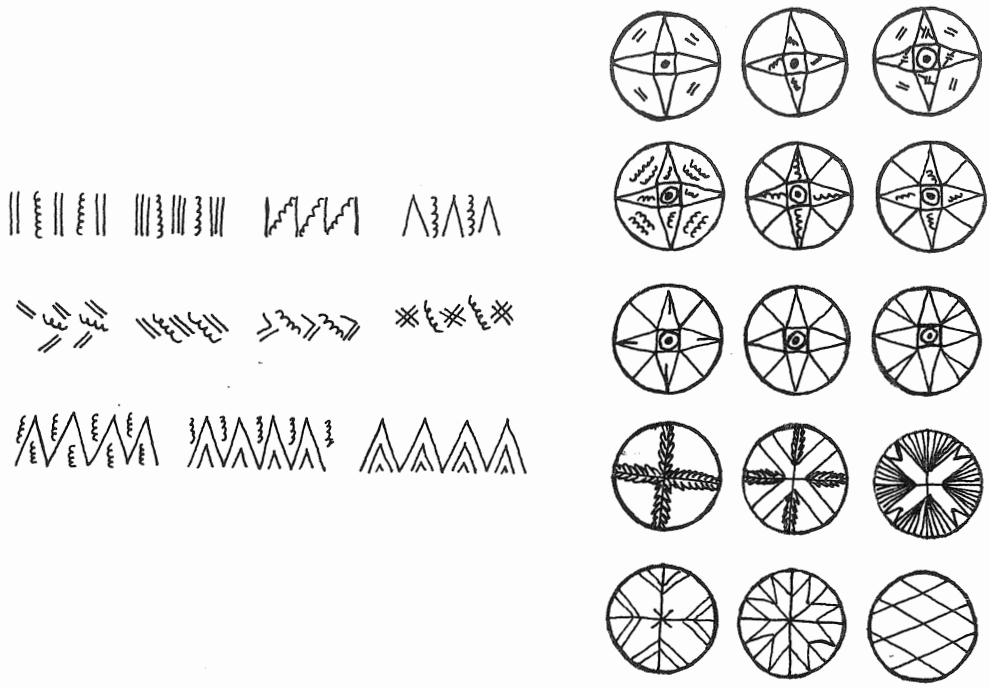

Figure 4: Designs on modern Mare red pattern-burnished pottery. Left: designs on the pot wall. Right: designs on exterior bases (upper three rows); designs on interior bases (lower two rows).

chemical compositions. The samples were analysed at x500 magnification, with a 100 second X-ray collection time (Graves *et al.* 1990). The results of the chemical composition analysis were then analysed using Principal Components Analysis (PCA).

RESULTS OF THE TECHNOLOGICAL ANALYSIS

The SEM paste analysis shows distinct differences between the ancient and modern Mare pottery traditions. For instance the structure of the ancient excavated pottery from Bukit Fato is very compact and lacks voids, while the recent pottery is very loose. The amount of temper added is important here. As seen under the microscope the percentage of inclusions in recent pottery ranges from 15 to 35%, while in the ancient pottery it is less, ranging from 5 to 15%. The addition of more temper in the younger red burnished pottery probably helps to reduce production time by speeding up the drying process. This red burnished ware is also well sorted with a more uniform grain size than the earlier incised pottery. Recent potters thus used a better sorting system in their paste preparation. As observed in the field, potters nowadays always sieve the sand temper before mixing it with clay.

In both ancient and recent Bukit Fato pottery, large voids are sometimes found together with smaller voids. The pattern of these voids has not been analysed statistically, but the void characteristics in both the incised and red burnished pottery traditions suggest that the degree of kneading has been more or less similar throughout.

Principal components results indicate that the following samples cluster quite closely on composition (details can be found in Mahirta 1996):

1. Both the Mare red burnished and the older incised pottery excavated from Bukit Fato;
2. Modern Mare red burnished ware and raw paste material from the island;
3. Red burnished ware from other sites in the Northern Moluccas.

The results suggest that the incised and the red burnished pottery styles excavated from Bukit Fato were made on Mare. The incised pottery from other Neolithic and Early Metal Phase sites in the Northern Moluccas (Uattamdi on Kayoa Island, Buwawansi and Um Kapat Papo on Gebe Island, and Tanjung Pinang on Morotai Island; see Bellwood *et al.* 1998) has different chemical composition and paste structure plus texture.

FORM ANALYSIS

In order to facilitate the comparison of vessel shapes produced today and in the past, Shepard's (1968) classification of circular vessel shapes is used as a guide. The primary focus of this classification is the vessel orifice and characteristic contour points. Because non-circular vessels also occur in the Moluccas, these forms are added as a separate type.

Both recent and ancient pottery traditions have a variety of forms: restricted and unrestricted vessels with simple contours; independent restricted vessels with composite contours such as carinations; and square vessels. Forms found only in the ancient pottery include both independent and dependent restricted vessels with composite contours, along with three types of square vessel and one half-circular pottery type (Figure 5). The latter is very similar to a type of pottery stove reported from Lombok (Elbert 1911: Tafel XIII:20).

When secondary attributes of form (handles, base shape and lip form) are considered, the variety inherent in the ancient Bukit Fato pottery is increased. Three types of pot handle are found in the excavated ancient Mare pottery assemblage. Only one of these still occurs in the modern assemblage, along with a new type of handle imitating the shape of an aluminium cooking pot handle. Ancient handles had complex shapes, such as the form of an animal head. By contrast, recent pottery handles have less complicated forms and require less preparation. They are also not as fragile as the ancient handles.

The lip forms of the ancient Mare pottery, especially the lips of simple unrestricted vessels, are also more varied than the modern forms (8 varieties). The square vessels have four varieties of lip form, compared with only three in the recent pottery tradition, while the independent restricted vessels of composite contour in the ancient pottery tradition have four varieties of lip compared to only one in the recent red burnished pottery. Thus, the modern pottery is more streamlined and mass-produced in technology and design than the ancient.

Modern Mare potters who make pottery for sale want to produce in large numbers in short time. On the other hand, they still have to consider the quality standards of their consumers. When these two variables are taken into account, those pot varieties which require complicated techniques with longer production times will tend to fade from the repertoire.

My ethnographic research on Mare supports Rice's (1987) proposition that standardisation does not necessarily lead to only one pot type eventually being produced. Mare pottery, which is made by many potters, is still made up of many different vessel types. Yet only two sizes are produced regardless of who makes them: small and large.

Comparing ancient and recent pottery in terms of the degree of standardisation of vessel thickness is not easy due to the small number of excavated ancient pots. There is also a tendency for both different vessel types and parts of a single vessel to have different thickness. The existence of

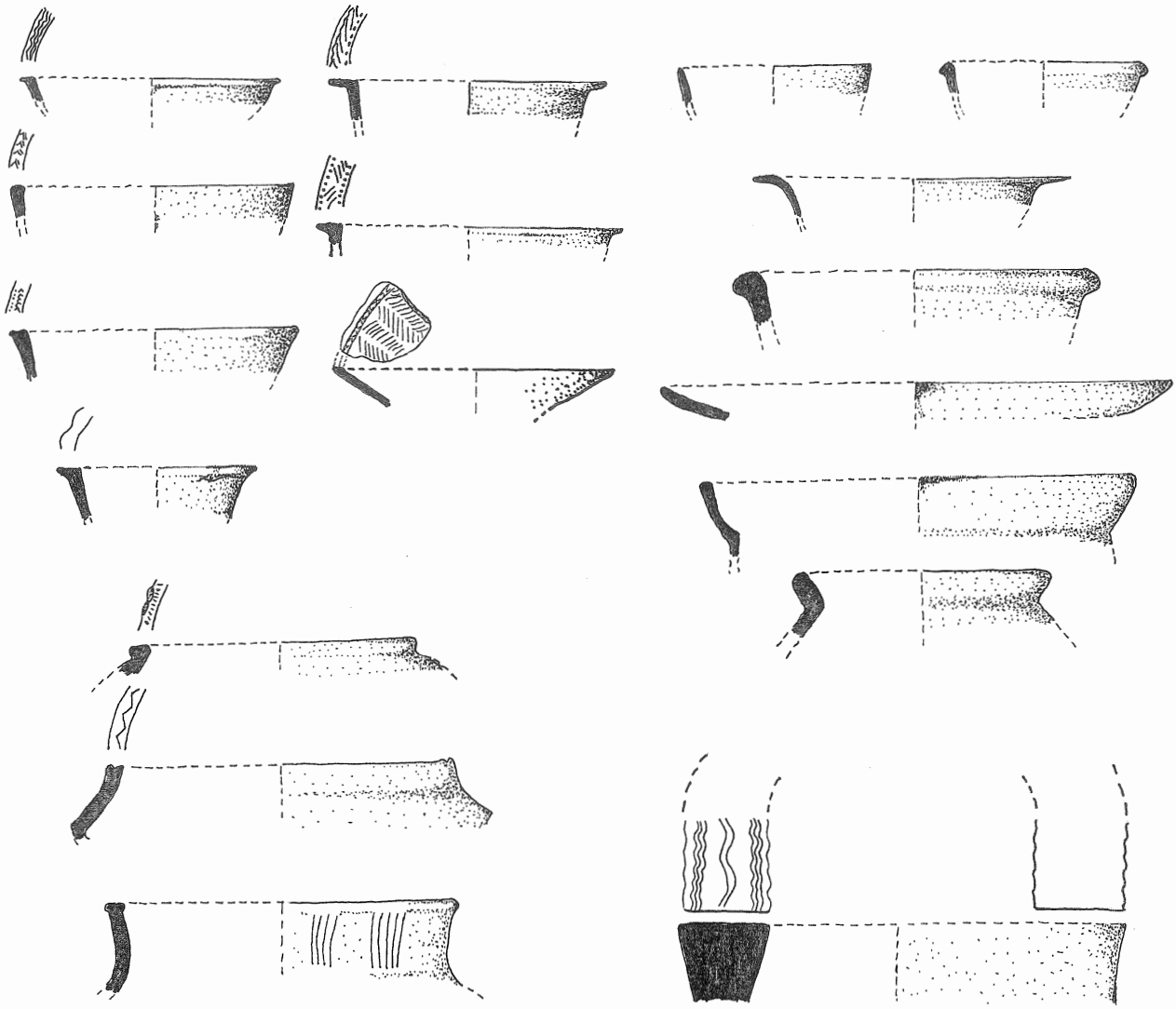

Figure 5: Ancient Mare incised pottery, plain or with incised decoration

many vessel types with different thickness occurs in both pottery traditions, so a much larger sample is needed for valid inference.

DESIGN ANALYSIS

The purpose of this analysis was to look at the development of decoration from the ancient pottery tradition to recent pottery on Mare, using a version of symmetry analysis (Shepard 1968; Hardin 1984:137). Because each design tradition has certain preferences for the types of symmetry that are used in decoration, any alteration from the usual pattern of symmetry can indicate a significant change in design tradition (Washburn 1983:13). Design structure may also change within one design tradition. There are many factors that may cause the design structure and layout to change. These changes in the formation of the design structure can be either gradual or substantive. Generally, substantive changes in design structure may indicate significant changes in cultural expression, which may result from borrowing from other cultures (Graves 1981). Gradual "linear" change over time in the design layout/structure is more likely to be caused by the internal dynamics of identity negotiation.

Graves (1981), working on Kalinga pottery production in Northern Luzon, Philippines, found that within one settlement there are differences in the application of design structure between younger and older potters. These differences, however, are very small in scale, such as adding a third band to the two bands normally painted on the pottery. The change in overall total production is gradual and occurs in a linear fashion. When the younger birth cohort of potters completely replaces the older potters, the

system of design is also replaced by the one chosen by the younger cohort. However, by then, the next generation is likely to be introducing further variations.

Unfortunately, no whole pots were excavated from Bukit Fato. Thus the design structure analysis is based on reconstruction from sherds. This is viable, as most pottery in Island Southeast Asia has repetitive patterns of geometric design that follow similar structuring principles – see the sample of pottery decoration from Sabah (Bellwood 1989) and the Talaud Islands (Bellwood 1980).

RESULTS OF THE DESIGN ANALYSIS

All of the recent red burnished pottery decoration is applied with a single technique; burnishing with a small pebble. Ancient pottery decoration was more complex, including punctation, incision, comb incision, cutting, pinching and appliqué, although incising and comb incision were the dominant techniques used.

Design elements on the ancient Mare pottery (Figure 6) consist of dots, short lines, small wavy lines, spiral and 'S' elements, which can be configured in horizontal, vertical or oblique directions. Horizontal and small wavy lines are used as zone markers that form band structures. Other elements are used to fill these bands. Dots may function as zone markers with a single line of dots, or can be used in bulk to fill spaces formed by the zone line markers. Other types of zone markers include double incised lines, three parallel wavy lines, and a band of raised clay with a triangular cross section.

Design elements on the recent red burnished pottery are fewer than those found on the ancient pottery. They consist only of coils and straight lines (Figure 3). These may be configured in horizontal, vertical, and oblique positions. When these design elements are not applied, as is common on large vessels, the body may be decorated with corrugation.

Generally the design structures of ancient pottery from Mare are arranged in bands, almost always with design elements placed between two zone markers. The preferred area for the design zone is a surface that is relatively flat and easily visible, as on the top of a flat lip or on the body/ shoulder of a vessel. When the position of the upper lip is not horizontal, the decoration is placed on the inside rim wall, as often found on cooking vessels.

The types of symmetry often applied on the ancient incised pottery include bilateral translation (vertical or horizontal reflection), a combination of horizontal and slide reflection, and rotation of 180°. Finite or radial symmetry is not found. One pot may have more than one decoration band, and each band may be decorated with similar or different motifs applied with different types of symmetry.

The recent and modern large red burnished pots that do not have ceremonial uses are not decorated, while all small pots including the square *forno* are decorated with pattern burnish. Compared with ancient pottery, the decoration on the red burnished pottery is larger in size and the distance between design elements is wider. The decoration looks full, not only because each element is drawn larger, but also because almost all the space is used as a decoration field, including the inside and outside of the base of the pot. Bases all remain undecorated on the ancient pottery. Filling the entire surface with decoration may also have a marketing purpose owing to the more visible and dramatic effect, thus attracting attention. This is important for commodity pottery. There also may be a practical explanation for the large scale of burnished decoration in the recent and modern pottery; it is difficult to produce tiny elements using the burnishing technique. Another difference in pottery decoration is that on the recent Mare burnished pottery, two design elements (coiled and straight lines) are often applied alternately to produce a band motif on the pot wall. However, some of the young potters often eliminate the coiled element, suggesting that change is still occurring with in the system (Mare potters refer to this design element as *hum).*

Ancient Mare potters only used one kind of design element to fill each band. A different element was used in each band when a pot had more than one band of decoration. Radial symmetry, commonly applied in the modern and recent Mare red burnished pottery, used for decorating a

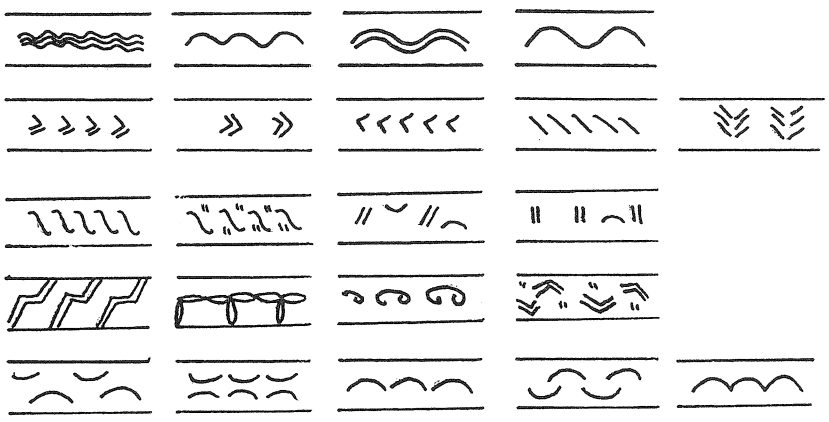

Figure 6: Incised decoration motifs on ancient Northern Moluccan incised pottery. Top three rows: motifs shared by more than two sites. Lower two rows: motifs occurring in only one site.

circular area, does not appear on the ancient incised Mare pottery from Bukit Fato. This suggests that radial symmetry was introduced together with, or after, the burnishing technique.

Some similarities in the types of symmetry used in both pottery traditions suggest that the modern pottery is to some degree a continuation of the ancient pottery tradition. At some time in the past though, Mare potters adopted a new technique of decoration focused on extensive pattern-burnishing, possibly from outside Mare, which affected the design configuration. Some types of symmetry were still maintained but a new type of symmetry focused on circular decoration areas was added.

POSSIBLE SOURCES OF THE CHANGE IN THE MARE POTTERY STYLE

It is difficult to determine from where the Mare potters obtained the pattern burnishing technique. The first possibility is to consider that there may have been contact with people who already had such a tradition. Contact between people in the Northern Moluccas Islands certainly did exist in the form of resource exchange. The flourishing spice trade also caused the Northern Moluccas to be visited by traders from China, Portugal and other parts of Southeast Asia. The latter included Javanese, Bugis, Sulu and Philippine peoples who had burnished pottery traditions in the main period of trade contact, between the 13th and 18th centuries.

According to 17th and 18th century Dutch sources (Andaya 1993), a village on Halmahera called Bobane produced pottery finer than Mare ware. Unfortunately, no ethnographic or archaeological research has been undertaken at Bobane so the possibility that the burnishing technique was originally developed here cannot be confirmed.

Several burnished pots were found by W.G. Solheim II at the site of Kumo-kumo on a small offshore island near Tobelo in northern Halmahera (collections in Sultan Palace Museum, Ternate). The Kumo-kumo assemblage is not dated, but most of the Kumo-kumo pottery is incised and the absence of imported ceramics in the site suggests a date older than the thirteenth century. No other site in the Northern Moluccas has yet produced evidence for a red burnished pottery tradition.

Certainly, burnished pottery is common in Javanese sites dating to the 14th century (Miksic 1984:167). Burnished pottery is also found in some South Sulawesi sites. However, the burnished pottery from Java and South Sulawesi is not pattern burnished. Another possible source of influence is the Philippines, where patterned burnished pottery occurs from around the 16th to 18th centuries. Sites at Kay Thomas and Santa Ana in Manila have produced burnished ceramics, as well as sites throughout Laguna Province, Northern Luzon. Here, however, the pattern burnish is not applied over a red slip (Main and Fox 1982:114).

Although it is possible that Mare potters borrowed the burnishing technique from one of these sources, there may be another influence that inspired Mare potters to produce burnished patterns on pottery surfaces. Foreign ceramics were being traded widely in the region by late prehistoric times, when Ternate, Makian and Bacan were important trade centres (Meilink-Roelofsz 1962; Lapian 1984). Among the imported materials are ceramics from China, Thailand, Vietnam, and, after the 16th century, Portugal (Adhyatma 1981). The latter arrived either directly or via other trading centres in Java and Sulawesi.

It seems that the Mare pattern burnished pottery might also have been inspired by the contrast of colours in foreign ceramic decoration. If this suggestion is right, the Mare potters adopted the design structure of these foreign ceramics and simplified the design elements as well as including their own. Simple design elements such as the three vertical lines that form decorative panels are copied, but more complicated elements such as leaves and flowers are simplified, leaving only triangular and coiled forms.

THE MARE POTTERY TRADITION IN THE NORTHERN MOLUCCAS CONTEXT

Comparisons with pottery found in other northern Moluccas sites suggests that the development of the more ancient incised Mare pottery was part of a wider incised pottery tradition that spread throughout the area over a long period of time. Yet, despite its longevity, this tradition has everywhere a similar design construction. Examples of incised pottery designs from the northern Moluccas are shown in Figure 6.

Radiocarbon dating indicates that the Mare assemblage from Bukit Fato is one of the youngest of the identified incised pottery traditions in the Northern Moluccas. The earliest date for this tradition comes from Buwawansi on Gebe Island, at 3160±60 BP (ANU 9770). A cave site on Gebe, Um Kapat Papo, also has incised pottery dated to 2030±60 BP (ANU 9316). Incised pottery also reached Morotai Island where it is found in the Tanjung Pinang shelter dating to 2090±180 BP (ANU 8439) (Bellwood 1995; Bellwood *et al.* 1998). Undated incised pottery is also found at the site of Pulau Kumo-kumo, excavated by Solheim in 1991.

According to oral history on Tidore, the island of Mare (as a vassal of Tidore) specialised in pottery making for the Tidore Sultanate in the 16th century (Departmen Pendidikan dan Kebudayaan 1981). From Dutch archives, it is also known that pottery was traded during the 17th and 18th centuries in the Northern Moluccas. This pottery was produced in at least two villages: Bobane (on Halmahera)

and on Mare. There is evidence also that red burnished pottery found in areas under the influence of the Tidore Sultanate in the northern Moluccas arrived as a result of trade or exchange. Analysis of pottery paste structure and texture plus chemistry shows that red burnished sherds found on the surfaces of sites on Kayoa, Makian, central Halmahera and Gebe have characteristics found also in recent Mare red burnished pottery. In contrast, the Bukit Fato incised pottery paste characteristics are never found in the other north Moluccan sites. This suggests that a wider scale of pottery trade existed in the northern Moluccas after the pattern burnishing technique was introduced.

CONCLUSION

The modern Mare red burnished pottery tradition developed from an older incised pottery tradition. The changes in pottery style could have been influenced by the spice trade in which exchanges of ideas and material culture became more pronounced. Mare potters seem to have borrowed traits from different sources, and moulded them to fit their own distinctive technique and style which suited their tradition and purpose. Over time, Mare men became the only pot traders in the Northern Moluccas after other villages ceased pot production. The widespread pottery trade within the Northern Moluccas probably only started recently, after burnished pottery was introduced into the area. Prior to this, each village produced its own incised pottery.

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REFERENCES

Adhyatman, S. 1981. *Antique Ceramics Found in Indonesia.* Jakarta: Jayakarta Agung Offset.

Andaya, L.Y. 1993. *The World of Maluku: Eastern Indonesia in the Early Modern Period.* Honolulu: University of Hawaii Press.

Bellwood, P. 1980. The Buidane Culture of the Talaud Islands. *Bulletin of the Indo-Pacific Prehistory Association* 2:69-127.

Bellwood, P. 1989. Archaeological investigation at Bukit Tengkorak and Sagarong, Southeastern Sabah. *Bulletin of the Indo-Pacific Prehistory Association* 9:122-69.

Bellwood, P. 1995. Archaeology research in the Northern Moluccas 1991-1994, a preliminary report. *Southeast Asian Archaeology International Newsletter* No.7:3-12.

Bellwood, P.G. Nitihaminoto, G. Irwin, Gunadi, A.Waluyo, D. Tanudirjo. 1998. 35,000 years of prehistory in the northern Moluccas. In Gert-Jan Bartstra (ed.), *Bird's Head Approaches, Irian Jaya Studies - A Programme for interdisciplinary research*, pp. 233-75. Rotterdam: AA Balkema (MQRSEA 15).

Corney, B. (ed.). 1855. *The voyage of Sir Henry Middleton to Bantam and the Maluco islands: being the second voyage set forth by the governor and company of merchants of London trading to the East-Indies 1604.* London: Hakluyt Society, No. 19.

Departemen Pendidikan dan Kebudayaan. 1981. *Gerabah Lokal Siwa Lima.* Ambon: Museum Siwa Lima.

Elbert, J. 1911. *Die Sunda-Expedition des Vereins für Geographie und Statistik zu Frankfurt-am-Main.* Band I. Frankfurt-am-Main: Minjon.

Graves, M. 1981. Ethnoarchaeology of Kalinga Ceramic Design. PhD dissertation, Department of Anthropology, University of Arizona, Tucson.

Graves, M., T.L.Hunt and D. Moore. 1990. Ceramic production in the Mariana islands: explaining change and diversity in prehistoric interaction and exchange. *Asian Perspectives* 29:211-34.

Great Britain Naval Intelligence Division. 1920. *A Manual of Netherlands India* (Dutch East Indies), compiled by the Geographical Section of the Naval Intelligence Division. London: HMSO.

Hardin, M. 1984. Models of decoration. In S.E. van der Leeuw and A.C. Pritchard (eds), *The Many Dimension of Pottery,* pp. 573-614. The Netherlands: Universiteit van Amsterdam.

Hieriej, W. 1984. *Teknologi Pembuatan Gerabah di Maluku.* Skripsi sarjana.Yogyakarta: Universitas Gadjah Mada.

Hunt, T.L. 1988. Lapita ceramic technology and compositional studies: A critical review. In P. V Kirch and T.L. Hunt (eds), *Archaeology of the Lapita Cultural Complex: A Critical Review*, pp. 49-59. Seattle: Burke Museum, *Thomas Burke Memorial Washington State Museum Research Report* No.5.

Kirch, P.V. 1988. *Niuatoputapu.* Seattle: Burke Museum. *Thomas Burke Memorial Washington State Museum* Monograph No. 5.

Lapian, A.B. 1984. Country Report of Indonesia. In *SPAFA Consultative Workshop on Research on Maritime Shipping and Trade Networks in Southeast Asia,* pp. 71-80. Bangkok: SPAFA.

Mahirta. 1996. The Development of Mare Pottery in the Northern Moluccas Context and its Recent Trading Network. MA dissertation, The Australian National University, Canberra.

Main, D. and R. Fox. 1982. *The Catalagan Earthernwares.* Manila: National Museum.

Meilink-Roelofsz, M.A.P. 1962. *Asian Trade and European Influence in the Indonesian Archipelago between 1500 and about 1630.* Netherlands: The Hague Martinus Nijhoff.

Miksic, J.N. 1984. Preliminary Excavation at Fort Canning, Singapore. In *SPAFA Consultative Workshop on Research on Maritime Shipping and Trade Network in Southeast Asia,* pp. 161-70. Bangkok: SPAFA.

Orton, C., P. Tyers and A. Vince. 1993. *Pottery in Archaeology.* Cambridge: Cambridge University Press.

Rice, P.M. 1987. *Pottery Analysis, A Source Book*. Chicago: The University of Chicago Press.

Rye, O. S. 1981. *Pottery Technology: Principle and Reconstruction*. Washington: Taracum Inc.

Shepard, A.O. 1968. *Ceramics for the Archaeologist*. Washington: Carnegie Institution.

Washburn, D.K. 1983. Symmetry analysis of ceramic design: two tests of the method on Neolithic material from Greece and the Aegean. In D. K. Washburn (ed.), *Structure and Cognition in Art*, pp.138-64. Cambridge: Cambridge University Press.