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The Beginnings of Pottery Production in the Southern Levant: Technological and Social Aspects

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Introduction

The inception of pottery production in the Near East is usually associated with the so-called Neolithic Revolution, and is related to the beginnings of settled life and the development of craft specialization. It is widely accepted that ceramics, when adopted, are associated predominantly with household activities, such as cooking and storage. The development of pottery production is usually designated as a unilinear trend, beginning with domestic fashioning of simply-shaped vessels, and going on to a well-established, full-scale specialism (Rice 1981). In the course of this process, some inventions are adopted, such as the potter's wheel and the pottery kiln. The latter are usually regarded as characteristics of full-time specialism, though several studies have demonstrated that this formula is not so clear-cut (e.g., Nicklin 1971). Since commercial craftsmen are driven mainly by market demands, they tend to produce more products per time-unit, involving better technologies and raw materials for this purpose (Nicklin 1971: 17–24, Arnold 1985: 127–167). Thus, the decreasing amount of time spent on each individual vessel should be considered as an improvement in the methods of pottery production. This model seems to be accepted elsewhere (e.g., Rice 1981, 1984, 1987: 10–12; Feinman et al. 1984; Arnold 1985).

These aspects being of a technological rather than typological nature, were considered to be criteria for the potter's skill and knowledge in producing functional and durable artifacts. Nevertheless, in many cases, pottery serves as a symbolic or artistic item. As Rice (1984: 252) points out, it is sometimes difficult to distinguish between genuine functional and symbolic or aesthetic categorizations since pottery may represent a combination of these. On the other hand, when used for a very specific purpose, with clear social implications (such as ranking expression or cult), pottery may be classed as "socially oriented." In these cases the craftsman's skill may be expressed

more in shaping and decorating, and the time spent on each individual vessel may increase (Rice 1984: 251–252). In both cases, a combination of typological and technological studies may assist in determining the vessel's function.

The technologies heralding pottery production in the Levant were originally associated with the production of plaster for architectural use and "*art mobilier*" objects in the Pre-Pottery Neolithic period (8th–7th millennium B.C.E.). Plaster products first appear in the southern Levant inventory of finds as early as the Pre-Pottery Neolithic A (PPNA, late 9th-early 8th millennium B.C.E.) and perhaps even earlier in Natufian contexts (Kingery et al. 1988). In many instances, burnt lime was used in making floors and movable artifacts, together with fired mud and clay. The pertinent technologies entailed the use of bonfires or kilns, and raw materials of flexible nature — all highly relevant to ceramic production (Frierman 1971; Gourdin and Kingery 1975, Aurenche and Maréchal 1985, Kingery, et al. 1988). Such products were first employed in building contexts, e.g. floor plastering or paving of installations. In the Pre-Pottery Neolithic B (PPNB, late 8th and 7th millennium B.C.E.) they became very common as floor covering and were also used for plastering skulls and for producing small quantities of vessels such as bowls and basins. The latter became more common toward the end of the 7th and during the 6th millennia B.C.E. in what had been termed "white ware" or "*vaisselle blanche.*" In this context it represents a developing stage in which lime plaster technology is oriented towards the production of vessels (Balfet et al. 1969; de Contenson and Courtois 1979; le Miere 1983; Maréchal 1984; Perinet and Courtois 1983).

During the last two decades, considerable interest has been expressed in the development of lime and lime plaster products in the protohistorical periods of the Near East, particularly the Pre-Pottery Neolithic B (PPNB). Traces of massive plaster production were found at numerous sites, the best known of which include Jericho, Tell Ramad, Mureybet, El Kowm, ʿAin Ghazal, Abu Hureyra, Bouqras and Catal Hüyük (Mellaart 1967; de Contenson 1967, 1969; Dornemann 1969; Moore 1975; Akkermans et al. 1981; Rollefson and Simmons 1986, 1988; Kafafi 1986). These occurrences of lime products have raised questions concerning the methods by which they were produced, their role in the development of craft specialization and their social and economic implications (e.g., Garfinkel 1987).

As a result of the growing interest in this subject, a number of articles have appeared that postulate various methods of Neolithic lime production (Frierman 1971; Gourdin and Kingery 1975, Aurenche and Maréchal 1985, Kingery et al. 1988). The discovery of lime vessels demonstrated a close relationship between PPNB plaster production and later pottery firing methods. A development of the latter from the former was suggested (Balfet et al. 1969; de Contenson and Courtois 1979; le Miere 1983; Maréchal 1984; Perinet and Courtois 1983). The tendency to consider lime plaster manufacture as a complicated, laborious process influenced the interpretations of some archaeologists concerning the socioeconomic development of Pre-Pottery Neolithic societies (Frierman 1971; Garfinkel 1987). The development of modern analytical techniques and instruments, such as the scanning electron microscope

(SEM), X-ray diffraction (XRD), and the electron microprobe, has stimulated some scholars to use sophisticated equipment in the study of early lime plaster technology (Gourdin and Kingery 1975, Kingery et al. 1988). Since both limestone and lime plaster are composed mainly of calcium carbonate ($CaCO_3$), the effectiveness of chemical analysis to distinguish between the two is low. However, since the newly-formed calcium carbonate crystals are much smaller than the ones usually found in limestone or chalk, the differentiation between the two is possible with the aid of an optical (petrographic) microscope.

We are currently engaged in a research project aimed at providing a better understanding of early pyrotechnology as a possible precursor of late Neolithic and Chalcolithic pottery. For this purpose, samples from some of the more important archaeological sites in Israel, including lime products from the PPNB and smaller samples from both earlier and later periods, are being examined. The samples include plastered floors, plastered walls, "white ware", bricks, plaster beads and figurines, as well as pottery assemblages from Neolithic sites. For the reasons discussed above, our results are based primarily on observations of petrographic thin sections using a polarizing optical microscope. Already in the preliminary stages of our work, it became clear that in many cases our results differed significantly from those of Kingery and his colleagues (Gourdin and Kingery 1975, Kingery et al. 1988). Neolithic lime plaster production has been commonly interpreted as reflecting the complexity of Neolithic society. This issue, in our opinion, merits greater emphasis at this time than the study of technological aspects.

Method

All analyzed samples were taken from archaeological sites in Israel. Due to current geopolitical realities, it was not possible to obtain samples from Syrian, Jordanian and Lebanese sites such as Tell Ramad, Bouqras, ʿAin Ghazal, Beidha and Abu Hureyra. Thus, although our results are limited in geographical scope, we are reasonably convinced that similar results can be obtained from artifacts in adjoining regions.

In sampling, we tried to cover a wide range of architectural and non-architectural artifacts from sites ranging from the Pre-Pottery Neolithic A to the Pottery Neolithic cultures (9th–5th millennia B.C.E.). The samples were first examined under a binocular microscope, using magnifications of ×10 to ×40. Petrographic thin sections were then prepared from samples that were impregnated and hardened by polyester resin under vacuum. Large samples (e.g., plastered floors, bricks, etc.) were cut perpendicular to their surface for the preparation of large-size thin sections (7.5 × 5 cm.). Standard-size thin sections (4.5 × 3 cm.) were prepared from smaller samples. The thin sections were examined under a petrographic polarizing microscope at magnifications of ×40, ×100, ×250 and ×400. In some cases alizarin-red stain was used for highlighting non-carbonate components, such as clays.

Results

Our examinations of the Neolithic plaster products revealed that high intrasite and intersite variability existed in the methods of Pre-Pottery Neolithic plaster production. In most instances, similar products were produced differently at each site, and sometimes even within the same site. In most cases, the use of burnt lime was minimal or even absent. This was evident in the presence of numerous microfossils in many of the products, including plastered floors and walls, indicating that the original raw material was never burnt and converted into lime, or at least that the burning process did not reach the temperature needed for decalcination. In some cases, a mixture of marl and small-sized stones together with clay was used in order to form a solid floor or wall pavement, whereas other samples were made of clay with the addition of some burnt lime. Where burnt lime was used in the mixture, it barely exceeded 30 percent of the matrix, while other materials, such as clay, animal manure, marl or soil, were added in larger amounts.

Technological examinations of ceramic vessels of the earliest pottery-using cultures in Israel, namely the Yarmukian and "Jericho IX" entities, point to a clear continuity with earlier PPNB mud and plaster products. A clear dichotomy is pronounced between decorated and undecorated wares, since the former are usually distinguished by the use of highly carbonatic pastes. These materials often contain marl or even burnt lime, though technically and practically inferior to the more accessible clays or soils. On the other hand, undecorated wares are characterized by the use of soils and a greater variety of tempering materials, belying their modification for cooking or storage uses. It may be concluded that in the case of the decorated wares, a white-shaded product was desired rather than a practical vessel. Stylistic analyses of these ceramics show that much time was invested in decorating the vessels. Each individual vessel was treated with both incising and painting (in Yarmukian assemblages), or slipping, painting and burnishing (in "Jericho IX" assemblages). This trend continues, with some modifications, to the mid–5th millennium B.C.E. Wadi Raba culture.

In Wadi Raba contexts, decorated wares continue to be produced of highly carbonatic pastes, providing very bright pottery. Decoration techniques become more sophisticated, yet treatment is less individual. In this case, well-levigated clay, with some content of ferrous oxides, was slipped over the entire "leather-hard" vessel to form a thin film of extremely fine-grained matter. When fired in oxidizing or reducing atmospheres, the iron contents would convert into magnetite or hematite, providing a black or reddish shade. This provides evidence that a pottery kiln was used for producing this decoration style, because the complete control over firing atmospheres cannot be achieved in bonfires. It consequently represents a developmental stage in terms of ceramic technology, yet it decreases the artistic investment "value" of each individual vessel. This technique is well established also in the Halafian assemblages of the Syro-Lebanese horizon (Noll et al. 1975).

Discussion

A primary result of the present study is the demonstration of pronounced variability in production methods of Neolithic wall and floor plasters and smaller objects such as "white ware," beads and figurines, even in a very limited geographical region such as the southern Levant. Technically, these data do not support the view of Pre-Pottery Neolithic society as one characterized by "social interchange and communication over wide regions... fostered by the movement or relocation of skilled craftsmen" (Kingery et al. 1988: 238). In our opinion, Neolithic craft specialization, at least in the case of plaster production, must be considered as rudimentary and by no means a full-time activity. As Blackman (1982: 112) points out, small-scale lime burning is of necessity a summer activity, since rains may cause severe problems in burning and storage of the product. Since calcined and slaked lime must be kept at reasonably low humidity to avoid spoilage, storage problems probably dictated the use of the lime in the same season that it was produced. Thus, scheduling considerations made it a part-time summer activity only. Furthermore, since only a low proportion of burnt lime was detected by us in most of the architectural samples, we are convinced that lime burning was a casual, limited activity which did not require the burning of tons of wood, dung or other type of fuel (in opposition to the interpretations of Garfinkel 1987; Kingery et al. 1988). This low-scale manufacturing activity did not require much labor, since pits and a low-quality fuel (e.g. animal dung, peat or brush wood) were sufficient for this purpose.

The limited geographical region of the study mitigates possible natural causes, such as availability of resources or climate, as an explanation for the high intersite variability in plaster producing technology. The explanation for this variability may therefore be sought in social and economic spheres. Thus, while at some sites very high-quality plasters occur, in others the quality is surprisingly crude. As has been recorded from Arab villages in the Levant, in cases where expensive lime is unaffordable, small amounts of lime are frequently mixed with mud plasters (Canaan 1933: 22; Blackman 1982: 111). The same practice seems to occur in the Neolithic of Israel. The intersite variability may be an expression to some degree of social, economic and functional differences. On the other hand, since most of the "*art mobilier*" (the non-architectural products) are composed of relatively high proportions of burnt lime, we concur with Blackman's (1982) comment that "the skills required to produce lime plaster bowls and those required in the construction of buildings are obviously quite different in nature. It seems likely that the connection between these two activities did not extend beyond the use of the same starting material." In our opinion, while architectural plasters are basically functional in nature, products such as plaster vessels, beads and figurines were probably more closely associated with decorative or ritual use. The similarities of the technical processes used to manufacture these items and some early forms of pottery raise the possibility that, in many cases, early pottery vessels may have served similar functions.

In some earlier summaries on the beginnings of pottery production in the Levant,

scholars such as Amiran (1965) and Kenyon (1969: 62–65) assigned the development of pottery production to a purely functional process, relating mainly to the improvement of the technological properties of the vessel. In their view, Neolithic pottery reflects an innovation in man's cooking and storing methods, and therefore must be evaluated on economic rather than artistic grounds. Against this background, the introduction of a well-established ceramic tradition in the mid–6th millennium B.C.E. in the southern Levant (the Yarmukian culture), was sometimes explained as a result of movement of people (Amiran 1965: 243–247;). This idea stems from the concept, that the earliest pottery to be found in this region was not "primitive" enough in form and decoration, as was the first pottery in other regions, such as Jarmo (Amiran 1965: 243–244). Therefore, these complexes were regarded as inventions diffused from other areas.

The technological and typological analyses of the pottery in question show that this model is oversimplified. The data presented here illustrate that the limited repertoire of lime vessels was augmented by a richer variety of shapes and decorative techniques with the increased use of mud-clay materials. The raw materials of the decorated pottery wares indicate that selection is directed more for the desired shade of the vessel than its technological quality. In later stages (late 5th–4th millennium B.C.E.) a higher standardization of shapes and decorative elements is developed. Only in the 4th-early 3rd millennium B.C.E. the use of selected raw materials intended for specific vessel types is developed and vessels are more functionally oriented. Thus, while the investment in material selection improves through time in terms of the vessel's performance in daily use, the decorative investment decreases concurrently. As opposed to the view of a unilinear trend of ceramic technology, stimulated only by functional improvements, we propose another possible model. This model is related solely to Israel, yet we assume that further research may lead to similar results in other parts of the ancient Near East. Some similarities from other regions, such as Greece (Vitelli 1989), hint at a broader distribution of this practice. According to this model, two regulating mechanisms act simultaneously in the process of ceramic production: one is driven by utilitarian needs such as cooking, storing, etc., whereas the other is affected by non-utilitarian factors. The former sees pottery mainly as functional, whereas the latter categorizes ceramic vessels as intended for consolidation of the social status of members of the society. It would appear that the emergence of pottery in 6th-millennium B.C.E. sites in Israel originated in PPNB traditions of skull plastering, bead and figurine fashioning and other related activities. In this context, "*vaisselle blanche*" and later decorated wares may be regarded as decorative or ritually oriented artifacts, rather than ones intended for daily use.

In the early pottery assemblages of the southern Levant (mid–6th millennium B.C.E.), an element of lime or lime-like materials continued to be used for the production of decorated wares in which time investment and raw materials selection were intended for decorative purposes alongside the mud-clay materials. Later, a bimodal trend of coexisting technologies for production of either lime-marl or mud-clay raw materials is discerned. The use of both lime and marl as raw materials for

architecture, and "*art mobilier*" items declines in time. Concurrently, the relative volume of mud-clay products increases to become the common medium both for the simple utilitarian household products, as well as the formal (social-symbolic) products. Time consumption for producing vessels goes through a conspicuous change from emphasized investment in decorative features and minimal investment in material to a greater investment in functional properties of the vessel, such as impact and thermal shock resistance and lower time consumption on each individual vessel. We may conclude that this is related to the introduction of other exotic raw materials, such as copper and ivory, which replace pottery as the main material utilized for the creation of elite items.

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