THE EXCAVATION OF A LATE PREHISTORIC CEMETERY IN NORTHWEST CAMBODIA.

Dougald O'Reilly[I], Kate Domett[II], Pheng Sytha[III]

Introduction

Phum Snay is a village located along National Route 6 in Preah Neat Prey District, Banteay Meanchey Province, NW Cambodia (48P UTM 0305983/1506856 N13° 37'26.3" E103°12'23.5") (Figure 1). The village of Snay is located on the edge of a large natural mound, three km in diameter. It is one of several small hamlets on the edge of this hummock. The Anlung Thma River is located approximately 100m to the west of the site. During 2000, road-work was undertaken to link the village with National Route 6. This construction work revealed the presence of a number of inhumation burials. Investigation proved the burials to be prehistoric, and they were associated with a great deal of material culture including bronzes and semi-precious stones.

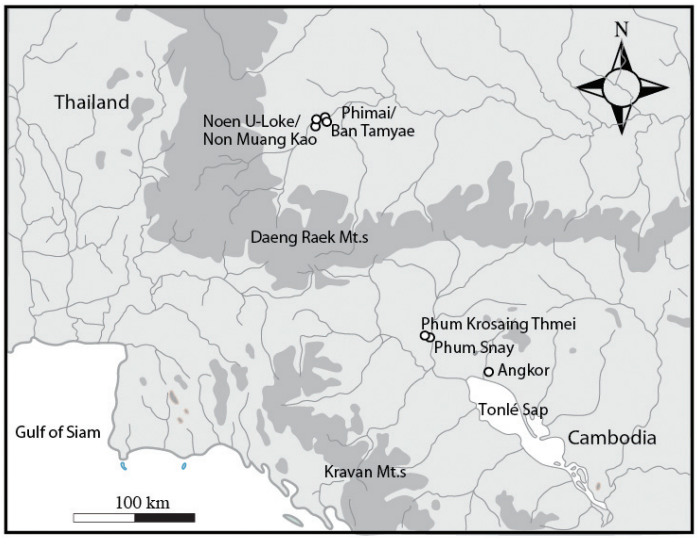

Figure 1. Map showing sites mentioned in the text.

I University of Sydney, Sydney, Australia.
II James Cook University, Townsville, Australia.
III Royal University of Fine Arts, Phnom Penh, Cambodia.

The discovery led to widespread looting at Phum Snay. The extent of the archaeological remains is difficult to gauge but the looting covers an area of .24 square km on the edge of the large natural mound (Figure 2). There is a large, apparently anthropogenic mound comprised of rocks near the centre of the cemetery (Figure 3) which has recently been disturbed.

Figure 2. Aerial view of Phum Snay and surrounds.

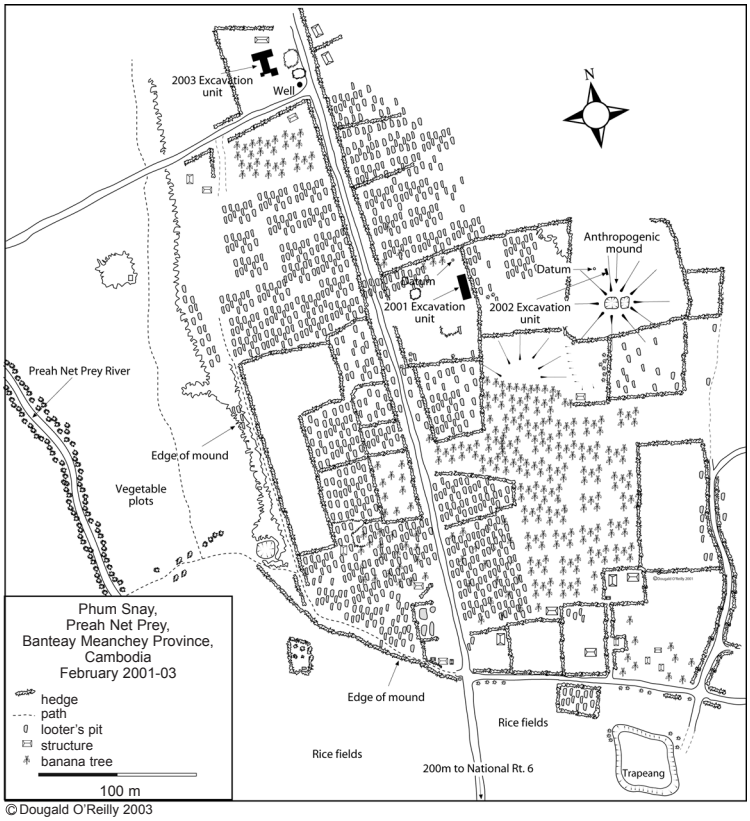

Figure 3. Map of Phum Snay showing excavated areas.

The widespread looting led the Royal University of Fine Arts to undertake rescue excavations at Phum Snay, funded by UNESCO/Japan Funds in Trust Project. In February 2001, a 15 x 5 m area was selected in a field along the dirt track that leads to Phum Snay. This area was divided into three, 5 x 5 m units and labelled as part of a larger grid, the centre point of which was located in the northwest corner of the first unit (Figure 4). This unit was therefore called S1E1. The other two units ran south from this point and were labelled S2E1 and S3E1. A concrete datum was set up to the north-east of the unit for the purpose of measuring levels.

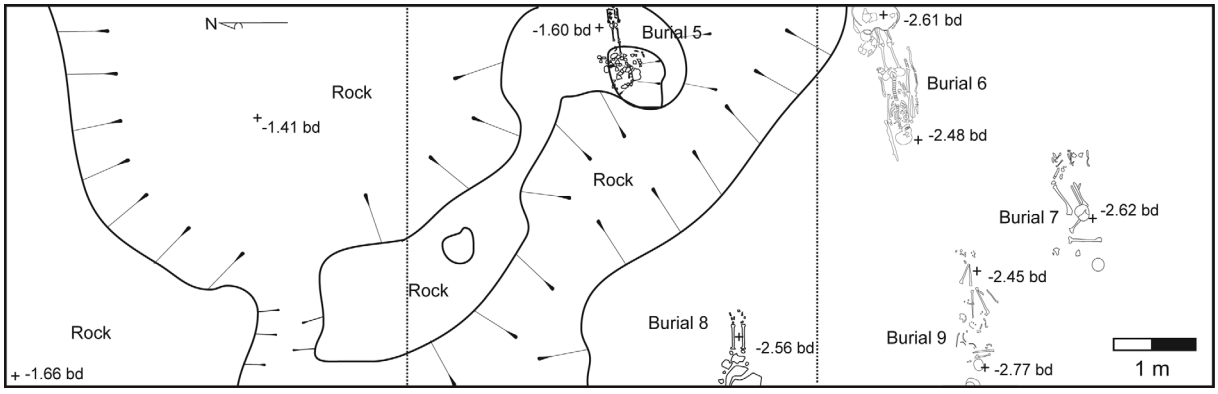

Figure 4. Map of area excavated in 2001.

The site was excavated, following the natural stratigraphy where possible, using both layers and 10cm spits. The soil was sieved using six mm screens.

Layer 1

Unit S1E1

The first 10 cm of all the units represents a zone disturbed by agricultural activity. The field in which the excavation unit was located is occasionally used to grow vegetables. Very few artefacts were recovered in these upper layers, save for some eroded pot sherds and a 9 mm bullet. Pieces of baked clay and red sandstone became more common near the bottom of Level 1 spit 2 (L1:2). Layer 1:3 revealed a number of pot scatters but little else. Layer 1:4 was only 5 cm deep as the soil color changed below it. This change heralded the advent of Layer 2.

Unit S2E1

Layer 1:1 and Layer 1:2 revealed similar artefacts as to those found in S1E1, ceramic sherds and glass beads. Layer 1:3 revealed a spindle whorl and a long, orange glass bead as well as

a good deal of pottery. In this unit, as in the last, spit 4 was only 5 cm deep (Figure 5).

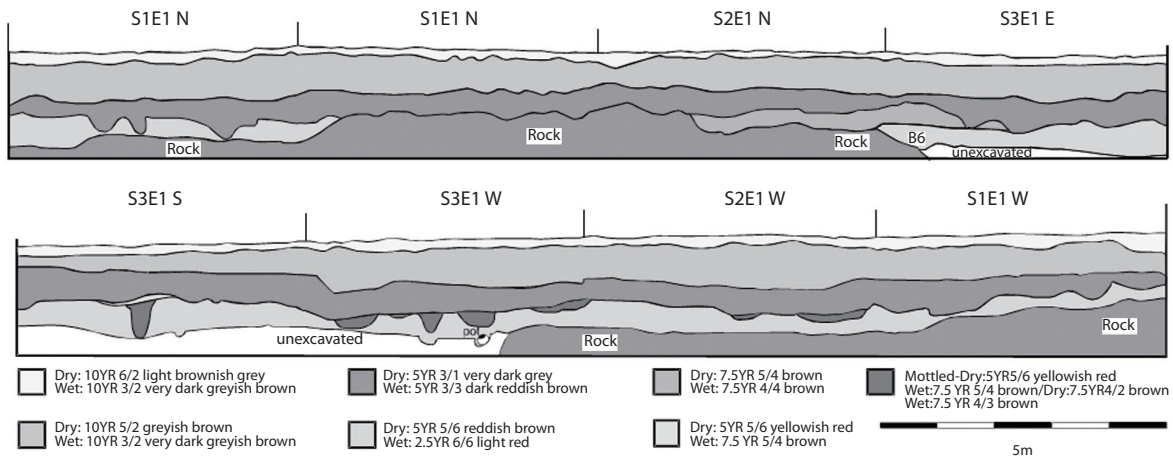

Figure 5. Profiles of Phum Snay excavation of 2001

Unit S3E1

Spits 1, 2 and 3 in S3E1 revealed very little except eroded sherds and a few glass beads.

Layer 2

Unit S1E1

Layer 2:1 revealed greater amounts of well preserved pot sherds. There was also an increase in the amount of faunal material. L2:2 was darker (Figure 5) and several features were defined which contained scatters of ceramic sherds and whole pots. Unidentifiable iron artefacts were also recovered in this layer. Layer 2 was approximately 50 cm in depth. At L2:5 the layer designation was changed to 3:1, distinguished by a yellowish soil and soft texture.

Unit S2E1

Layer 2:1 revealed several pot scatters, a projectile point and a carnelian bead. The number of beads recovered increased in the second spit (L2:2). A human central incisor and fragment of an adult maxilla were also found.

The surface of 2:3 revealed a grave cut along the eastern baulk comprising a yellow glass bead and pot sherds in a sandy pit. Burial 1 was a disturbed adult burial. This burial consisted of cranial fragments and teeth, hand bones, a few vertebrae and ribs, a clavicle, left tibia, some foot bones. This adult was estimated to be a middle aged male based on features of the cranium and

molar wear. This man had evidence of severe joint degeneration in the cervical spine. The dentition showed evidence of caries, linear enamel hypoplasia, pathological tooth loss and ablation of some anterior teeth.

Another disturbed burial, Burial 2, was located in layer 2:3 towards the eastern baulk. This burial consisted of part of the right femur and pelvis, a few vertebrae, part of the pectoral girdle and the right temporal bone, all in good condition. This adult was estimated to be female based on pelvic and cranial features and was older than 25 years. This woman also had evidence of pregnancy in the pelvis.

Unit S3E1

Layer 2 in unit S3E1 revealed much the same artefacts as the other units. Some ash-glazed and iron-glazed stone-wares were also found. There was an increase in the number of features, especially postholes filled with red sand.

Layer L2:2 contained two features consisting of lumps of burnt clay, in the centre of which were a number of animal bones.

The central area of unit S3E1 in Layer 2:5 revealed a linear scatter of pottery sherds and complete vessels on a north-south axis. The soil around the sherds was dark and included some charcoal fragments while the soil outside of this area was sandier and of a darker red. It is unlikely that the area was used for cooking as there is very little bone but it may represent a discard area.

The amount of pot sherds across all of the units in Layer 2 was significantly higher than in the preceding layer (Figure 6). This increase may suggest that the area was used for domestic activity but little other evidence of this was found except for the faunal material and the presence of hearth-like features in Unit S3E1.

Layer 3

Unit S1E1

Layer 3 is the last layer that lies atop the natural substrate of the site and is markedly different in color to the preceding layer. It is similar in color, although darker, than the substrate which corresponds to Munsell 5YR 5/6 reddish brown (wet) and 2.5 YR 6/6 light red (dry).

As excavation continued in S1E1, a substantial rock dome began to appear, the surface of which was heavily pitted and grooved as if by water action. This material appears to be a conglomerate of quartz and lime.

The amount of pottery found decreased around the rock feature although some scatters of pot sherds and animal bone were recovered.

Excavation revealed that the highly weathered or leached rock formation covered the entire unit of S1E1 and would seem to account for the decrease in the number of artefacts found.

Unit S2E1

The rock formation uncovered in unit to S1E1 continued in the adjacent unit. A burial was uncovered on the northwest side of the unit sitting directly atop the rock formation. Burial 5 was a well preserved, near complete and articulated child skeleton. Nearly all long bones were complete and much of the axial skeleton was present. The cranium and mandible were disturbed but many teeth were present. The diaphyseal lengths and dental eruption pattern suggest a child of 2-3 years. The infant was interred with a set of ivory bangles on each arm and bronze anklets on each leg. Four pots were broken at the feet of the infant and some glass beads were recovered from the thoracic area.

A further burial was recovered at the western baulk in Layer 3:5. Burial 8 lay atop the natural substrate and comprised the well preserved lower half of an articulated adult skeleton. The upper portion of the burial remained in the baulk. Pelvic features indicated this adult was probably a female. The lack of fusion between the first and second sacral vertebrae suggest the woman was probably less than 25-30 years of age at the time of her death. The length of the right tibia allowed an estimate of stature around 163.6 cm. The right tibia had evidence of healed periostitis (infection) in the lower midshaft on the posterior aspect. The burial was associated with two pots, and bronze bangles adorned the left and right wrists.

Unit S3E1

In Layer 3:1 the artefacts were concentrated in the eastern half of the square. Much of this layer appeared to be heated, relative to a feature found in Layer 2:5. The surface of 3:1 sloped down toward the southwest.

Human bone was encountered in Layer 3:2 in the north-west quadrant of the square. Burial 3 was found to be an incomplete disturbed adult burial situated in clean sand. The burial was mostly comprised of poorly preserved fragments of various long bones and ribs, a few hand and foot bones and one molar. Little information could be gained from this incomplete skeleton except that it is an adult of moderate gracility. No artefacts were found in association with the burial.

Another disturbed adult burial (B4) was also situated in Layer 3:2. This burial comprised poorly preserved fragments of the right pectoral girdle, a few ribs and vertebral fragments, part of the left humerus, some hand bones, a fragment of the left tibia, and one third molar. The bone from this individual was of a moderately robust adult but no other evidence for sex or age was

observed. No artefacts were found in association with the burial. Burial four returned the only radiocarbon determination for the excavation of this area rendering a date of 2297 BP to 2256 BP ± 30 BP (R28863/2, NZA22375) or 207 calB.C. to 53 calB.C. at 2 σ.

In Layer 3:3 a large pot was discovered during the sectioning of what appeared to be a post-hole. This large vessel was found to be in association with human remains (B7). The semi-articulated remains of an adult were found at a range of depths. The uppermost bones included pieces of the cranium, femora and one tibia. Further down were the right pectoral girdle, both humeri, hand and foot bones, and the right pelvis, both patellae, two more tibiae and a fibula. Four teeth were also found, one with caries. Evidence of ablation of anterior teeth was also observed. The bones of this individual (excluding the uppermost tibia which did not belong) were quite gracile and the greater sciatic notch morphology suggested an adult female, although features of the cranium were more masculine. There was a moderate degree of wear on the loose incisors but little other information on which to base an age estimate. Long bone measurements of the humeri and left tibia were possible and the latter estimated stature to be 155.3 cm. There were three broken but complete pottery vessels found in association with Burial 7 as well as 10 spindle whorls and some bronze fragments.

Burial 6 was discovered in Layer 3:5 at the interface with the natural substrate (Figure 4, Figure 6). The grave abutted the natural rock formation that covered most of unit S3E1. This burial comprised the articulated remains of an adult in excellent condition. All bones were represented although a few were incomplete. This adult burial was estimated to be male based on evidence from the pelvis and skull. This individual was a young adult, within the range of 18-22 years based on the appearance of the pubic symphysis and state of fusion of other epiphyses. The upper canines and lateral incisors had been ablated and there was evidence of periapical infection of some posterior teeth. The right clavicle was 8.6 mm shorter than the left and was also thicker in the shaft. This may be the result of a well-healed fracture of the right clavicle although no callus was identified. There was also evidence of joint degeneration in the lower lumbar vertebrae and Schmorl's nodes in the lower thoracic vertebrae, unusual for a young man. The stature of this individual was estimated

Figure 6. Burial 6 from 2001 excavation of Phum Snay.

Figure 7. Photograph showing glass earring on individual excavated in 2001.

to be 160.8 cm based upon the lengths of the femur and tibia.

Burial 6 was found in association with a number of artefacts. The skull was adorned with a green glass earring of considerable size (Figure 7). At the neck the individual had a large sun bear canine that bore no evidence as to the method of suspension (O'Reilly, von den Driesch et al. 2006). Glass beads were found scattered in the thoracic area. Two ivory bangles were associated with the burial, and an unidentifiable bronze object was found clasped in the left hand. This hand also bore a number of bronze finger rings. To the right of the burial, an iron sword was found along with the hind leg of a deer. Another unidentifiable iron implement, possibly a weapon, was found at the shoulder. A cache of iron projectile points was recovered at the feet as were four ceramic vessels.

A final burial (B9) was encountered in Layer 3:5 where it met the surface of the natural substrate (Figure 4). This burial was considerably disturbed and lay below the water level of the site. Excavation was difficult due to the continual seepage of water into the area of the burial. Burial 9 comprised a semi-articulated adult skeleton in good condition. Nearly all bones were present except the right forearm. Pelvic morphology and other features estimated this adult to be a possible female, although some features were equivocal. This woman was probably a young adult based on partial fusion of the first and second sacral vertebrae and the light wear of the dentition. A middle hand phalanx had a healed shaft fracture. The upper canines and lateral incisors were ablated. The right humerus and right femur lengths were taken and the latter indicated stature to be 164.9 cm.

The artefacts recovered were found in a disturbed state, mixed with the human remains. One spindle whorl and a whole pot were recovered. Bronze rings were found on the left hand and one ring was found loose in the matrix with a bronze bangle. Several black glass beads were recovered from the area around the bones. Faunal remains in the burial comprised two buffalo hooves and a buffalo horn.

Ceramics

A total of 74.0 kg (349,131 sherds) were recovered in the excavation of the three layers at Phum Snay. The majority of the ceramic material was located in Layer Two (Figure 8).

The majority of the pottery was made using the paddle and anvil technique and the exterior surface is smoothed on most of the pots. A proportion was cord-marked or paddle impressed (Figure 9).

Aside from plain smoothed sherds there were a number of other decorative techniques employed at Phum Snay including, glazing, slipping, painting and burnishing. The relative proportions of each of these techniques are shown, by layer, in Figures 9-12. Sherds that are glazed are of two types, ash or lime-glaze and iron-glaze (Figure 13). The ash-glaze is created by mixing wood ash and

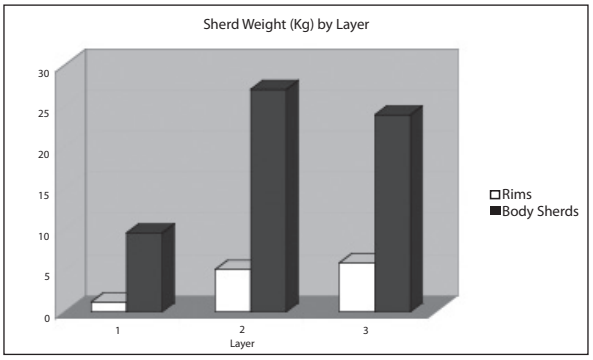

Figure 8. Sherd weight by layer from 2001 excavation.

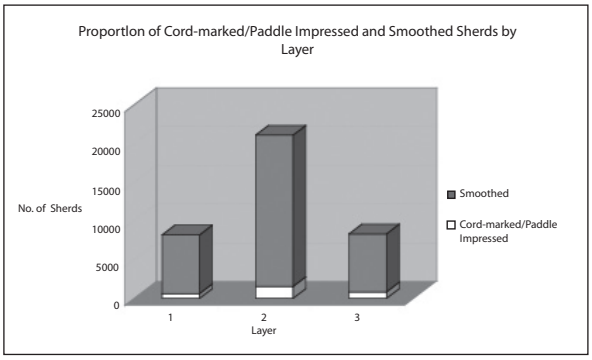

Figure 9. Proportion of cord-marked/paddle-impressed sherds and smoothed sherds from 2001 excavation.

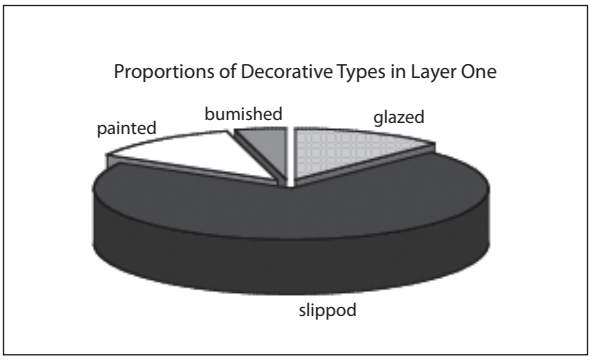

Figure 10. Proportion of decorative types in Layer one in 2001 excavation.

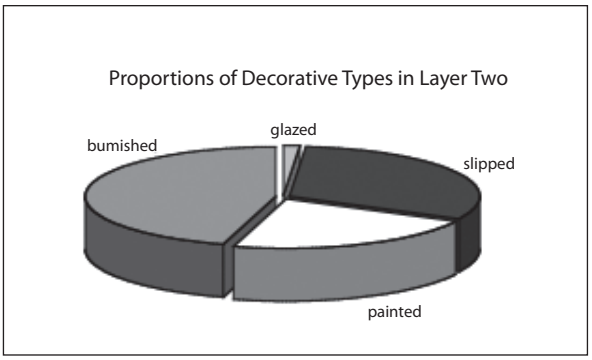

Figure 11. Proportion of decorative types in Layer two in 2001 excavation.

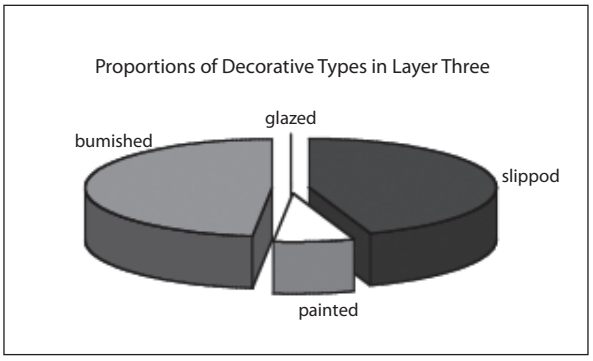

Figure 12. Proportion of decorative types in Layer three in 2001 excavation.

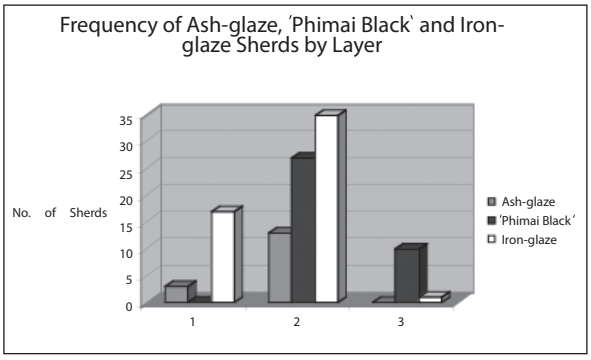

Figure 13. Proportion of ash-glaze, 'Phimai black' and iron-glaze sherds by layer in 2001 excavation.

clay that contained a small amount of iron oxide, which created a greenish-yellow glaze. The clay used to make these vessels is of a light color and the same clay was probably used in the glaze (Cort, Farhad et al. 2000). Although this technique was known as early as 1400 B.C. in China, the Phum Snay examples probably date to much later. They are very similar to the vessels produced at the Tani kiln site near Angkor and some of the bases are incised with what appear to be maker's marks.

The iron-glaze sherds are much more robust than the ash-glaze sherds. They are of a dark bluish-black color and often have laterite inclusions. The glaze is also of a much darker brown color. The difference in color results from the addition of extra iron oxide to the ash glaze (Cort, Farhad et al. 2000).

Other decorative techniques are also present at Phum Snay including slips, paints and burnishing. The slip used at prehistoric Phum Snay is of a reddish hue and the paint is of a similar color or brown. None of the burnished sherds are highly polished, the majority having only a slight reflective quality.

It is apparent that a wide variety of vessel forms was utilized at Phum Snay judging from the wide variation noted in the rim forms, with over 100 forms being identified.

A small component of the provenanced pot sherds are similar to what Welch (1985) identifies as the 'Phimai tradition' (Figure 13). In Thailand, this tradition includes ceramics that are primarily chaff tempered although sand, laterite or grog may be used in conjunction with the rice husks. The surfaces are sometimes slipped or burnished. The most distinctive vessels of this type are the 'Phimai black' pots but the tradition also includes thick fibre tempered earthenware (Solheim 1965; Solheim and Ayers 1979 in Welch 1985).

In Thailand, vessels of this tradition take a number of forms, the most common being a large ovoid jar with a constricted neck and everted rim. The bodies of these pots are usually thin and cord marked while the rims are thick and undecorated. Bowls are also a common vessel type within the 'Phimai tradition', demonstrating much variation. Many of the sherds are burnished to varying degrees and some vessels are pattern burnished, this being the most common decorative technique. The burnishing takes many forms including horizontal and diagonal streaks, spirals and lenticular patterns, cross-hatched squares and diamonds on pot bodies and less frequently, impressed circles or banded grooves on pot shoulders.

'Phimai tradition' vessels were usually fired in an oxygen-poor atmosphere, with some probably being removed prior to complete blackening. A characteristic of pots of this tradition is a flaky and pitted appearance caused by the burning out of the rice chaff.

The stoneware sherds from Phum Snay probably correspond to the 'Khmer' or 'Lopburi tradition' at sites in Thailand (Welch 1985) (Figure 13).

Unprovienanced artefacts

Unfortunately, Phum Snay has been the focus of intensive looting by the inhabitants of the village. Copious amounts of artefacts have been recovered by these illicit activities. The villagers report the presence of thin-walled bronze bowls, iron swords and daggers, axes, gold, carnelian, agate and glass beads, bronze helmets, and ceramic "epaulettes", some with bronze bull's horns affixed to them. This bovine motif is common among the looted artefacts from Phum Snay. There are many examples of bronze finger rings with bull's horns and local inhabitants engaged in looting report that some of the bronze helmets are horned.

The looting activity has resulted in many incomplete ceramic artefacts being discarded. There are many broken ash-glazed vessels as well as 'Phimai black' bowls, similar to those found at Ban Tamyae and other sites in Northeast Thailand (Payom Chantaratiyakarn 1984; Payom Chantaratiyakarn 1984; Welch 1984; Welch and McNeill 1988-9; Fine Arts Department Thailand 1992).

An assortment of human skeletal material was collected from part of the looted area. These remains included eight crania and a variety of long bones, both adult and subadult, many of which were complete. The skeletal remains appear to have been discarded during the looting activity.

Discussion and conclusion

The Pre-Angkorian period of Cambodia is little understood. The majority of archaeological research carried out in Cambodia prior to the 1970's focussed on the post-800 AD era. Only a few prehistoric sites received serious attention (Carbonnel 1979; Groslier 1966a, 1966b; Levy 1943; Malleret 1959; Mansuy 1902, 1923; Mourer and Mourer 1970; Noulet 1879; Pavie 1904; Saurin 1969). Recently, Albrecht *et al.* (2001) have argued that the circular earthwork sites of eastern Cambodia, may date to the Iron Age. They base their conclusions on the presence of lithophones, glass bangle fragments, and possible lumps of iron ore from one site. They also cite Do (Do 1999) who has done a comparative analysis with dated sites in Nambo, Vietnam. Do believes that the artefacts from the circular earthworks probably date to *c.* 1550-550 B.C. These sites have been previously ascribed to the Neolithic (Malleret 1959; Groslier 1966; Carbonnel 1979; Pham Duc Manh 1996; Kojo and Peng 1997; Dega 1999; Dega 2001) on the basis of artefact assemblages, including many stone adzes and the absence of metal artefacts.

The radiocarbon dates from these sites are problematic. Recent dates have been published which show the deepest layers at one site (Trameng near Memot) to date to 2290-2030 CAL B.C.

Another sample from the upper layers at Chi Peang provided a date of 400-350 CAL B.C. or 320-200 CAL B.C. (Dega 2001:154-6) while other samples place the dates from 180 B.C.- A.D. 800 (Carbonnel 1979) and 1920-1690 CAL B.C. and 2620-2350 CAL B.C. (Albrecht, Haidle et al. 2001).

Clearly these sites cannot yet be confidently ascribed to the Iron Age based on the present evidence. Further research may resolve the dating issue of the circular earthwork sites of eastern Cambodia.

Prehistoric remains have been reported in the Angkor region (Groslier 1979) but until recently these have been neglected. Higham, Pheng et al. (2001) excavated a small area at the 10th century temple, Baksei Chamkrong. According to Higham *et al.* (personal communication) this test unit confirmed the presence of a prehistoric Iron Age settlement on the northern side of the Bakheng. The prehistoric occupation layer contained a possible iron working facility, cord-marked and red-slipped pottery and a glass bead.

Another recently excavated site in the Angkor region has revealed ceramic vessels similar to Phimai Black vessels found in the Mun River Valley. Prei Khmeng is a temple site located near the Western Baray near the Angkor temple complex. The brick temple, which has been excavated by the École Française d'Extrême-Orient and the Authority for the Protection and Management of Angkor and the Region of Siem Reap (APSARA), sits atop pre-Angkorian remains including inhumation burials (Pottier, personal communication).

Phum Lovea is another possible Iron Age settlement located in the Angkor area. This site appears to share a similar morphology to the moated sites of Northeast Thailand as it is surrounded by ditches and banks. The site was investigated by Malleret (Malleret 1959), whose preliminary excavations revealed nothing of substance, although there were reports of undated iron and bronze objects being unearthed from the site.

The discovery of 'Phimai Black' style ceramics may indicate that Phum Snay was a component of an interaction network which stretched over the Daeng Raek mountains. This type of pottery is commonly found in Thai archaeological sites dating to the Iron Age including, Non Ban Kham and Ban Tamyae (Welch 1985), Non Tung Pie Pone (Nitta 1995), Ban Prasat (Fine Arts Department Thailand 1992), Ban Suai (Parker 1966), Nakon Ratchasima (Welch 1985), Muang Phet (McNeill 1997), Noen U-Loke (Higham 1998; Higham 1998; Higham and Thosarat 2000) and Non Muang Kao (O'Reilly 1998).

The presence of ceramics with an ash-glaze poses a further problem. These ceramic forms are usually dated to the 10th century AD and their association with ceramics that bear a strong resemblance to Phimai Black vessels would appear to be an anachronism.

There can be no doubt that Phum Snay represents an important late prehistoric settlement in the later Angkorian hinterland. Regrettably, further large-scale scientific excavation may be impossible as most of the site has now been looted and the archaeological deposits destroyed.

References Cited

Albrecht, Gerd; Haidle, Miriam; Chhor, S.; Heang, L. H.; Heng, Sophady; Heng, T.; Mao, S.; Sirik, K.; Som, S.; Thuy, Chanthourn and Vin, Lay, 2001, "Circular Earthworks Krek 62/52: Recent Research on the Prehistory of Cambodia," *Asian Perspectives* 39 (1-2): 20-46.

Carbonnel, Jeane-Pierre, 1979, "Recent Data on the Cambodian Neolithic: The Problem of Cultural Continuity in Southern Indochina," In R. B. Smith and W. Watson, eds., *Early South East Asia: Essays in archaeology, history and historical geography*. New York, Oxford University Press: 223-226.

Cort, L. A., Farhad, M. and Gunter, 2000 *Asian Traditions in Clay*. Washington D.C.: Smithsonian Institution.

Dega, Michael, 1999, "Circular Settlements within Eastern Cambodia," *Bulletin of the Indo-Pacific Prehistory Association* 18: 181-190.

Dega, Michael, 2001, "Prehistoric Circular Earthworks of Cambodia," unpublished Ph.D. dissertation, University of Hawai'i, Manoa, University Microfilms.

Fine Arts Department Thailand, 1992, *Ban Prasat; An Archaeological Site*, Bangkok: F.A.D. Thailand.

Groslier, Bernard-Phillipe, 1966a, "Découvertes Archéologiques Récentes au Cambodge," *Kambuja* 16: 76-81.

Groslier, Bernard-Phillipe, 1966b, *Archaeologia Mundi: Indochine*. Geneva, Nagel.

Groslier, Bernard-Phillipe, 1979, "La Cité Hydraulique Angkorienne. Exploitation ou Surexploitation du Sol?," *Bulletin de l'École Française d'Extrême-Orient* 66: 161-202.

Higham, Charles and Thosarat, Ratchanie, 2000, "The Origins of the Civilisation of Angkor," *Antiquity* 74: 27-28.

Higham, Charles, F. W., 1998, *Thailand: From Prehistory to Sukhothai*. Bangkok, River Books.

Kojo, Yashuki. and Peng, Sytha, 1997, "A Newly Discovered Earthwork in Southeastern Cambodia," *Journal of Anthropological Science* 105 (3): 181-7.

Levy, Paul, 1943, "Recherches Préhistoriques dans la Région de Mlu Prey," *Publications de l'École Française d'Extrême-Orient*, Hanoi, École Française d'Extrême-Orient 30.

Malleret, Louis, 1959, *L'archeolgie du Delta du Mekong*, Paris, Bulletin de l'École Française d'Extrême-Orient.

Malleret, Louis, 1959, "Ouvrages Circulaires en Terre dans L'Indochine Méridionale," *Bulletin de l'École Française d'Extrême-Orient* XLIX (fasc. 2): 409-435.

Manh, P. D., 1996, "Proto-history and Pre-history of the Eastern Part of Nam Bo: Past and Modern Perceptions," *Vietnamese Studies 1996/2, Special: Archaeological Data II* New Series 50 (120): 63-119.

Mansuy, Henri, 1902, *Stations Préhistoriques de Samrong-Sen et de Longprao (Cambodge)*, Hanoi, F. G. Schneider.

Mansuy, Henri, 1923, "Contribution a L'étude de la Préhistoire de l'Indochine. Résultats de Nouvelles Recherches Effectuées dans le Gisement Préhistorique de Samrong Sen (Cambodge)," *Mémoires du Service Géologique de Indochine* 10 (1).

McNeill, Judith, 1997, "Muang Phet: Quaritch Wales' Moated Site Excavations Reappraised," *Bulletin of the Indo-Pacific Prehistory Association* 3 (16): 167-76.

Moorrees, C.F.A., Fanning, E., A. and Hunt, E.E., 1963, "Age Variation of Formation Stages for Ten Permanent Teeth," *Journal of Dental Research* 42(6): 1490-1502.

Mourer, Cécile and Mourer, Roland, 1970, "The Prehistoric Industry of Laang Spean, Province of Battambang, Cambodia," *Archaeology and Physical Anthropology in Oceania* 5: 128-145.

Nitta, Eji, 1995, "Prehistoric Industries and the Mekong Civilisation," *Historical Science Reports; Kagoshima University* 42: 1-17.

Noulet, Jean-Baptiste, 1879, *L'Âge de la Pierre Polie et du Bronze au Cambodge d'après les Découvertes de M. J. Moura*, Toulouse: Archives du Musée d'Histoire Naturelle de Toulouse 1.

O'Reilly, Dougald, J. W., 1998, "The Discovery of Clay-Lined Floors at an Iron Age Site in Thailand; Preliminary Observations from Non Muang Kao, Nakon Ratchasima Province," *Journal of the Siam Society* 85 (1): 1-14.

O'Reilly, D. J. W., A. von den Driesch, V. Vuthy, 2006, "Archaeology and Archaeozoology of Phum Snay: an Iron Age Cemetery in Northwest Cambodia." *Asian Perspectives* 45(2): 188-211.

Parker, H., 1966, "Excavation at Pimai Preliminary Report," In W. Solheim II, ed., *Preliminary Reports on Excavations at Ban Na Di. Ban Sao Lao, Pimai, No. 1.* Honolulu, University of Hawaii: 1-10.

Pavie, Auguste, 1904, *Mission Pavie Indo-Chine 1879-1895. Étude Diverses: Recherches sur l'histoire naturelle de l'Indo-Chine Orientale par Auguste Pavie, Anthropologie* 3 .

Payom Chantaratiyakarn, 1984a, "Excavations at Ban Chiang Hian, Chi Valley, Northeast Thailand, 1981," *in* D. Bayard, ed., *Southeast Asian Archaeology at the XV Pacific Science Congress*. Dunedin, N.Z., University of Otago. 16**:** 65-72.

Payom Chantaratiyakarn, 1984b, "The Excavation of Ban Chiang Hian and Ban Kho Noi, The Pottery from Ban Chiang Han and Related Sites, the Middle Chi Area: Settlement Patterns, The Middle Chi Area: conclusions," *in* C. Higham and A. Kijngam, eds., *Prehistoric Investigations in Northeast Thailand*. Oxford, B.A.R.**,** 576-643.

Saurin, Edmond, 1969, "Les Recherches Préhistoriques au Cambodge, Laos et Vietnam (1877-1966)," *Asian Perspectives* 12: 27-40.

Ubelaker, D.H., 1987, "Estimating Age at Death from Immature Human Skeletons: an Overview," *Journal of Forensic Sciences* 32(5): 1254-1263.

Welch, David, 1984, "Settlement Pattern as an Indicator of Socio-political Complexity in the Phimai Region, Thailand," *in* D. Bayard, ed., *Southeast Asian Archaeology at the XV Pacific Science Congress*. Dunedin, New Zealand, University of Otago. 16**:** 129-152.

Welch, David, 1985, *Adaptation to Environmental Unpredictability: Intensive Agriculture and Regional Exchange at Late Prehistoric Centres in the Phimai Region in Thailand*, Manoa, University of Hawai'i, Ph.D thesis, Ann Arbour, University Microfilms.

Welch, David, J. and McNeill, Judith, R., 1988-9, "Excavations at Ban Tamyae and Non Ban Kham, Phimai Region, Northeast Thailand," *Asian Perspectives* 28 (2): 99-123.