RECENT OBSERVATIONS OF RICE TEMPER IN POTTERY FROM NIAH AND OTHER SITES IN SARAWAK

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ABSTRACT

Hard evidence is limited for the introduction and spread of rice across Sarawak. Poor preservation of organic material in tropical soils means that rice (either as whole grains or husk) is unlikely to remain at most archaeological sites. Now, with the first discovery of rice (as pottery temper) at Gua Sireh, a re-examination of previously excavated earthenware is in progress. To date this has identified rice temper from 35 further sites, including the important Neolithic burials as Niah.

This paper reports new observations of rice temper in pottery from a large number of archaeological sites in Sarawak. Until ten years ago there was no evidence of early rice use in Northern Borneo. The situation changed in 1989, when Ipoi Datan and Peter Bellwood's excavations at the cave site of Gua Sireh found a carbonised rice grain included within the body of an earthenware sherd. This grain gave an AMS date of 3850±260 BP demonstrating the suprisingly early occurence of rice in this part of Island Southeast Asia (Datan and Bellwood 1991). Although it has not yet been directly demonstrated that the rice–tempered pottery at Gua Sireh was locally produced, fragments of carbonised rice husk have now been identified in the soils from the AMS dated levels at the site indicating that rice was definitely processed here (Beavitt *et al.* 1996).

Given this early availability of rice in Sarawak it is puzzling why it's uptake only appears within living memory over large areas of the interior (Beavitt 1997). It may have been that there have been earlier periods of experimentation with rice in Sarawak but conditions in open sites may not have favored the preservation of rice debris. This preservation of rice as pottery temper at Gua Sireh suggested to us the great potential of studying earthenwares from the large number of archaeological sites excavated and archived by the Sarawak Museum. Perhaps by examining the evidence in pottery from a series of coastal and interior sites we would be able to comment on patterns of early rice use within Sarawak.

METHOD

The task of looking for rice remains in pottery is favored by the relatively distinctive appearance of rice husk. Where preservation is good, rice husks can be readily identified in pottery using a simple microscope at low magnification (x10). However, where preservation is poor recognition becomes increasingly difficult, with very degraded husk impressions being hard to distinguish from other microtextural elements of the pottery fabric. In this study, a series of replicate rice-tempered briquettes was produced using modern-day rice husk, and other tempers (sand) with both site (Niah) and laboratory clays. In addition to demonstrating the appearance of rice inclusions, this exercise was designed to show to what degree overfiring of the sherd altered and obscured the appearance of the rice husk temper.

As the major aim of the 1997 fieldwork was to evaluate the potential of the pottery archive at the Sarawak Museum, the priority was to screen as many sherds from as wide a range of suitable sites as possible. A rapid system of processing was followed in which a low magnification examination was made on a single freshly made random fracture. In order to maintain a rapid sample throughput, all examinations were made using a wall-mounted customised binocular microscope in which the objective lens and stage had been removed. Using this system, sherds could be rapidly focussed at x10 magnification without the need to

adjust stage and illumination settings. Higher magnification (up to x30) proved to be necessary only to verify extremely poorly preserved rice husk impressions.

1997 RESULTS

Following the examination of a total of 10,315 sherds, nine new sites were identified which had rice inclusions in pottery. These sites are shown in Figure 1 and Table 1. Evidence for rice was found in 375 sherds which represents a find rate of 36 sherds per 1000 examined. These sites cover the period from 4000-3000 BP to 400 BP.

As work progressed it became apparent that rice was present in pottery in very different amounts. For example, at Niah West Mouth rice husk usually only occurs in very low quantities, often only as a single grain per sherd and in very few sherds. In contrast, at Niah Kain Hitam, where large numbers of rice-tempered sherds were identified, rice husk is usually present in large amounts. From the point of view of its effect on the properties of the potting clay, it is therefore possible to distinguish between those sherds in which:

1. Rice husk is present in relatively large amounts; in which case it could function as temper.
2. Rice husk is present only in minor amounts; i.e., at levels too low to act as temper, perhaps indicating that its inclusion was for cultural reasons or was accidental.

There are several ways in which this variation can be explained, depending upon whether the observed amounts are original or have been modified by firing. If the observed variation is original, there are two possible interpretations:

(i) different clays are being used which require different degrees of tempering, i.e., there is a technological reason for the use of rice husk.

(ii) rice husk frequency is independent of clay type, i.e., the presence of rice is related to cultural aspects of pottery manufacture or vessel use.

The other possibility is that the observed variation is not original but is due to differential preservation of the rice husk inclusions during firing. In this case there are three possible interpretations:

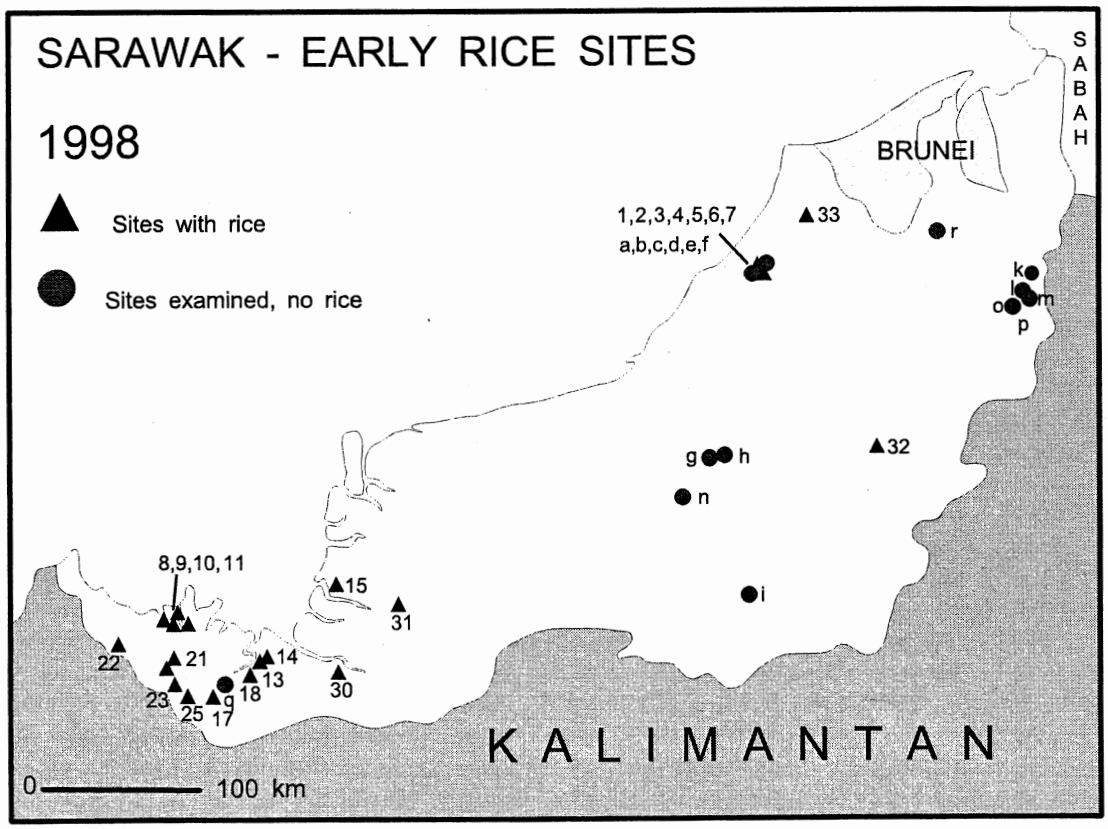

Figure 1: Early rice sites, Sarawak.

Table 1: Summary of all known Sarawak sites with rice in pottery, 1998. Sites known in 1991 - Gua Sireh (map key 17), (Datan and Bellwood 1991). Sites known by 1997: 1, 2, 3, 4, 8, 9, 10, 18

Rice in pottery			No rice in pottery		
Area	Site	Map key	Area	Site	Map key
Niah	West Mouth	1	Niah	L.Imam	a
	Kain Hitam	2		L. Sabrang	b
	L.Tulang	3		L. Kusing Sekolah	c
	L. Angus	4		L .Jeragan	d
	L. Batu Parang	5		L. Petang	e
	Dalam Kabon	6		L. Kusi	f
	Gan Kira	7	Inland central	Kakus	g
				Kakus Sarang	h
Coastal (Santubong)	Sungai Buah	8		Sungai Putai	i
	Tanjong Kubor	9	Highland east (Kelabit)	Batu Nawi	k
	Bongkissam	10		Batu Ritong	l
	Sungai Jaong	11		Pa Main	m
	Bukit Maras			Punan Ba	n
Simunjan	Ensika	13		Long Bora	o
	Sungai Ba	14		Long Abanaing	p
Kalakka	Tebing Tinggi	15			
	Sungai Kalakka				
Inland west	Gua Sireh	17	Inland west	Kedadum	q
	Gedong	18	East central	L. Angin (Mulu)	r
	Bukit Sandong	21	Not located	Gua Sebetong Begu	
	Sungai Benat	22		Batu Gading	
	Gua Tupap	23		Bukit Belhala	
	Gunong Staat	25			
	K. Semadang				
	Gua Roya				
	Pandawa				
	Bukit Sekunyit				
	Gua Chupak				
	Lobang Batu				
Inland west Central	Sekadang	30			
	T.T. Tandoh	31			
Inland east	Long Luar	32			
Miri	Bakong	33			
Limbang	Gua Baya				
Not Located	Batu Tekuruk				
	Tanjong Sangidum				

(i) Fabrics which are more open (i.e., porous) have experienced a greater loss of organic inclusions (i.e., rice husk) as the bodies of these pots will tend to be more fully oxidised.
(ii) Coarser/sandy clays have not been able to take a detailed impression of the husk surface and therefore do not reliably record the former presence of rice.
(iii) The rice husk was pounded to a relatively small size, making it both difficult to recognise and more susceptible to loss on firing.

Laboratory analysis and replicated firings of test briquettes from Sarawak clay samples are currently being undertaken to model the preservation of rice husk during firing. This will allow us to determine whether the observed levels of rice husk are original and therefore enable a sensible comparison of rice temper frequency between sherds. These findings will be published in a forthcoming report which examines the provenance of the Niah earthenware fabrics.

1998 RESULTS

Again we examined previously excavated material using a low power lens (x10), but now our better understanding of how rice is variably preserved in pottery allowed us to modify the level of observation according to the nature of the fabric. This more selective approach proved to be very successful with 26 new sites being identified. Also, at the Neolithic cemetery at Niah West Mouth we were able to find rice inclusions in pottery associated with 14 more burials. The results are listed in Tables 1 and 2 and located on Figure 1.

NIAH

As in 1997, nearly all the 1998 observations of rice husk in pottery from Niah West mouth were of only very few grains or fragments, and these had always been totally combusted to leave just a mould. Perhaps the most important find was rice in a sherd from under burial 110 which has a C14 date of 4990 BP (Brooks *et al.* 1977) and which, pending verification, may prove to be the earliest rice yet found in Borneo.

The case of this particular burial illustrates the needle-in-a-haystack task of finding rice at these low levels. Only a single small sherd was available measuring 2.5 x 3.5 cm. This sherd was chipped into 240 rice-sized pieces over a period of 3 hours before rice was found in the last three pieces (which were directly under the museum catalogue number!).

The consistent low levels of rice in the burial associated pottery from the West Mouth at Niah supports the previous conclusion that rice was not added as temper (the observed quantities are too low for it to have been effective). Instead it records the accidental inclusion of rice debris during potting. Most of these moulds are contained within the body, suggesting either that the rice had become incorporated before forming, or that rice adhering to the surface had migrated into the body during paddling (all the earthenwares were made using the paddle and anvil technique). Rice at these low levels was also found in pottery from the other 1998 Niah sites, i.e., L. Bau Parang and Dalam Kabon, but Gan Kira pottery had both low and medium amounts.

Table 2: Rice tempered pottery from Neolithic burials at Niah West Mouth with published C14 dates (index A = collagen-rich sample with acceptable date, see Brooks *et al.* 1977)

Burial	Date (BP)	Collagen Index
2		
52		
57	2520 ± 130	B
59a		
67	2630 ± 80	A
75	2630 ± 375	D
76	4160 ± 90	A
103		
106		
110	4990 ± 90	A
159		
187		

DISCUSSION

Prior to this study, rice was known to occur only at one archaeological site in Sarawak (Gua Sireh). Re-examination of previously excavated pottery, using a simple low-level approach, has now demonstrated the presence of rice in 35 more sites. From the age and distribution of the these sites we can now make the following broad comments on the pattern of rice use in Sarawak, acknowledging that these may be subject to revision as this project proceeds.

1. Rice was being used at the coastal plain sites of Niah from as early as 4990 BP and at Gua Sireh by 4300BP. If the early dates for Niah can be verified this possibly pre-dates the Austronesian migrations into Southeast Asia which are generally considered responsible for the introduction of rice farming in Sarawak (Spriggs 1989). At Niah, rice in earthenware is present only in very low amounts and whole grains rather than husk are the norm here, observations that suggest that it occurs as accidental inclusions rather than temper. This type of occurrence of rice in pottery is also seen at Gua Sireh, e.g., the sherd dated at 4330 BP (Datan and Bellwood 1991), but at this site there is a (later?) transition to the use of genuine rice husk temper.
2. Widespread use of rice is demonstrated at the numerous coastal sites from the 10th century AD (e.g., Sungai Jaong, Santubong). At all of these sites the earthenwares

consistently contain high proportions of rice temper, indicating a reliable supply of husk for tempering. It is plausible to assume that if rice had been imported into these coastal sites it would probably have been de-husked, as this would reduce the cargo volume by nearly half. The observation of husk temper therefore argues for sustained local rice cultivation in this period.

3. No evidence for early rice has been found for inland sites, including the Kelabit highland sites where the antiquity of wet rice cultivation has been generally assumed. Of course, rice may have been available at the time these earthenwares were made but was not being processed near the clay source or potting area. Many of the interior sites appear to have a different tempering tradition than those of the coastal plain, using predominantly coarse shale for temper. This temper is more readily available in the interior but is also occasionally seen at Niah.

Therefore, despite the availability of rice from the early Neolithic and again from the early historic period, this study has produced no evidence for rice cultivation in the interior until late historic times (and this is limited to a single observation at Long Luar, which is probably a relatively recent site). These results support the idea stated previously (Beavitt 1997) that the spread of rice into the interior did not occur until the migration of the rice-growing Iban and Kayan peoples from the 15th century. Perhaps the situation for northern Borneo was that the limited populations of the interior did not justify the labour-intensive practice of growing hill rice and this situation only changed when the population of the interior increased dramatically following the Iban and Kayan influx.

The outstanding requirement of this project is now to verify the date of the rice-tempered pottery from Niah West Mouth. Unlike other sites in Sarawak, where carbonised rice has been found in pottery (e.g., Santubong, Gua Sireh), the evidence at Niah West Mouth is always in the form of rice husk moulds, the actual rice grains having been completely burnt out. Because of this there is no opportunity for direct carbon dating.

As this limitation became evident, pottery was targeted which was unequivocally associated with C14 dated skeletal material from the Neolithic burials. Although this meant reducing the odds of finding rice temper by further limiting the range of suitable sherds for inspection, its occurrence was successfully demonstrated in pottery from 16 different burials. The oldest of these burials has a published C14 date of 4990 BP (Brooks *et al.* 1977), and therefore we are now possibly looking at the oldest evidence for rice in Borneo. Clearly, as acceptance of this associated date will result in a significant revision of our understanding of rice cultivation in the region, we would like to secure direct dates on the pottery.

Given the lack of suitably preserved rice grains for C14 or AMS dating, one possibility currently under consideration is that of thermoluminescence (TL) dating of the pottery body itself. Provided that the Niah pottery is of sufficient sensitivity, this method is capable of yielding good dates given the dry nature of the site (which eliminates many of the problems of modeling groundwater-related variables). The feasibility of TL dating on Niah West Mouth pottery is currently being evaluated on a limited number of sherds at the Research Laboratory for Archaeology, Oxford University. A successful outcome to this program of TL dating would be not only the dating of the rice-tempered pottery itself, but also an independent dating of the associated burials.

CONCLUSIONS

This work has been successful in advancing our understanding of the archaeological occurrence of rice, allowing us for the first time to make tentative comments on the pattern of rice use in Sarawak. The study of these earthenwares, beyond the usual consideration of their style and form, has been demonstrated to have tremendous potential. Using fabric analysis we intend to build on this initial work in order to more fully understand the patterns of pottery production and trade, basing our investigations on the material archived at the Sarawak Museum.

Our findings have shown that rice was being used at Niah from a very early period (possibly as early as 4990 BP), perhaps predating or contemporary with the rice found at Gua Sireh (4300 BP). Both of these occurrences pre-date the Austronesian migrations of 3000-4000 BP that had been considered to have introduced rice into the region. The next phase of our research will be to investigate the cultural similarities between these Niah and Gua Sireh groups by reconstructing and comparing their pottery manufacturing technologies. The selection and preparation of clays, and tempers, the methods of construction and decoration and the degree of firing used can all be ascertained by petrographic analysis of the pottery fabrics. As can often be shown, the preparation of the raw clay and choice of temper (in this case, rice) may be more dependant on cultural tradition than the physical limitations of the available potting clay. In these cases similar pottery technologies may suggest some degree of cultural linkage.

ADDENDUM

Since this issue of BIPPA went for layout, the following important information has come to hand. Optically-stimulated luminescence dates run directly on three sherds of burial pottery from Niah are as follows:

Code	Sample ID	Date (BP)	Date from Brooks *et al.* 1977:28
OxL-1037	Niah Burial 67	2160±110	2630±80
OxL-1038	Niah Burial 76	1890±100	4160±90
OxL-1039	Niah Burial 187	2820±150	-

In addition, moulds of complete single rice husks (indicating incidental incorporation rather than added temper) were found in three sherds from Bukit Tengkorak in Sabah, two of which were unstratified material (probably resulting from looting according to Peter Koon, Sabah Museum, pers. comm.). One sherd, however, labelled BT 95 R36/Q3 18 (85-90), from Stephen Chia's excavations, is from a fairly early context in the history of the site (c.3000 BP).

Moulds of single whole rice husks have also been observed in sherds from the Lubang Angin site in Gunung Mulu (Datan and Bellwood 1991).

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