RICE IN POTTERY: NEW EVIDENCE FOR EARLY RICE CULTIVATION IN THAILAND

Brian Vincent

PO Box 5165, Dunedin, New Zealand

ABSTRACT

Recent studies have revealed that exotic pottery entering Khok Phanom Di (KPD), an important pottery production centre, located on an estuary of the Bang Pakong River, contained rice by-products. This suggests a close association with rice and that sufficient was available for it to play a critical role in potting technology. Its use to temper pottery fabrics, a highly sensitive component of ceramic technology, suggests that its availability was consistently reliable. The source of this exotic pottery is of considerable interest. Petrographic evidence will be presented which could help trace its likely origins. Other technical aspects of the rice-tempered pottery indicate that it was made by potters working within an advanced ceramic tradition. The producers of these technically sophisticated wares were clearly familiar with highly developed potting industry, which had probably been developed over a long period under stable conditions. This tradition, in terms of the use of rice and complex manufacturing techniques, contrasts sharply in comparison with other 2nd millennium BC Thai potting traditions.

Petrographic examination of a large pottery assemblage, represented at KPD (Figure 1), has allowed developments in local and exotic ceramic technologies to be traced in some detail. While the use of rice by-products was not favoured by local potters until relatively late in the sequence, some of the earliest exotic manufacturing traditions involved the deliberate addition of rice to prepared clay tempers. A few of these exotic wares display a high degree of technological development. The sophistication of these techniques suggests well-developed potting traditions of considerable duration. They represent the earliest use of rice in Thai contexts known to the author. Their mineralogical composition suggests a source in or near the headwaters of the Bang Pakong River (Figure 1).

CERAMIC TECHNOLOGY IN THAILAND

Craft potting, even at its most basic levels, requires considerable skill. Some understanding of the characteristics of potting clays and other materials is essential. Not all clays are suitable. Potting clay must be sufficiently plastic for forming while holding its shape during drying. It must also be suited to drying and firing without cracking (Arnold 1985:20, Shepard 1956:25). Most naturally occurring clays require the addition of non-plastic material (temper) to prevent cracks appearing during the drying and firing stages and to help ensure a strong ceramic body. Tempers act to reduce the amount of chemically unbound water in the clay body, an essential step if catastrophic cracks are to be prevented. A knowledge of firing responses is essential, for even otherwise excellent pottery can fail if badly fired. Tempers affect the critical drying and firing processes. They are therefore almost invariably mutually exclusive. Because one does not grade into another they help to index different potting traditions. An understanding of fuel temperatures as well as the kind and duration of firing is required. Although perhaps seeming a simple process, because of these underlying considerations, craft potting is probably best characterised as a highly technical operation requiring skill and dexterity. It can involve a wide range of working methods, from simple hand modelling to coating pot surfaces with clay slips. The use of rice temper in combination with the complex slipping technique signals a highly skilled potting tradition. In Britain, the first slips appear as a Late Bronze Age innovation (Varndell and Freestone 1997:36). In Thai contexts, *it is important to note that slips are correlated with rice temper.*

Paints differ from slips (for a discussion of paints see Shepard 1956:31). Paints are *generally* liquids composed of water soluble pigments whereas slips are composed of liquids containing clay *minerals* held in suspension. They may be more-or-less viscous but clay minerals form their basic component. Slips are here defined as specially prepared homogeneous mixtures composed of clay and water

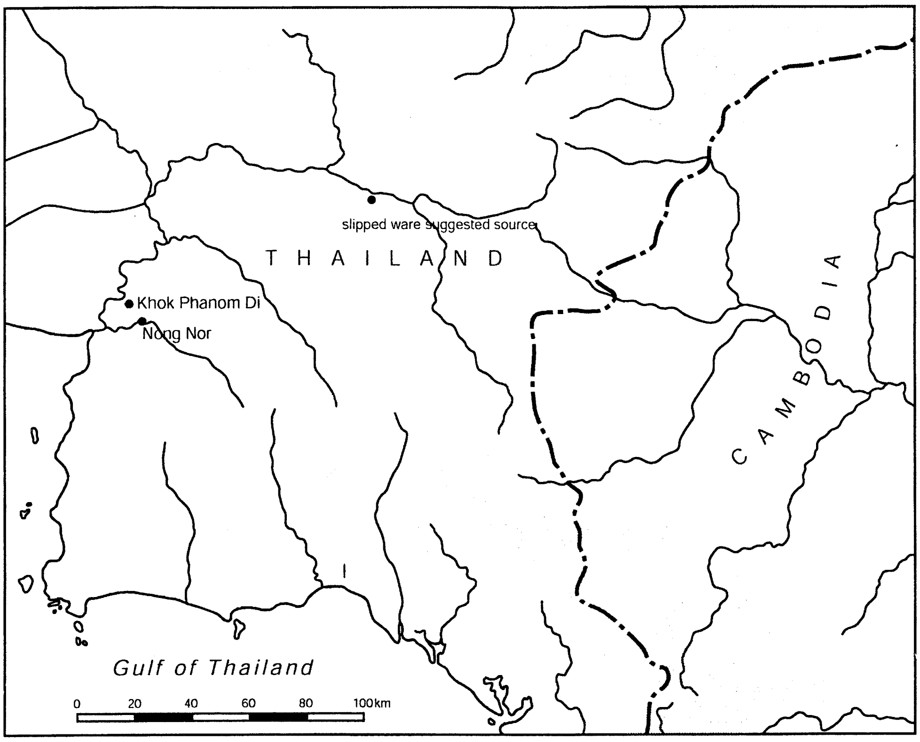

Figure 1: The Bang Pakong Valley geomorphology and site locations. Suggested source of early slipped ware containing bleb temper with rice.

from which coarse particles have been removed. This is achieved by first adding water to raw clay and mixing it into a thin slurry in a container. This mixture is then levigated allowing the heavier particles to settle to the bottom. The fine upper fraction is then decanted leaving behind unwanted sand or nonplastic lumps. It is this former mixture of clay minerals and water that form a true slip. Such true slips differ from "self slipping", a process which can occur when the potter forms pots using particularly plastic clays (Shepard 1956). As the wet clay is mobilized during shaping and smoothing, fine colloidal clay particles can migrate to the surface to form a slip-like outer layer. This layer is actually an element of the vessel wall. As this component does not involve a separate application of an additional clay layer, it is not a true slip (see Simpson 1997:41, 51; Williams 1997:89; Gaimster 1997:128; Roberts 1997:188).

Colourants, for example iron oxides, may be added to the levigated mixture. The preparation can then be applied to the air-dried leather hard vessel prior to firing. The slip can be brushed, wiped, dripped or poured on to the vessel, or alternatively the vessel can be dipped into the mixture. Slips are usually finer and richer in clay minerals than the pots they cover. If the slip is too thin it may need to be thickened. In some cases the potter may need to stir the slip between applications to keep the clay minerals in suspension. The complete removal of nonplastics may not always be necessary, however, as a thin slurry (Hamer 1975: 277) will be sufficient in many cases. Slips have good adhesion and usually bond well with the pot body. As well as being used to apply designs, they give colour and a smooth textured surface to pots.

In craft potting, fired slips vary markedly in thickness depending on viscosity and the number of applications used. Viscosity is influenced by particle size and their dispersion. True slips, which have seldom been reported in Southeast Asia can be difficult to detect without a petrographic microscope. They are usually very thin, but some may be over 2mm thick. In contrast, paints tend to be much thinner. Mineral paints, for example haematite, (i.e. ochre), are usually ground to reduce lumps but not particle size. Mixed with water, and in some instances an organic medium to help spread and bind the paint, they can have a vessel body. It is important to note that in each instance grainy texture when applied. Although slips may be painted on to pot surfaces they should, if possible, be described in the same way as the main pottery fabric. This is because they are composed of the same materials (clay and nonplastics). Slips have sometimes been used to coat coarser wares in an effort to imitate a finer fabric, but conversely, some sandy slips have a particularly rough surface (Simpson 1997:66, 79).

In Thailand true slips are rare. Pottery from Tha Kae, Lopburi, includes a thick red slipped and burnished ware (TRBW), ascribed to the mid to late 2nd millennium BC (Ciarla 1992:121). It is tempered either with vegetal particles or chaff (Rispoli 1992:129). Rispoli notes that TRBW ware, although very distinctive, has Lopburi region significance and notes similarities with Kok Charoen pottery about 100 km northeast of Tha Kae. A few such slipped sherds were also present in the lower levels at Non Pa Wai (Rispoli 1992:130). Aside from this Central Thailand pottery, a distinctive early 1st millennium AD Roi Et *sgraffito* ware, which involves a highly specialized two-stage decorative technique, is also known from the lower Mun Valley within the Khorat Plateau (Vincent 1988:176). With this technique a coating of slip is dried to the leather hard stage when a design is scratched through the coating to reveal the underlying vessel body. The clay slip may or may not be a different colour to that used for the vessel body. It is important to note that in each instance these wares were tempered with material consistent with rice by-products.

RICE TEMPER IN POTTERY

Potters are very conservative in their choice of tempers. Given its technological importance, selection of suitable materials would likely be determined by availability and the security of reliable supplies. Such restrictions have been observed by researchers elsewhere, for example in early European contexts (Hodges 1965:121). Varndell and Freestone note that "the earliest use of pottery in Britain is associated with the advent of farming about six thousand years ago". Changes in clays and tempers were apparently resisted:

> The potters appear to have been very conservative in their use of clays and tempers, and the same materials were used over long periods of time and across wide areas. Fabrics tend to reflect local availability of raw materials. For example, in Wessex crushed flint and shell were commonly added to pottery throughout the neolithic, while Beaker wares of the Early Bronze Age showed a marked preference for grog. (Varndell and Freestone 1997:34)

A similar process seems to have occurred in Thailand where changes in temper distributions have also been recorded (Vincent, 1988, 2000a, 2002a, 2003). Natural tempers, such as sand, are associated with Neolithic communities, while *synthetic* tempers (grogs), manufactured by the potter, tend to occur with the advent of the Bronze Age along with the introduction of rice agriculture. Significantly, natural temper deposits are uneven and randomly distributed around the globe, whereas cultural factors determine where potters can manufacture non-plastic additives. In Thailand, bleb grog (in Thai *"chua"*), which includes rice, first appears in Bang Pakong Valley pottery *c.* 2,000 BC (Vincent in press).

The importance of temper varies depending on clay quality. Some clays require little modification, while others are unsuitable without temper. Untempered wares are extremely rare in Thailand, a clear signal that temper was nearly always an essential ingredient. The ability to either manufacture grog temper and/or access agricultural by-products, such as rice husk, would eliminate the necessity to acquire natural tempers, especially when these were unavailable locally. Suitable natural tempering materials often have a limited distribution, but in spite of this potters are known to expend considerable energy in securing them. A worldwide maximum threshold distance of 7 km for the transportation of temper materials has been identified (Arnold 1985:38, 1988). Most potters studied obtained their temper from less than 1 km distance, but some travelled as much as 25 km.

Rare exotic pottery sherds containing rice temper or bleb grog were recovered from basal levels at KPD. These include vessel base fragments and either paddle impressed or incised body sherds. Paddle impressed pottery fabrics were tempered with either sand, or three varieties of grog. Such diversity suggests that paddle-impressing was a regional decorative mode. One exotic burnished and incised appliqué sherd, composed of a bleb-tempered fabric, was also recovered. A single local rim sherd contained incidental rice particles, but these were probably accidentally lodged in the wet clay, perhaps during quarrying or clay processing. Petrographic analysis shows that this clay was obtained from deposits next to the site. A sample of KPD vessels are illustrated in Figures 2, 3 and 4.

The KPD sequence is represented by four Ceramic Periods (CPs). Rice was present in the general matrix in all but the uppermost layer at KPD (Thompson 1996:157), but local potters did not add rice to their potting mixtures until late in the sequence. The first relatively brief CP featured sand temper (Table 1). In CP2-3 this was replaced by grog, and in CP4 rice was finally adopted (Vincent 1998). Radiocarbon determinations derived from charcoals indicate that the second two CPs span the period 2000-1500 BC (Higham 1996:251, Vincent in press). The upper 1.2m of cultural deposits (CP4) included a potting workshop. Suitable charcoal for radiocarbon determinations was initially unavailable for the workshop, but two AMS dates (OxA 7777 and OxA 7778), have subsequently been obtained from rice husk temper. Unfortunately they predate the underlying strata (Vincent 2002c:96). Although rice was not used as temper during CP3, it was added to selected vessels, probably as a medium of symbolic expression. A similar process has previously been recorded from ritual contexts at Ban Na Di (Vincent 1988:131).

Although rice was available at KPD during the 2nd millennium BC, local potters did not exploit it. Potters are conservative in technological matters and prefer to use readily available materials. New tempers are unlikely to be adopted unless reliable long-term supplies can be secured.

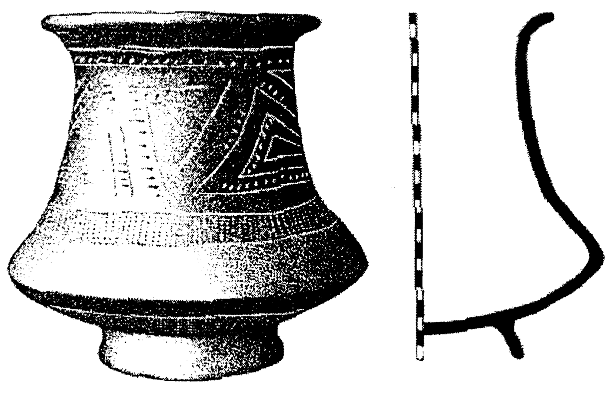

Figure 2: Ceramic Period 2: local footed vessel.

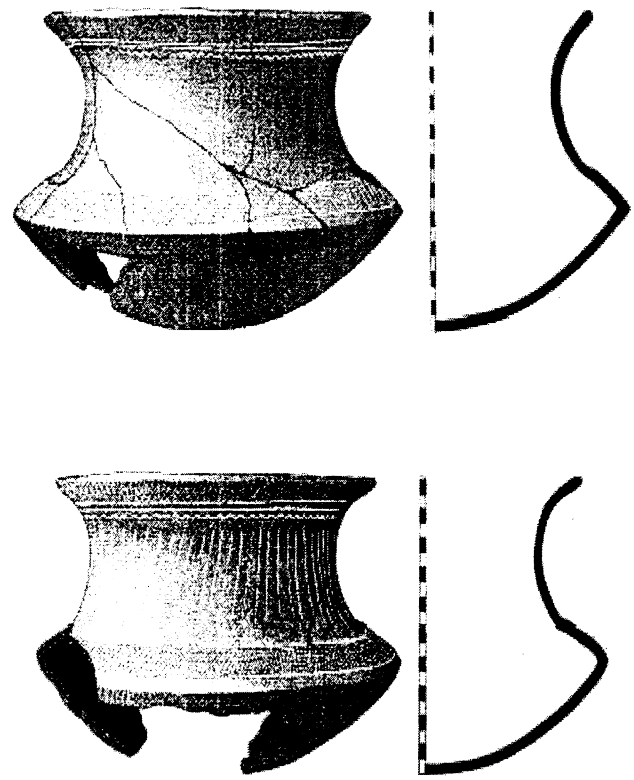

Figure 3: Ceramic Period 2: local burial jars.

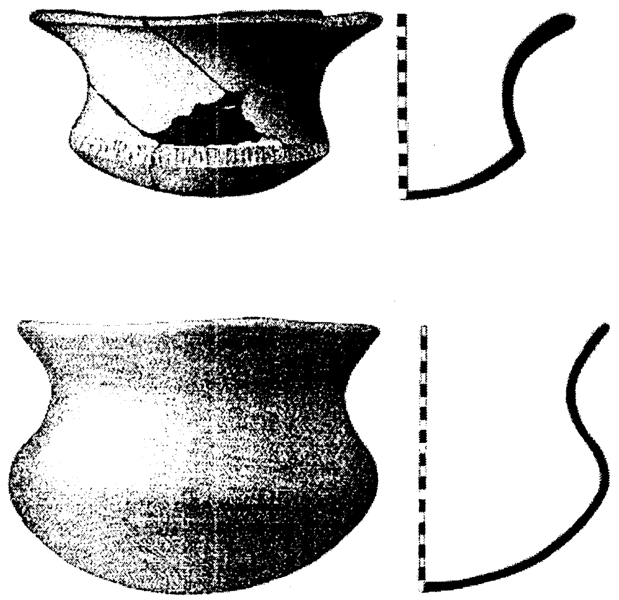

Figure 4: Ceramic Period 3: exotic burial jars.

This could suggest that rice was not cultivated locally in any sustained manner. During CP2-3 the local industry relied on grog temper. Because this grog was made from the same clay as the parent body fabric, the need to acquire extra tempering materials was eliminated. Given such independence, it would be unnecessary to change tempers unless some other aspect of the potting process demanded it. For example, potters could be induced to change their methods if suitable potting clays were difficult to obtain, or if an alternative temper, which allowed a much simpler method, was readily available in abundance. The decision to manufacture grog adds another stage to an already complex process. To manufacture *orthodox grog*, small balls of potting clay are first fired in bonfires and then crushed to a suitable size. Some potters add rice by-products to help prevent the balls from shattering in the fire (this is *"chua"* or *bleb grog*). We noted above that rare examples of exotic wares tempered with either bleb grog or rice alone were found at KPD. We can now examine this pottery in more detail.

TRACING THE ORIGINS OF RICE-TEMPERED POTTERY AT KPD

All of the early pottery with rice inclusions at KPD feature exotic clay preparation and decoration techniques. One special ware featured highly developed potting methods: bleb grog temper and a true slip composed of a refined clay. Petrographic analysis suggests that this pottery derived from the upper reaches of the Bang Pakong Valley (Figure 1). It contains abundant particles of rice husk associated with the characteristic bleb-shaped grog. Because some of the sherds carry a true clay slip, it is unique in the KPD ceramic spectrum (the range of pottery types which characterize a ceramic assemblage).

The parent fabric is medium dense with a micaceous matrix containing few non-plastics. Angular to sub-rounded mono and polycrystalline quartz (up to coarse sand size), and sub-angular opaque ferruginous minerals (medium to coarse sand size), were noted. The latter are rare. Some polycrystalline quartz grains display undulose extinction. A few quartz grains include regrowths, indicating a reworked

Table 1. The Khok Phanom Di ceramic sequence

Ceramic Period	Date	Preferred Temper
Four	Post *c.*1500 BC	Rice
Three	*c.*1650 - 1500 BC	Orthodox grog (sandy clay)
Two	*c.*2000 - 1650 BC	Orthodox grog (micaceous clay)
One	Pre 2000 BC	Sand

sediment. Limestone (LST) fragments, with anhedral crystals (dolomitic[?] or recrystallized calcite), and abundant authigenic calcite were observed (Vincent in press).

The slip is over 2mm thick with a red (Munsell 10R/5/6) surface consistent with an iron oxide. It contains rock fragments which include plagioclase feldspar, LST, polycrystalline quartz and mica. Coarse to very coarse sand-sized angular dolomitic(?) LST, mono and polycrystalline quartz (to medium sand size), and micaceous siltstone fragments are also evident. Some quartzitic grains (quartzite) have crenulated boundaries which suggest a metamorphic origin. Both the interior and exterior sherd surfaces examined in thin section are slipped, but in some cases only one surface may be coated.

In terms of the exotic pottery spectrum (the range of exotic pottery types in a ceramic assemblage), there is a clear coastal emphasis during CP1 (Vincent in press). This evidence is supported by analyses of sediments (Aitken 1992), and shellfish remains (Mason 1994). Coastal interaction continued until the CP2/3 boundary when a marked change is evident in the local potting industry. A clear shift in the exotic ceramic spectrum, from coastal to inland, is evident (Vincent in press). Biological indicators (Higham and Bannanurag 1991; Mason 1996; Thompson 1996), support an environmental shift, probably as sea levels fell away and the site became increasingly isolated from the coast.

Ceramic evidence, much corroborated by mortuary data, demonstrates that a major cultural change occurred with the commencement of CP3 (Vincent 2000b, 2002b). Changes in mortuary rituals included a different cemetery layout, a unique mortuary structure containing, in terms of grave goods, two female potters. Burial vessels were smashed during CP3, rather than placed into graves intact, as before. Exotic burial jars suggest the arrival of immigrant males. Turtle carapace plaques and potting anvils first appear in CP3 mortuary contexts, the former restricted to male graves, the latter to female. Tooth ablation first occurred, as did rice in local pottery. In concert with the CP3 emphasis on inland pottery imports, there is a marked increase in exotic sources. An exotic anvil in a female grave suggests that marriage alliances with inland communities were established. Carinated burial jars, the most common mortuary vessels, differ in shape, decoration and proportions compared to earlier examples. Apparently made expressly as mortuary dedications, they carry motifs, probably representing social groups. Only one of six CP2 motifs survived into CP3. But several new motifs were introduced during CP3 and at least five of these were on exotic jars. One such exotic motif, introduced with the earliest male burial which contained a special turtle carapace ornament subsequently only found in male burials, became increasingly prominent in tandem with a motif associated with female potters. Burial wealth increased markedly in CP3 and potters appear to have become important.

The local potting technology changed in CP3 when a different potting tradition was instituted. Output was concentrated on newly introduced utilitarian cylindrical containers, almost doubling coarseware production compared to CP2. Access to the central cemetery area seems to have been reserved for wealthy female potters and males with turtle ornaments and/or motifs. Female potters and turtle group males appear to have been a closely associated socio-economic group. One possible explanation of this development is that this group achieved socio-economic prominence by promoting and expanding important inland exchange networks. They may, for example, have promoted the exchange of salt and/or salted fish in the coarseware containers for desired, but locally unavailable, resources, including rice. In this respect, it is important to note that although local potters were likely to have been familiar with rice temper in imported pottery, they did not use it themselves.

Given the need to secure reliable temper supplies, perhaps the early KPD potters did not choose rice because its local cultivation was inconsistent. Soon after CP3 began shell knives suited to harvesting grasses, such as rice, were deposited within the excavated area (Higham 1993:177). Thompson (1996:213), however, has argued that successful rice cultivation in coastal regimes, such as that prevailing at KPD during this period, would be most unlikely. She also notes that rice remains did not increase in abundance at any point in the cultural sequence and points out that rice imports should not be excluded.

The CP3 shell knives could represent an unsuccessful attempt to establish sustainable rice cultivation by an immigrant group. Higham and Lu (1998:875) support the notion that rice cultivation was a brief temporary phase at KPD stimulated by environmental changes. But alternatively, such a response is perhaps predictable for groups familiar with growing rice elsewhere and this proposal would fit with the marked CP3 cultural changes noted above. Thus, inland groups, accustomed to favourable cropping conditions, could have attempted to establish traditional rice cultivation strategies in an untried environment. Failure of this staple crop, however, would leave them with little option other than to import it or change their diet. But the latter does not appear to have happened, because, as Thompson (1996) reports, rice remains are ubiquitous in the cultural contexts.

Knowledge of, and access to, inland communities located along familiar waterways is likely to have stimulated the kinds of exchange interactions mentioned above. Although coastal donor sources are emphasized in the earliest (CP1) exotic pottery spectrum, wares consistent with inland sources also entered KPD from the outset. In some, the fabric mineralogy suggests a source near the headwaters of the Bang Pakong River. This pottery not only contains rice particles but it also displays a level of technological skills presently unknown elsewhere in Thailand from this period, the late 3rd to 2nd millennium BC. Although detailed evidence is lacking, given its presence at Nong Nor (Higham *et al.* 1994), rice cultivation was probably widespread in the Bang Pakong Valley by the 1st millennium BC. But rice was not detected in the earliest phase at Nong Nor dated to *c.*2450 BC (Higham 1996:249). This is surprising because CP1 pottery at KPD mirrors in many respects the initial Nong Nor phase 1 tradition.

According to O'Reilly (1995, 1998a, 1998b, 1998c) early pottery at both sites is likely to either represent production by the same potters or very close exchange relationships. These two sites are only 14 km apart and it seems reasonable to expect, given the similarities noted by O'Reilly, that both also contained similar exotic pottery. Until further research is undertaken this question remains unanswered. But there can be little doubt that these two assemblages represent the output of either the same potters or that of a very closely-knit regional potting tradition.

Tracing the ultimate origins of rice in Thai pottery fabrics awaits further research. Bang Chiang Early Period II (EPII) incised ware fabrics include rice. White (1990:125) places EPII between the 3rd and early 2nd millennium BC, the earliest outside the Bang Pakong Valley region, leaving open the possibility that rice in pottery entered Thailand from multiple directions. A logical source for the early upper Bang Pakong Valley rice-tempered pottery tradition lies to the east in present-day Cambodia. Ready access would have been available through the upper reaches of rivers draining into the Tonle Sap. Unfortunately, at least from a pottery perspective, Cambodia presently remains *terra incognita*, with little technological data available. But some important evidence has recently been presented from the circular earthwork Krek 52/62 (Albrecht *et al.* 2000:20).

Rice husk from Krek 52/62 pottery provided radiocarbon determinations with calibrated ages of 1920-1690 and 2620-2350 BC (Albrecht *et al.* 2000: table 3). But, as little carbon was available, and contamination by older carbonaceous material could not be ruled out, the authors note that these dates must be treated with caution. And Dega *et al.* 2000 (cited by Albrecht *et al.* 2000), reported five dates from organic pottery temper (presumably rice remains) from four Cambodian earthworks which range from 2290-2030 BC at a 95.4 confidence level (Albrecht *et al.* 2000:42).

SUMMARY

Pottery which combines the highly developed *chua* grog (tempered with rice), and clay slip technologies clearly reflects an enduring, stable industry. Neither technique is readily adopted by other than highly skilled potters with reliable access to quality materials. Slips generally require relatively plastic potting clays containing suitable clay minerals. But even such clays normally require levigation, and this process implies a detailed understanding of their complex properties. The use of clay slips changes drying and firing procedures, because slipped pottery must be dried in at least two stages, and therefore the firing techniques need adjusting. Similarly, *chua* grog also requires two firing and drying stages. Such knowledge elevates basic craft potting to higher levels. Although these methods could have been developed within Thailand, the presently available corpus of evidence suggests that they were introduced into the Bang Pakong Valley, probably in the 3rd millennium BC, from Cambodia. This is the earliest evidence for rice in Thai pottery known to the author.

ACKNOWLEDGEMENTS

Peter Bellwood and Doreen Bowdery are thanked for their tireless work in producing yet another issue of BIPPA. I wish to thank an anonymous reviewer and Michael Dega for their helpful comments , but reserve the credit for any mistakes which may remain for myself.

REFERENCES

Aitken, J.J. 1992. Archaeological Sediments as Artefacts: The Dirt on Khok Phanom Di, Central Thailand. PhD dissertation, University of Otago.

Albrecht, G., M.N. Haidle, C. Sivleng, L.H. Heang, S. Heng, T. Heng, S. Mao, K. Sirik, S. Som, C. Thuy and L. Vin. 2000. Circular earthwork Krek 52/62: recent research on the prehistory of Cambodia. *Asian Perspectives* 39(1-2):20-46.

Arnold, D.E. 1985. *Ceramic Theory and Cultural Process.* Cambridge: Cambridge University Press.

Arnold, D.E. 1988. A universal catchment area for ceramic resources: update. In Symposium *Ceramic Ecology Revisited: Current Research on Ceramic Materials.* American Anthropological Association, November 16, Phoenix.

Ciarla, R. 1992. The Thai-Italian Regional Archaeological Project: preliminary results. In I.C. Glover (ed.), *Southeast Asian Archaeology 1990. Proceedings of the Third Conference of the European Association of Southeast Asian Archaeologists.* pp. 111-28. Hull: Centre for South-East Asian Studies, University of Hull.

Dega, M.F L. Poch, U. Moninitha and C. Samouen. 2000. The timing of Cambodian earthworks. Paper presented at the 65th Society for American Archaeology meetings, Philadelphia, Pennsylvania.

Gaimster, D.R.M. 1997. Regional decorative traditions in English Post-Medieval slipware. In I.C. Freestone and D.R.M. Gaimster (eds), *Pottery in the Making. World Ceramic*

Traditions, pp. 128-33. London: Trustees of the British Museum.

Hamer, F. 1975. *The Potters Dictionary of Materials and Techniques*. London: Pitman.

Higham, C.F.W. 1996. *The Bronze Age of Southeast Asia*. Cambridge: Cambridge University Press.

Higham, C.F.W. and R. Bannanurag. 1991. *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Volume II: The Biological Remains. (Part I)*. London: Society of Antiquaries of London, *Research Report no.* L.

Higham, C.F.W. and T.L.-D. Lu. 1998. The origins and dispersal of rice cultivation. *Antiquity* 72 (278):867-77.

Higham, C.F.W., R. Thosarat, W. Boyd, N. Chang, J. Debreceny, T.F.G. Higham, A. Hogg, V. Hunt, G.M. Mason, D. O'Reilly, C. Pailles and N. Tayles. 1994. *The Excavation of the Prehistoric Site of Nong Nor, Central Thailand. Report to the National Research Council of Thailand.*

Higham, T.F.G. 1993. The shell knives. In C.F.W. Higham and R. Bannanurag (eds), *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Volume III: The Material Culture. (Part I)*. pp. 177-237. London: Society of Antiquaries of London, *Research Report no.* L.

Hodges, H.W.M. 1965. Aspects of pottery in temperate Europe before the Roman Empire. In F.R. Matson (ed.), *Ceramics and Man*, pp. 114-23. Chicago: Aldine.

Mason, G.M. 1994. The shellfish, crab and fish remains. In C.F.W. Higham and R. Thosarat (eds), *The excavation of Nong Nor. A Prehistoric Site in Central Thailand*, pp. 173-211. Dunedin: University of Otago, *Studies in Prehistoric Anthropology No* 18.

Mason, G.M. 1996. The micromolluscs. In G.B. Thompson, *The Excavation of Khok Phanom Di: a Prehistoric Site in Central Thailand*, pp. 239-64. London: The Society of Antiquaries of London, *Research Report* no. LIII, Volume IV: *Subsistence and environment*: The botanical evidence *(The Biological Remains, Part II)*.

O'Reilly, D. 1995. An Archaeological analysis of the Initial Occupation Phase at Nong Nor, Thailand. MA dissertation, Department of Anthropology, University of Otago, Dunedin.

O'Reilly, D. 1998a. The ceramic analysis. In C.F.W. Higham and R. Bannanurag (eds), *The Excavation of Nong Nor, a Prehistoric Site in Central Thailand*, pp. 97-118. Dunedin: University of Otago, *Studies in Prehistoric Anthropology No* 18.

O'Reilly, D. 1998b. Analytical results. In C.F.W. Higham and R. Bannanurag (eds), *The Excavation of Nong Nor, a Prehistoric Site in Central Thailand*, pp. 137-44. Dunedin: University of Otago, *Studies in Prehistoric Anthropology No* 18.

O'Reilly, D. 1998c. Comparative analysis between Nong Nor Phase 1 and Khok Phanom Di. In C.F.W. Higham and R. Bannanurag (eds), *The Excavation of Nong Nor, a Prehistoric Site in Central Thailand*, pp.161-72. Dunedin: University of Otago, *Studies in Prehistoric Anthropology No* 18.

Rispoli, F. 1992. Preliminary report on the pottery from Tha Kae, Lopburi, Central Thailand. In I.C. Glover (ed.), *Southeast Asian Archaeology 1990. Proceedings of the Third Conference of the European Association of Southeast Asian Archaeologists*, pp. 129-42. Hull: Centre for South-East Asian Studies, University of Hull.

Roberts, P. 1997. Mass-production of Roman fine-wares. In I.C. Freestone and D.R.M. Gaimster (eds), *Pottery in the Making. World Ceramic Traditions*, pp. 188-93. London: Trustees of the British Museum.

Shepard, A.O. 1956. *Ceramics for the Archaeologist*. Washington DC: Carnegie Institute of Washington, *Publication* 609.

Simpson, St.J. 1997. Early urban ceramic industries in Mesopotamia. In I.C. Freestone and D.R.M. Gaimster (eds), *Pottery in the Making. World Ceramic Traditions*, pp 50-61. London: Trustees of the British Museum.

Spencer, A.J. 1997. Dynastic Egyptian pottery. In I.C. Freestone and D.R.M. Gaimster (eds), *Pottery in the Making. World Ceramic Traditions*, pp 62-7. London: Trustees of the British Museum.

Thompson, G.B. 1996. *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol IV: Subsistence and the Environment: The Botanical Evidence. The Biological Remains (Part II)*. London: The Society of Antiquaries of London, *Research Report no.* LIII.

Varndell, G. and Freestone I.C. 1997. Early prehistoric pottery in Britain. In I.C. Freestone and D.R.M. Gaimster, (eds), *Pottery in the Making. World Ceramic Traditions*, pp. 32-7. London: Trustees of the British Museum.

Vincent, B.A. 1985. Exotic Wares at Non Nok Tha. Manuscript prepared in 1985 for publication in Non Nok Tha final report.

Vincent, B.A. 1988. *Prehistoric Ceramics of Northeastern Thailand*. Oxford: BAR *International Series* 461.

Vincent, B.A. 1998. Khok Phanom Di pottery processing scheme. In M.J. Klokke and T. de Bruijn (eds), Southeast Asian Archaeology 1996. *Proceedings of the 6th International Conference of the European Association of Southeast Asian Archaeologists, Leiden, 2-6 September 1996*, pp. 1-12. Hull: Centre for South-East Asian Studies, University of Hull.

Vincent, B.A. 2000a. Pottery technology studies in Southeast Asia: A review. In W. Lobo and S. Reimann (eds), *Southeast Asian Archaeology 1998. Proceedings of the 7th International Conference of the European Association of Southeast Asian Archaeologists, Berlin, 31 August-4 September 1998*, pp. 265-80. Hull: Centre for South-East Asian Studies, University of Hull.

Vincent, B.A. 2000b. The pottery of Khok Phanom Di. Paper presented at the 8th Conference of the European Association of Southeast Asian Archaeologists, Sarteano.

Vincent, B.A. 2002a. Ceramic technologies in Bronze Age Thailand. *BIPPA* 22:73-82.

Vincent, B.A. 2002b. Prehistoric craft specialists and social hierarchies: New Mortuary Evidence from Khok Phanom Di. Paper presented at the 9th Conference of the European Association of Southeast Asian Archaeologists, Sigtuna.

Vincent, B.A. 2002c. Radiocarbon dates from the Oxford AMS system: *Archaeometry* Datelist 31, 44(3):96.

Vincent, B.A. 2003. Earthenware in prehistoric Thailand. In J. N. Miksic (ed.), *Earthenware in Southeast Asia*, pp. 230-48. Singapore: Singapore University Press.

Vincent, B.A. (in press). *The Pottery. The Material Culture (Part II)*. C.F.W Higham and R. Thosarat (eds), *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol VI.* London: Society of Antiquaries of London, *Research Report no.* LXX.

White, J.C. 1990. The Ban Chiang chronology revised. In I.C. Glover and E. Glover (eds), *Southeast Asian Archaeology 1986. Proceedings of the First Conference of the Association of Southeast Asian Archaeologists in Western Europe*, pp. 121-9. Oxford: BAR *International Series* 561.

Williams, D. 1997. Ancient Greek pottery. In I.C. Freestone and D.R.M. Gaimster (eds), *Pottery in the Making. World Ceramic Traditions*, pp. 86-91. London: Trustees of the British Museum.