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CERAMIC TECHNOLOGY AT PREHISTORIC BAN CHIANG, THAILAND: FABRICATION METHODS

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Introduction

The previous paper concentrated on the physiochemical aspects of the clays and paints used in the production of certain groups of Ban Chiang ceramics spanning the time period *circa* 2500 B.C.-A.D. 200 (McGovern *et al.,* this issue). To understand the fabrication methods employed in that same artifact corpus, however, requires another scientific methodology, specifically a combination of macroscopic surface examination and xeroradiography of individual vessels. This methodology has already proven very effective in application to Late Bronze/Early Iron Age wares from the Baq'ah Valley in Jordan (Glanzman 1983), where the potting techniques of wheel-throwing and coil-building were distinguished. In this paper we show that it is equally feasible to distinguish what are known as the *coil-and-slab* and the *lump-and-slab* methods, and that they were the central elements of the prehistoric Ban Chiang repertoire. Additionally, our data indicate that both these methods, with variations, lent themselves well to the making of a visually diverse set of vessel shapes.

Fabrication methods

Neither of the two methods of vessel building identified in our corpus is used by potters in the Ban Chiang region today: the modern method involves the production of the entire vessel form from a single lump of clay (Plate 1). However, common to the ancient and the modern pottery is the use of the paddle-and-anvil technique of vessel shaping.

The successive steps in the coil-and-slab method are presented schematically in Fig. 1. First, a rolled clay coil is attached to a flattened, roughly circular slab of clay. Then a second coil is placed on top and worked in some way so that it binds to the coil beneath. Each additional coil gradually raises the upper part of the vessel towards a desired height. The lower and the upper parts of the vessel are each given appropriate

Plate 1:
Woman in the modern village of Ban Kham Oo, shaping a globular vessel with a paddle and an anvil.
(Photograph: Courtesy of Joyce White, Asian Section, The University Museum.)

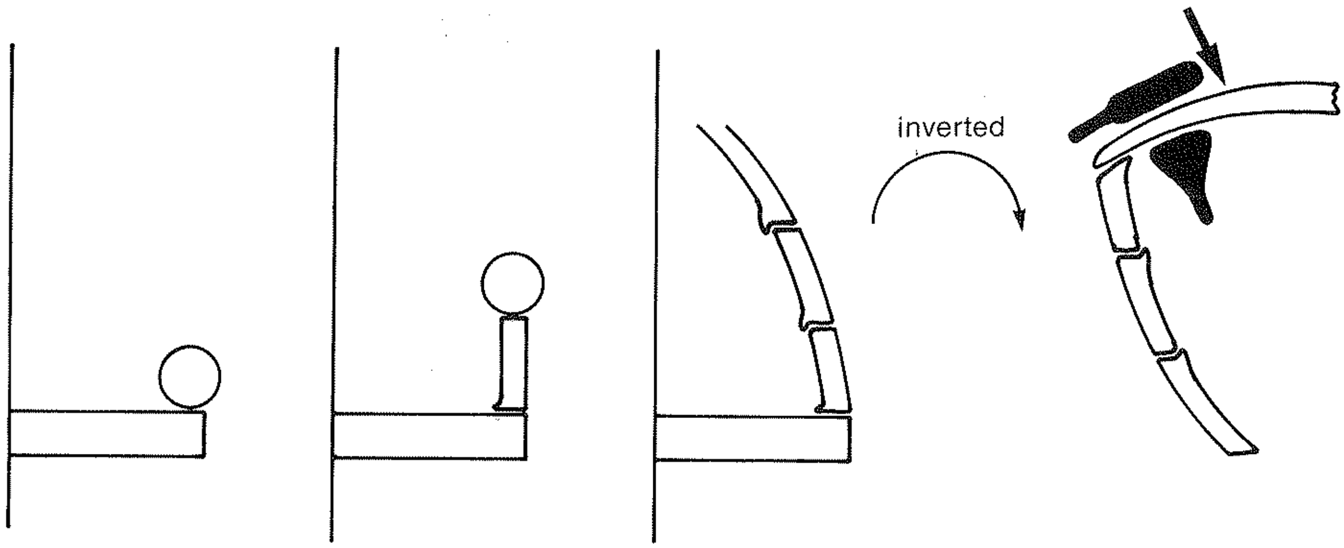


Fig. 1:
The coil-and slab construction method.

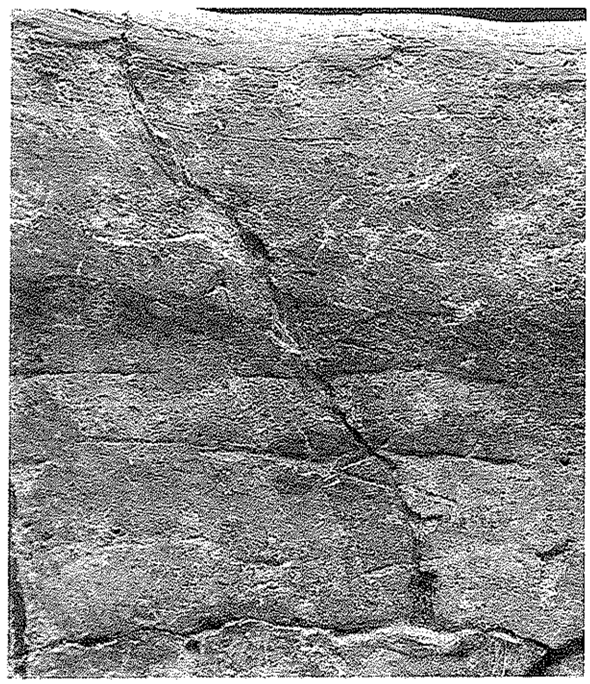


Plate 2:
Interior detail of vessel BC-44 (from phase EP IV), showing how the horizontal coil-joins are partially "welded" together.

Plate 3:
Xeroradiograph of vessel BC-44 (see Plate 2), in which all the laminar flows of air voids associated with coil-joins are clearly defined (arrowed).
Measurement conditions: 50kV, 400 milliamp.sec, 1.02 meter focal distance.

curvature by the potter placing an anvil against its interior, and rotating the entire vessel slowly while he rhythmically beats the outside with a paddle.

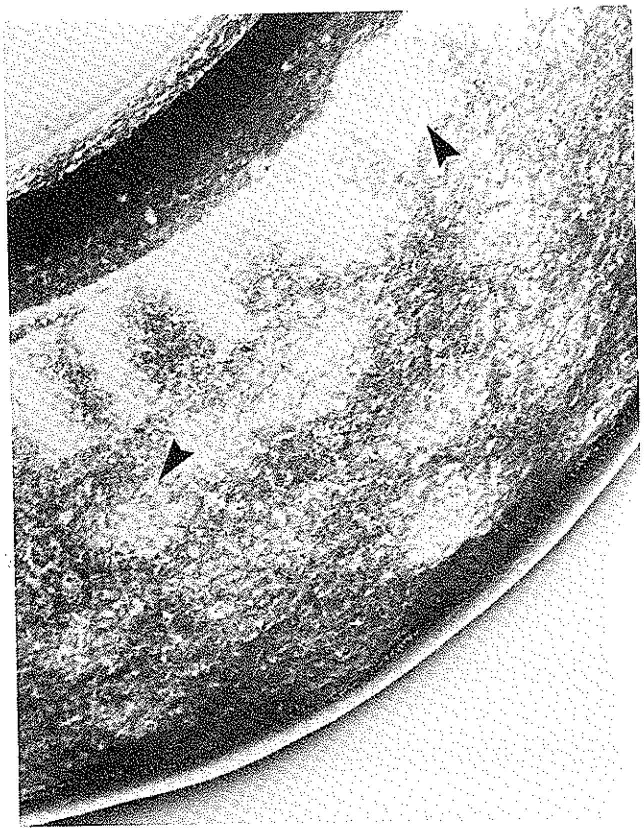
If either of the vessels' surfaces had not been worked further, we would have expected to see some traces of the parallel grooves or "welding" marks as superficial signs of the joined coils. These marks are found on some interior surfaces (Plate 2), but the Ban Chiang potters invariably carried out enough treatment of the exterior surfaces (wet-smoothing, and/or decoration with cord mark impressions) to obliterate all macroscopic features of this manufacturing process.

The xeroradiographic image of the coil-building process detects the presence of horizontal, laminar flows of air voids which are the pockets of air trapped when the coils were joined together (Plate 3). They are clear even where all surface signs of coil-joining were smoothed away.

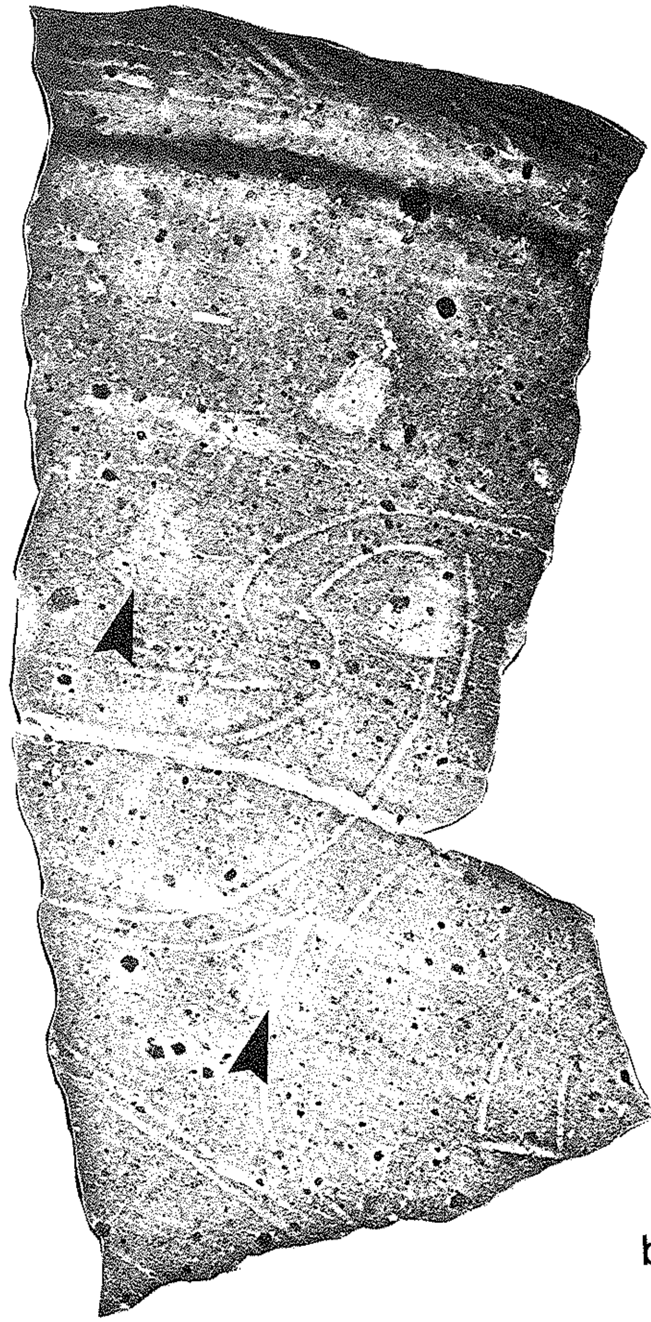
The use of an anvil during surface paddling, though obvious as circular indentations on the inside of modern Ban Chiang vessels, is not visually apparent on some of the ancient ones:

surface smearing has obscured the indentations. As for the corresponding paddle facets on the vessel exterior, while Rye (1981) has shown that they are sometimes discernible on pottery from other cultures, they are visible in this Ban Chiang corpus only when a cord-wrapped/textured paddle was employed (*e.g.*, vessels BC-1 to BC-8).

The use of the paddle-and-anvil technique shows up most clearly in xeroradiographic images of complete modern Ban Chiang vessels, but it is also quite discernible on the ancient ones (*cf.*, Plates 4 a and b).



a



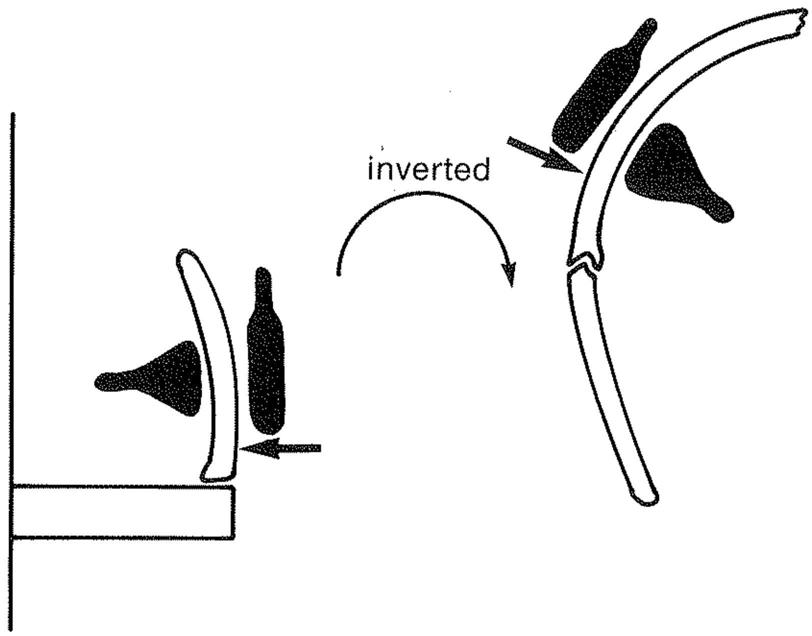
b

Plate 4:
Xeroradiographs of a., a modern Thai vessel, and b., the ancient vessel BC-2 (from phase EP II). The anvil marks in (a) are fully rounded (arrowed) while those in (b) are rounded-to-triangular (arrowed) and much obscured on the upper body by incised decoration.
Measurement conditions: 60kV (a) and 50 kV (b), 400 milliamp.sec, 1.02 meter focal distance.

The lump-and-slab method of construction is somewhat different in execution. A lump of clay is shaped into a hollow cylinder (or a truncated cone) and attached to a flat clay slab. The shape is then developed by a rhythmic paddle-and-anvil treatment (Fig. 2).

The join of these two members is critical to the vessel's structural stability and ultimate shape. For carinated vessels, where the join is quite sharply angled, it was sealed by extra clay being smeared over it on the vessel's interior. This seam is macroscopically visible (Plate 5) and usually shows an impression of the edge of the tool—perhaps the anvil—where it was used to press in and smear clay.

Fig. 2:
The lump-and-slab construction method.



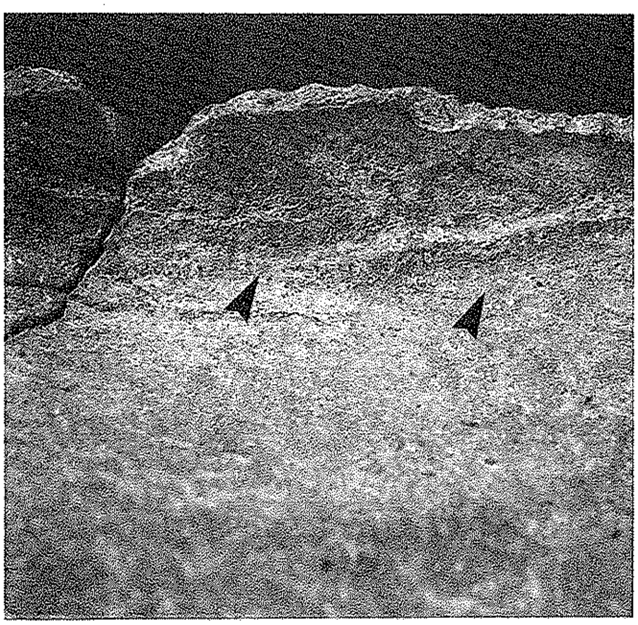
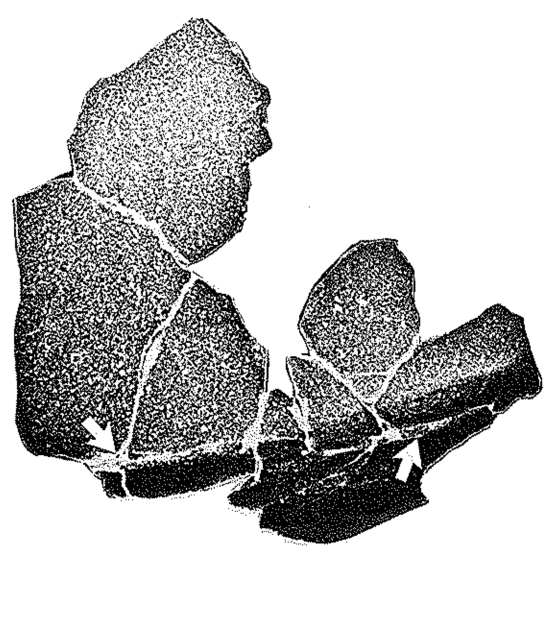


Plate 5:
Interior detail of vessel BC-4 (from phase MP VII). The added clay seam (arrowed), with its remnants of tool impressions, covers the interior angle created by the carination.

Plate 6:
Xeroradiograph of vessel BC-7 (from phase MP VII). The plain surfaced upper body lacks any trace of coil joins above the carination seam (arrowed).
Measurement conditions: 50kV, 400 milliamp.sec, 1.02 meter focal distance.



For globular vessels, no such clay seam is structurally necessary. The junction between the lump and the slab was therefore made secure just by intensive paddling, to a degree where scarcely any macroscopic evidence for the seam is discernible.

The xeroradiographic images for the upper body of vessels made in this way lack any trace of flow patterns for laminar voids. Only the main join between the lump and the slab is detectable (Plate 6) along with anvil marks on both the upper and lower parts of the vessel.

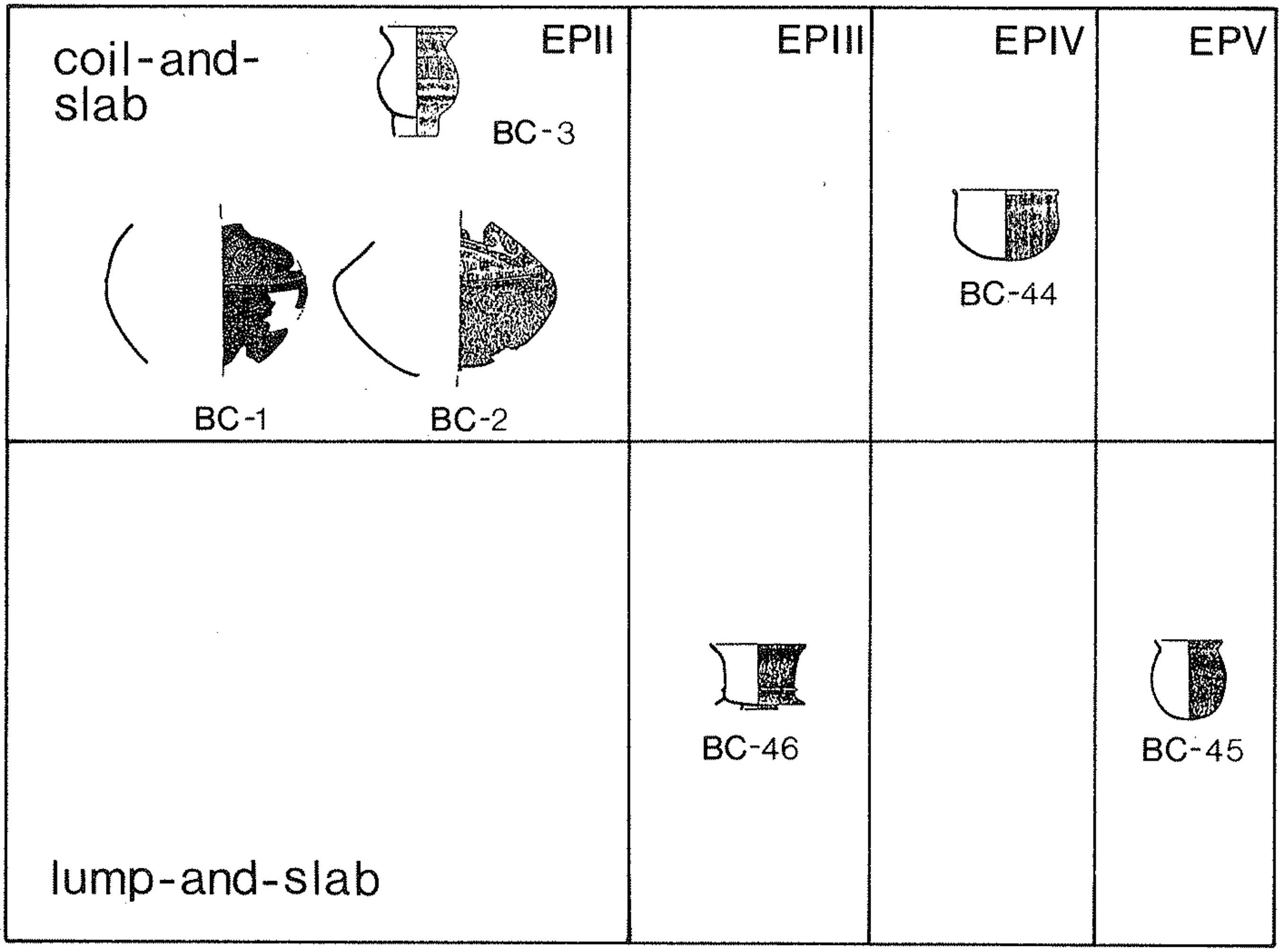


Fig. 3: A summary of the construction methods used for the individual vessels in this program.

Results of xeroradiographic studies

The chronological ordering of the individual Ban Chiang vessels, in terms of their forms and construction methods (as identified using xeroradiography) is summarized in Fig. 3. Supplementary data pertinent to this chart are given in the following discussion and in Fig. 4.

Early Period vessels

The three EP II vessels are all closed forms; none of them are carinated. They were all made by the coil-and-slab method. The join of the first coil to the slab base is well below the vessel's maximum diameter. (The extant part of BC-2 comprises only coils, even though the missing basal portion is quite small.) The coil-joins are evenly spaced (*circa* 1.5-2.2 cm apart), and the coils themselves are thin (*circa* 4-5 mm). They have flat tops, so that each coil-join creates a narrow, horizontal air void.

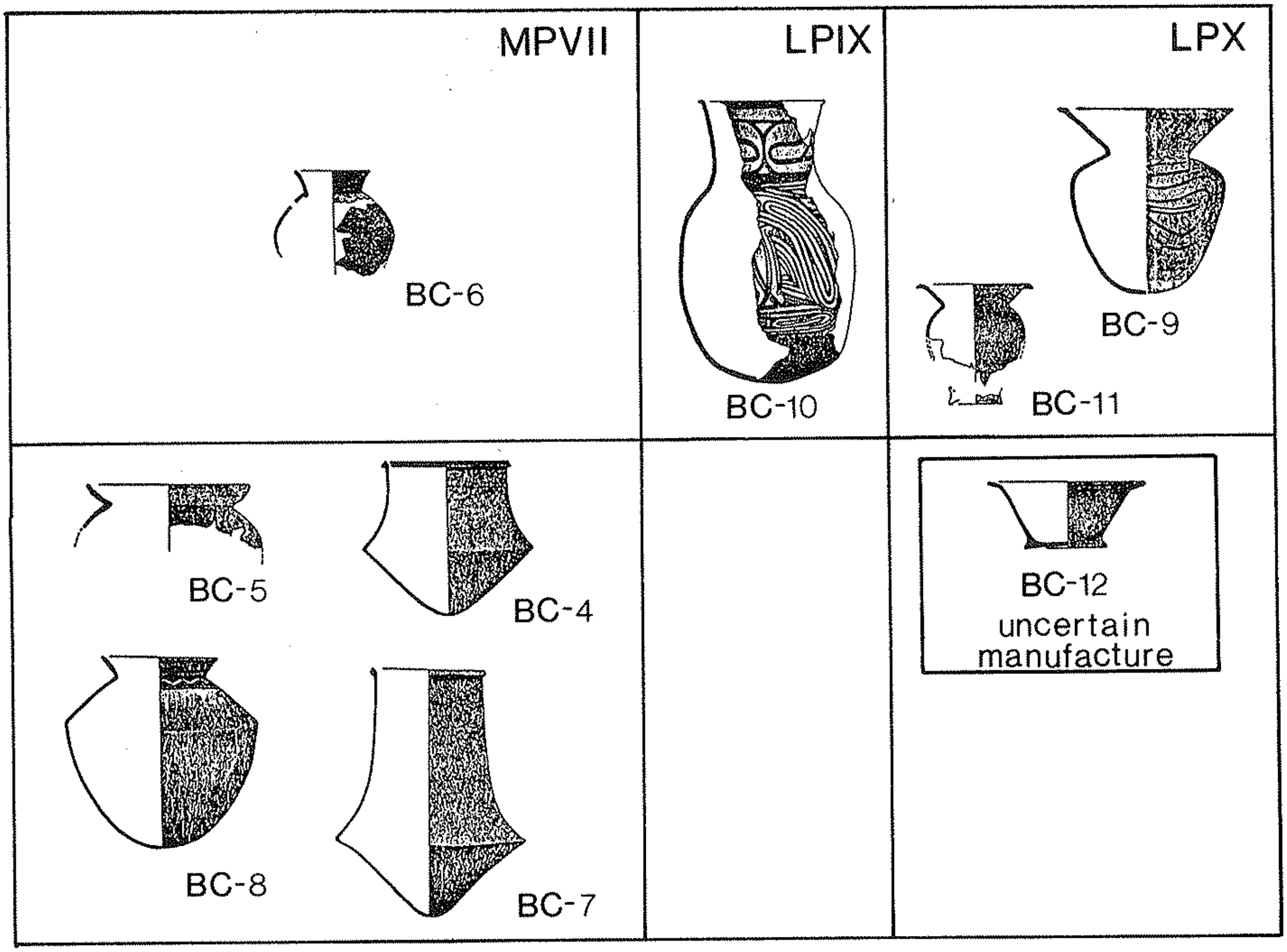
The one EP III vessel (BC-46) studied has an open form, and a flanged base. It was made by the lump-and-slab method. The join of the two clay members is at the angle of the base where the outside flange has been added. This vessel's thickness is uniform (*circa* 4-5 mm).

The one EP IV vessel (BC-44) studied also has an open form; it is not carinated. It was made by the coil-and-slab method. The join of the first coil to the slab base is low on the side of the body. Its coil-joins are evenly spaced (*circa* 1.5-2.0 cm apart), while the coils themselves are thin (about 4 mm) and have flat tops (see Plate 3).

The one EP V vessel (BC-45) studied has a closed, globular form. It was made by the lump-and-slab method. The join of the two clay members is only about a quarter of the way up the body. This vessel's thickness is uniformly about 4 mm.

Middle Period vessels

Only one phase of the Middle Period is represented in our corpus: MP VII. The vessel forms that characterize that phase—large carinated and large globular—were both produced by the lump-and-slab method. Among the carinated vessels, the join between the two clay members always occurs at the carination (*i.e.*, at the vessel's maximum breadth), and always has an interior seam of clay smeared over it (see Plate 5). The height of the carination seam is quite variable in these vessels, being only 30% of the total height for BC-7, 40% for BC-4, and 60% for BC-8. An instance of the use of the coil-and-slab method was, however, identified in a less common type, the small globular vessel (BC-6). The join of the first coil to the slab



base is relatively high on this vessel, in fact a little way above its maximum diameter. The coils themselves are evenly spaced about 2.0 cm apart, thin (*circa* 4 mm) and flat topped.

Late Period vessels

The one LP IX vessel (BC-10) studied has a closed form; it is not carinated. It was made by the coil-and-slab method, with the first coil join quite low on the body. The coil-joins are irregularly spaced (but at minimum, only 3 cm apart), and the coils themselves are thick (*circa* 6-9 mm), with the coil-ends partially overlapping as the coil spirals upwards. They have rounded tops, causing the line of the air voids at each coil join to appear quite wide.

Two of the LP X vessels (BC-9, BC-11) studied have a closed, globular form; neither is carinated. They were made by the coil-and-slab method, with the first coil-join low on the vessel's body. The coil-joins are irregularly spaced, and the coils themselves are thick (at minimum, 10 mm for both BC-9 and BC-11), with overlapping termini (Plate 7). Like BC-10, they have rounded tops. Those in BC-9 may have been finger-pinched into shape, rather than paddled by the paddle-and-anvil technique.

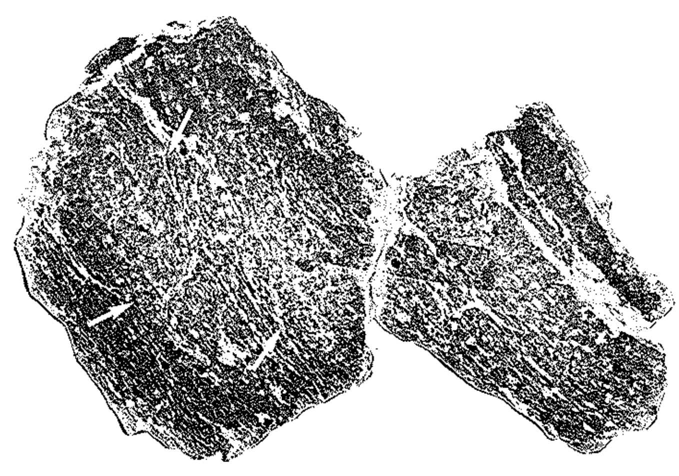
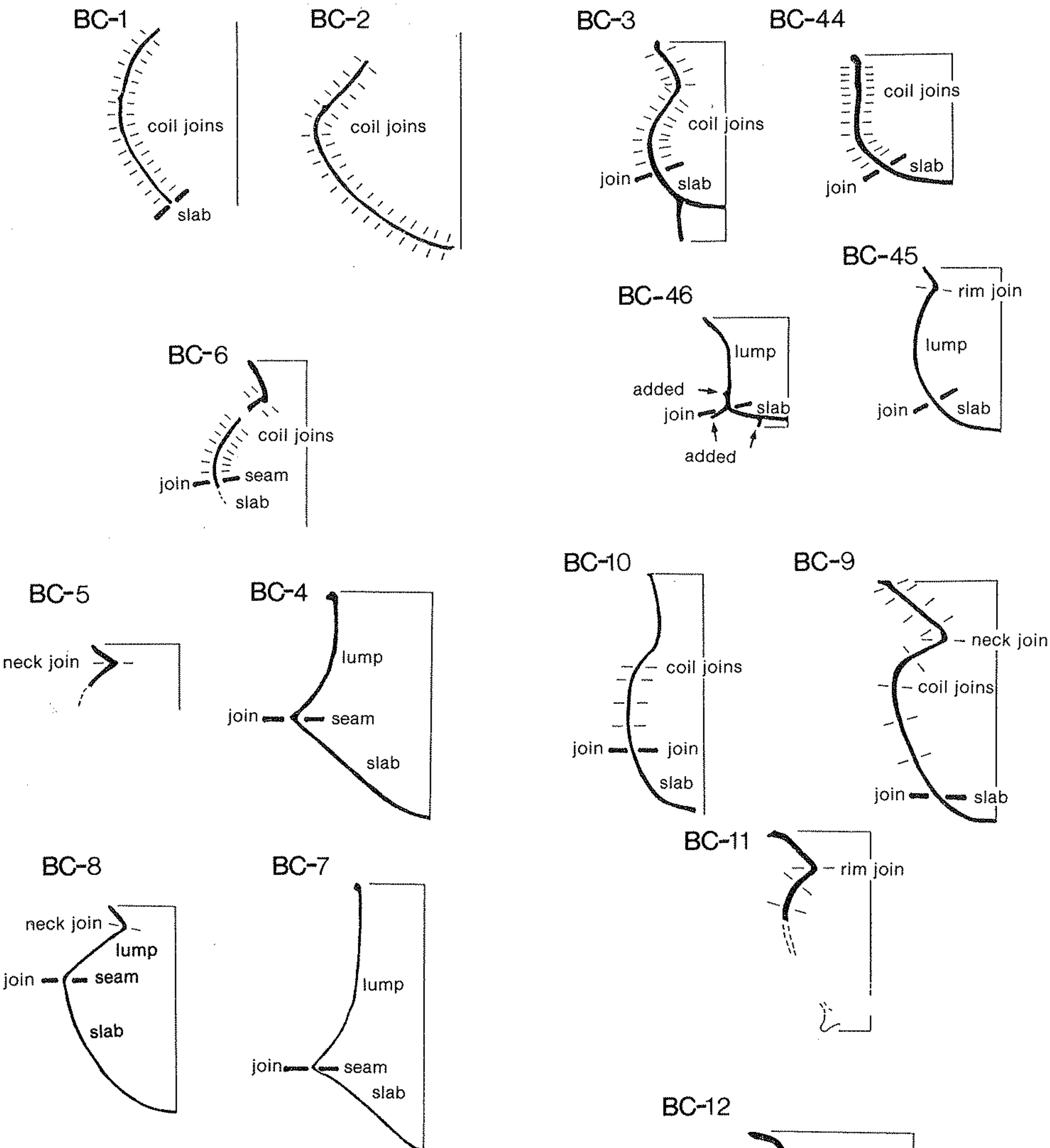


Plate 7:
Xeroradiograph of BC-11 (from phase LP X). The overlap of the coil termini produces a curved pattern in the flow of the air voids (arrowed). Measurement conditions: 60kV, 400 milliamp.sec, 1.02 meter focal distance.



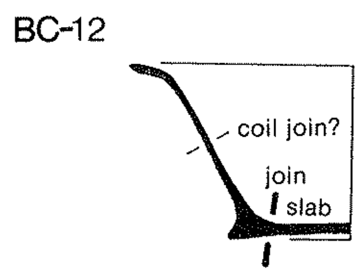
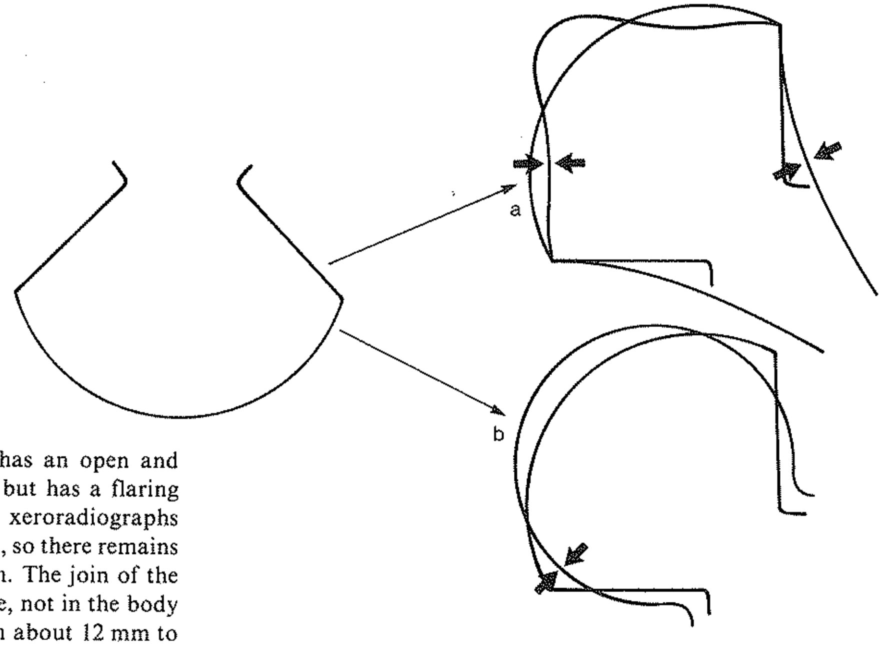


Fig. 4:
A cross-sectional view of each vessel showing the coil-joins (*fine lines*) where appropriate, and the principal join (*thick line*) for either the slab and the lump or the slab and the first coil added to it. (For scale, see Fig. 3).

Fig. 5:
Sketches illustrating how an initial vessel form created by the lump-and-slab method can be modified into either a flaring carinated vessel (a) or a squat globular one (b).



The other LP X vessel (BC-12) studied has an open and truncated conical form; it is not carinated, but has a flaring base. The one air void that shows up in the xeroradiographs could be either a coil seam or a hairline crack, so there remains ambiguity about the method of construction. The join of the slab base is contained within the vessel's base, not in the body wall which tapers upwards in thickness from about 12 mm to less than 7 mm.

Observations *

The earliest EP vessels in this corpus were all coil-and-slab construction, irrespective of vessel size. The lump-and-slab method is only first attested here in the EP III phase. However, we hesitate to give the coil-and-slab method primacy in the Ban Chiang potter's repertoire since only two of the many EP II vessel forms were studied. (Nor did the program include any vessels from the even earlier EP I phase.) The fact that the two later EP phases did provide an example of each fabrication method would suggest that, given an expanded sample, we would find that both methods were in use contemporaneously.

For the one phase of the Middle Period studied, MP VII, both its most characteristic forms were made using the lump-and-slab method. The final form of a vessel like BC-8, with its bulbous lower body and its quite shallow conical upper body, is remote from that of a vessel like BC-7 (or BC-4), with its slightly flaring base and its elegantly inward-curving and tall upper body. In fact, the form differences derive only (a) from the amount of clay allocated by the potter to the slab and to the lump, and (b) from how and where the paddling process was applied most extensively.

Thus, in the making of BC-8, we estimate that the slab was initially about three times as heavy as the lump added to it. For BC-7, on the other hand, the slab was initially only about a sixth as heavy as the lump added to it. For both vessel forms, the Ban Chiang potter exploited the presence of carination to appreciable aesthetic advantage (Fig. 5 a).

We note that it was quite feasible for the potter to take any carinated vessel similar in form to BC-8, and apply the paddle and the anvil to the upper body and the carination so that the entire vessel took on a globular form (Fig. 5 b). In so doing the carination angle would be entirely rounded off, and the original join between the slab and the lump would be virtually obliterated. The vessel BC-5 may have been made this way, though insufficient amounts of its body wall remain to confirm the idea.

That the coil features (uniformity in thinness, height, and edge shape) of the one coil-and-slab MP VII vessel that we studied are identical to those found among the EP coil-and-slab vessels illustrates continuity of a potting tradition. However, things have changed by the Late Period. Whether the sheer bulk of the coils of LP vessels is a determining factor in the way the coil-joins were subsequently achieved is difficult to judge. Objectively we can state only that, in their dimensions and morphology, LP coils stand in clear contrast to those of earlier times. Only an appreciable expansion of the xeroradiographic program will establish whether there is more diversity still in the way that prehistoric Ban Chiang wares were made.

Acknowledgments

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*The important contribution of Vincent (1984) with respect to the construction methods of the Ban Na Di mortuary pottery was available only at time of press, and thus is not referred to in our text. Our expanding fabrication studies of the Ban Chiang corpus will present the comparisons with that study.

References

Glanzman, W., 1983: *MASCA Journal 2* (6), 163.

McGovern, P.E., Vernon, W.W., White, J.C., 1985: *MASCA Journal 3* (4), 104.

Rye, O.S., 1981: *Pottery Technology: Principles and Reconstruction,* 84 (Manuals on Archeology 4, Taraxacum, Washington, D.C.).

Vincent, B., 1984: in *Prehistoric Investigations in Northeast Thailand,* 644 (Eds. C. Higham and A. Kijngam, BAR International Series 231, Oxford).