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– ARTICLE –

Baikaboria Ossuary and the origins of the Kesele Clan, Upper Kikori River, Papua New Guinea.

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ABSTRACT

This paper presents archaeological evidence for the initial occupation and use of a large clan ossuary on the upper Kikori River at Baina in Papua New Guinea. Drawing extensively on clan oral accounts of its use and function, it is posited that the timing and use of the site as an ossuary effectively dates the establishment of a sub clan entity known as Kesele and the fragmentation of larger clan based land owning units into smaller sub-clan entities dating from around 200 years ago in the region. It is further posited that evidence of the more intensive use of the site from around 600 years ago and its subsequent use as an ossuary at 200 years ago may be linked to its proximity to an important lithic raw material source used in the manufacture of sago pounders, a major trade item linked to the *hiri* pottery trade.

Keywords: Ossuary, Clan fissioning, *hiri* trade

INTRODUCTION

A growing body of archaeological research in the western Gulf of Papua and its associated river systems has highlighted the dynamic nature of occupation over the last few thousand years (Rhoads 1983; David 2008; David *et al*. 2010; McNiven *et al*. 2010; Barker *et al*. 2012; Barker *et al*. 2015; David *et al*. 2015). For example, it has been posited that the articulating stone-sago-pottery production systems and trade relations between the upper, middle and lower Kikori River effected regional polities, including marking the beginning of the social system which produced the headhunting cults described ethnographically (David *et al*. 2010; Barker *et al*. 2015). This paper contributes to this body of evidence by utilising contemporary oral history and archaeology to establish the timing of major social changes in the form of Kesele clan establishment and changes to the control and use of land on the upper Kikori River. It is proposed that the impact of long distance trade networks such as the *hiri* pottery trade may have been one of the catalysts for changes to clan structures.

KESELE CLAN

Kesele (sometimes spelt Kasial) can be identified as a 'sub' clan of the major clan grouping Kuyymen, part of the Ikobi/Kesere language group occupying the tropical rainforest limestone karst country on the upper reaches of the Kikori River (Figure 1). Kuyymen (Kesele) trace their origins from the Mt Bosavi, Lake Kutubu region, some 100 km west of their current location. According to clan elders Kaipu Hau and Max Haipa, the first Kesele man was named Yohm Hai who founded the first village named Papatiti. Yohm Hai had a son, also named Yohm Hai, from which a patrilineal sequence spanning 10 generations can be traced (the named generational sequence was given to us but at the request of Kesele is not presented here).

Establishment of the Kesele boundary with their closest neighbours to the south west, the Keipte Kuyumen clan, involved a dispute over the planting of sago which was resolved by the transference of land ownership by Kesele to Keipte Kuyumen through the payment of Kina shells (*kerekere*). It was Sawa, son of Yohm Hai 2 who initiated the change of ownership. When Yohm Hai 1 first established Papatiti village the people had no sago and it was his son Yohm Hai 2 who brought sago to the area from the Bosavi/Kutubu region. Yohm Hai 2 was a strong warrior and he travelled extensively to Bosavi and all parts of the Western Province to fight and when he returned he bought sago suckers with him. Initially he tried to plant the sago in the mountain areas but it did not do well so he planted it at a lower elevation and according to the Kesele that sago plant is still there in a swamp by the Kikori River and if cut down, it will continue to grow again and again.

Kesele share with Keipte Kuyumen access to a major chert source from which sago pounders were manufactured, nodules of which are found in limestone outcrops (the source is called Sikikare by the Kesele clan and Fakaiku and Tabakaroe by the Keipte Kuyumen). These sago pounders were extensively traded and have been recorded near Mount Bosavi some 100 km to the west and as far

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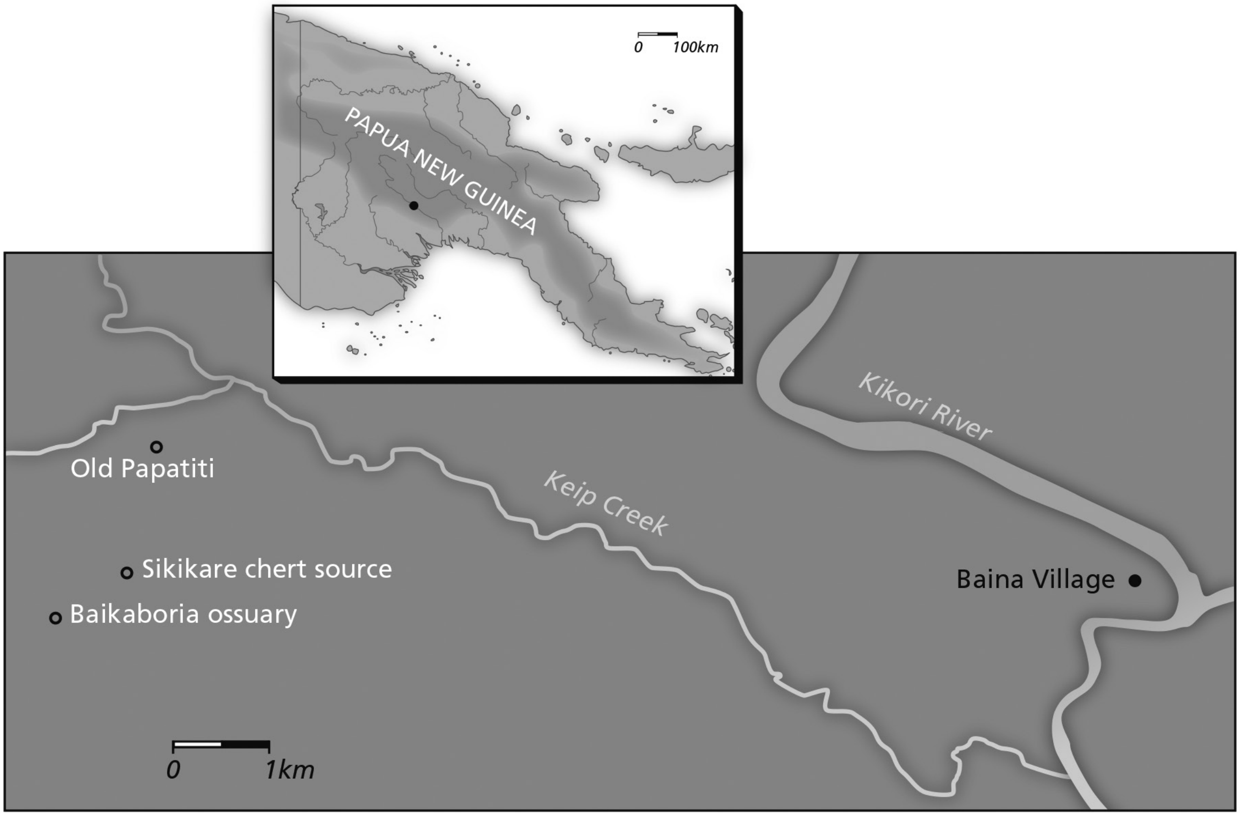

Figure 1. Map of Study Area.

south as the Aird Hills in the Kikori River delta (David *et al.* 2015; Sanex Koba pers. comm. 2014). Today Ikobi-Kasere villages have a typically lowland economy dominated by sago cultivation; however before the colonial era, families lived in relatively dispersed hamlets, moving residences frequently between garden land and sago resources. Kesele state that before sago arrived they did not grow gardens, and they relied more on hunting, with their staple being wild yams. Importantly however, they state that manufacture of sago pounders for trade commenced before sago arrived in the upper Kikori. Kesele have 12 named 'village' locations within their clan lands beginning with (Old) Papatiti as the origin village; these locations were often reoccupied through time. Aggregations of clans into a single large permanent village was largely a product of colonial administration, and Baina, the main village of Ikobi-Kasere in the Gobe region today was established around 1960 by Seventh Day Adventist Missionaries.

OSSUARIES – SPIRITUAL KEEPING PLACES

Traditional mortuary practices among Kesele involved the placing of the body on a purpose built wooden platform shortly after death. After a period of time, when only the skeleton was remaining, the bones were taken down and a ritual relating to the spirit of the deceased was performed; after this, the bones were carried to a place of internment, usually a small cave or rockshelter overhang. Each clan has their own ossuary on clan lands and Baikaboira was identified by clan members as exclusively a Kesele clan ossuary (Figure 2). Once the bones are placed in the ossuary, kin would visit at least once a year and perform a ceremony in which offerings of food were made. Traditional mortuary practices were discouraged by the first patrols into the upper Kikori from the early 1920s onward and the practice had ceased by the late 1950s with the arrival of missionaries into the area. For the colonial administration and missionaries, ossuaries were seen as simply a way of disposing of the dead. However for Kesele, the function of an ossuary encompassed much more than just physically disposing of human remains. For example David *et al.* (2008: 163) state that ossuaries:

> are also places that mediate the spirit flow from the land of the living to the land of the dead. At the same time, they are also places that enable memorialisation of the ancestors, remembrances of how clan members are unified into communities of landed peoples, each with ancestral claims to mutual obligations and responsibilities as social beings who are required by ancestral privilege to ensure the safety of the clan in the present, among the living, and by seeing the spirit of the dead through to the afterlife.

Figure 2. Southern end of the Baikaboria ossuary (permission was granted by Kesele to show skeletal remains for publication).

Although there is still a strong spiritual bond to their ossuary, the importance of its maintenance today for Kesele was expressed more strongly in terms of it indisputably marking the landscape, both cosmologically and physically. The recitation of ancestors' names who reside in the ossuary was seen as important in maintaining links to a past that legitimized clan ownership of land (Max Haipa pers. comm. 2013).

BAIKABORIA OSSUARY

Baikaboria Ossuary is located 10 km west of Baina Village, 7 km west of the main Kikori River channel and approximately 3.5 km west of the main channel of Keip Creek. Keip Creek, a tributary of the Kikori River, is a major clan boundary and the location of a range of ancestral Kesele village settlements (Figure 1). The ossuary is in a shallow rock shelter perched half way up a sheer limestone karst tower (Figure 2). The outcrop contains 2 separate shelters both with evidence of human remains. The smaller shelter facing south contained some human bone on the surface but very little cultural deposit. The larger shelter facing westward and measuring 12 × 3 m contained an extensive scatter of disarticulated human bone consisting of at least 22 individuals but probably many more, a range of material culture items including ground adzes and axes and over 30 cm of cultural floor deposit. The floor deposit in the central section of the shelter had been extensively disturbed by pig-rooting, leaving only the talus edge of the deposit intact. Thus a 50 × 50 cm square was established at the southern end of the shelter on the talus edge of the deposit. This square was termed SQ1 and almost immediately came down on limestone bedrock and is thus not presented here. A 50 × 50 cm square, termed Square 2 was then established 2 m to the north-west of SQ1 and was excavated to a depth of 33.9 cm (Figure 3). Excavation proceeded in arbitrary excavation units, taking into account stratigraphic changes where encountered with XUs averaging 2.11 cm overall. Excavated material was dry sieved using 2 mm mesh size and bulk sediment samples were taken for each XU.

CHRONOLOGY

Two *in-situ* dates were obtained; one on charcoal in XU5, at 12 cm depth in SU2 and one on bone in XU11, at 27.5 cm depth in SU3. The AMS charcoal date from XU5 of 146 calibrated to between 9 and 274 calBP with highest probability distribution (1 σ 68.3%) of 183–244 calBP and a median probability distribution of 152 calBP. The date on bone of 629±23 calibrated to between 561–652 calBP with highest probability distribution (1 σ 68.3%) of 577–597 calBP and a median probability of 597 calBP. The median probability calBP dates of 152 calBP and 597 calBP rounded to the nearest 10 years (150 and 600 calBP) are used as a heuristic device to calculate temporal discard of cultural material.

Figure 3. Square 2

The precise species identification of the bone sample is unknown but values of the isotope analysis (δ^{15}N and δ^{13}C) are typical of terrestrial herbivores and the size of the bone submitted would suggest a medium to large animal such as a macropod (Fiona Petchey pers.comm. 2015).

SU4 beginning immediately below this date demonstrates very low levels of cultural deposit and remains undated. As we know that this site was used in living memory, the surface is treated as modern (Table 1).

STRATIGRAPHIC DESCRIPTION

Four Stratigraphic Units were identified in Square B (Figure 4). Overlap of SUs as they relate to XUs is outlined in Table 2 and relates to possible stratigraphic transition zones between SUs of around 2 cm (Figure 4).

- SU1 consists of a dry, powdery, loose, grey sediment with a Munsell colour reading of 10YR4/1. This SU, encompassing XUs 1–5, has high densities of cultural material, mainly in the form of human bone.

Table 1. *Radiocarbon dates from Baikaboria Ossuary*

SQ	Lab No. (Wk)	XU	Depth (cm)	Sample Type	δ^{13}C	% Modern Carbon (F^{14}C%)	^{14}C Age (Yrs BP)	Calib. age BP 1σ (68.3% prob.)	Relative area under probability dist.	Calib. age BP 2σ (95.4% prob.)	Relative area under probability dist.	Median Calib. age BP
SQ2	35158	5	12.0	Charcoal	–30.2 ±0.2	98.2 ±0.3	146 ±25	10–30 80–100 110–120 114–150 170–180 180–220 260–270	0.206 0.097 0.031 0.121 0.033 0.355 0.156	0–40 60–120 120–150 170–230 240–280	0.177 0.204 0.121 0.329 0.169	150
SQ2	38123	11	27.5	Bone	N/A	92.5 ±0.3	629 ±23	560–570 580–600 630–650	0.245 0.380 0.374	550–610 620–660	0.602 0.398	600

Calib Rev7.1.0. Stuiver and Reimer 1993 (IntCal13). Calibrated ages have been rounded to nearest 10yrs

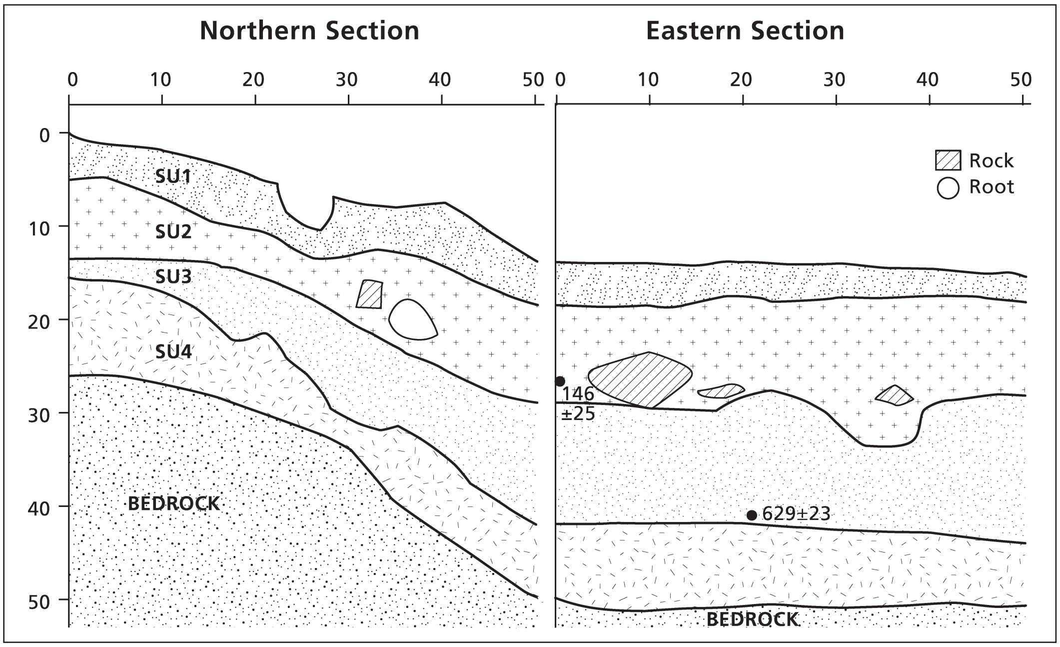

Figure 4. Stratigraphic section.

- SU2 is a more compact, brown, humic layer extending to a maximum depth of 19 cm below the surface in the eastern section with a Munsell reading of 10YR3/2. SU2, encompassing XUs 4 to 8, contained relatively high densities of cultural material including human bone, shell and stone artefacts.
- SU3 is a hard, compact, grey sediment, a mixture of humic soil and limestone deposit with a Munsell reading of 4YR6/2. This SU, spanning XUs 7 to 13, saw a marked decrease in cultural material including an absence of human bone.
- SU4, encompassing XUs 12–16, mostly comprises com-

Table 2. *Excavation details*

XU	SU	Mean Depth at Top (cm)	Mean Depth at Centre (cm)	Mean Depth at Base (cm)	Mean Thickness (cm)	Weight of Excavated Sediments (kg)	Volume of Excavated Sediments (litres)	pH
1	1	0.00	0.87	1.74	1.74	5.0	4.8	6.5
2	1	1.74	2.29	2.84	1.10	5.8	5.6	6.5
3	1	2.84	4.27	5.70	2.86	4.1	5.6	6.5
4	1/2	5.70	6.47	7.24	1.54	8.1	7.0	6.5
5	1/2	7.24	8.28	9.32	2.08	5.4	7.0	7.0
6	2	9.32	10.87	12.42	3.10	4.1	4.0	7.0
7	2/3	12.42	13.42	14.42	2.10	6.7	6.0	7.0
8	2/3	14.42	15.36	16.30	1.88	6.1	6.0	7.0
9	3	16.30	17.45	18.60	2.30	6.3	8.0	7.0
10	3	18.60	19.43	20.46	1.86	4.2	4.0	7.5
11	3	20.46	21.54	22.62	2.16	4.5	5.0	7.5
12	3/4	22.62	24.07	25.52	2.90	3.1	2.0	7.5
13	3/4	25.52	26.64	27.76	2.24	3.7	4.0	9.0
14	4	27.76	28.37	28.98	1.22	3.5	4.0	9.0
15	4	28.98	30.18	31.38	2.40	3.6	4.0	9.0
16	4	31.38	32.57	33.76	2.38	3.4	3.6	9.0

pacted limestone with a Munsell reading of 5YR8/2. There is a marked reduction in discard of cultural material in SU4.

CULTURAL MATERIAL

Cultural material consisted of bone, both human and non-human, lithics, shell, ochre and charcoal with the assemblage dominated by stone artefacts and bone material (Table 3, Figure 5). Charcoal was sparse and not present after XU8. Small pieces of red ochre were present in XUs 2, 4 and 8 none of which had striations or other indications of use (i.e. Fe-rich nodules) (Figure 6). Discard of cultural material was assessed between dated blocks which largely corresponds to the beginning or end of Stratigraphic Units.

Table 3. *Excavated material by weight (g) from SQ2*

XU	Lithics	Bone	Shell	Charcoal	Land Snail	Ochre	Seeds	Other Plant Material	Sediment
1	1.21	32.96					0.71	12.40	1278.0
2	5.46	25.49	0.29	0.001	2.39	0.56	0.67	4.00	1123.0
3	8.12	50.37	5.73	0.07	1.69		0.22	53.00	846.0
4	45.53	20.33	10.28	0.22	0.77	0.18	0.18	1.66	1086.0
5	50.32	16.10	5.28	0.67	1.50		0.11	2.39	576.0
6	55.73	16.91	5.02	0.03	0.76			0.57	269.0
7	20.24	6.11	11.84	0.21	0.39			0.11	303.0
8	16.69	3.00	2.46	0.02	0.08	0.21	0.10	0.79	315.0
9	0.08	4.10	0.95		0.62			0.28	289.0
10	22.58	2.78	1.85					0.41	271.0
11	1.90	3.63			0.10			0.10	97.4
12	0.03	0.85			0.36			0.14	133.0
13	1.02	1.07	0.20		0.09			0.66	81.8
14	0.00	1.21	0.75		0.10			0.54	69.1
15	0.07	0.18	0.13		0.21			0.08	71.8
16		0.12						0.001	46.2

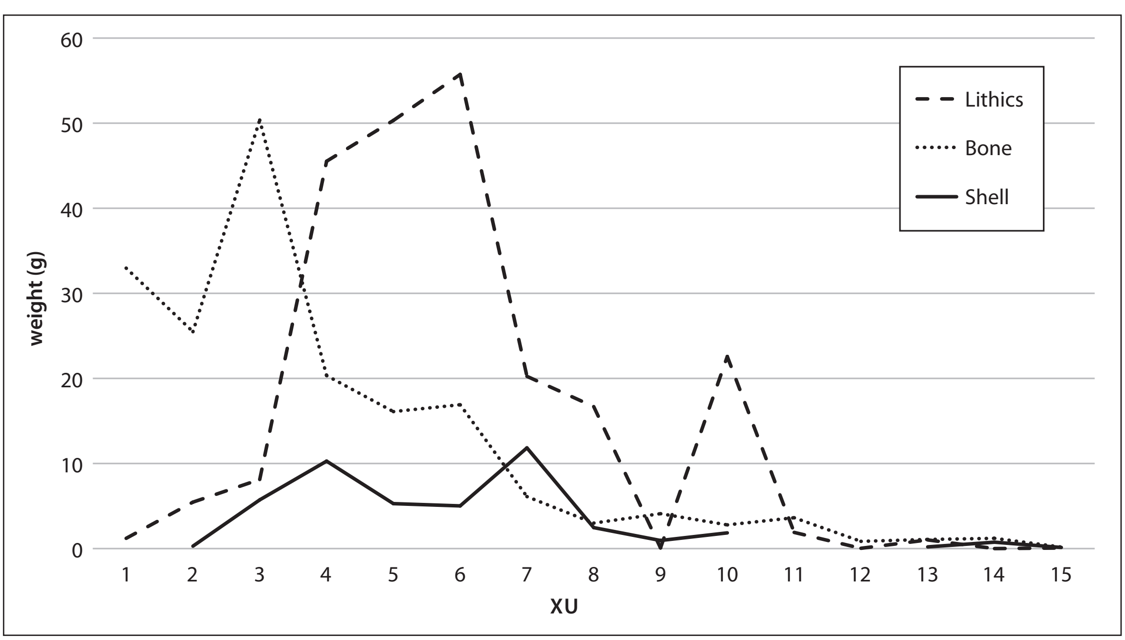

Figure 5. Discard of Bone, Lithics and Shell.

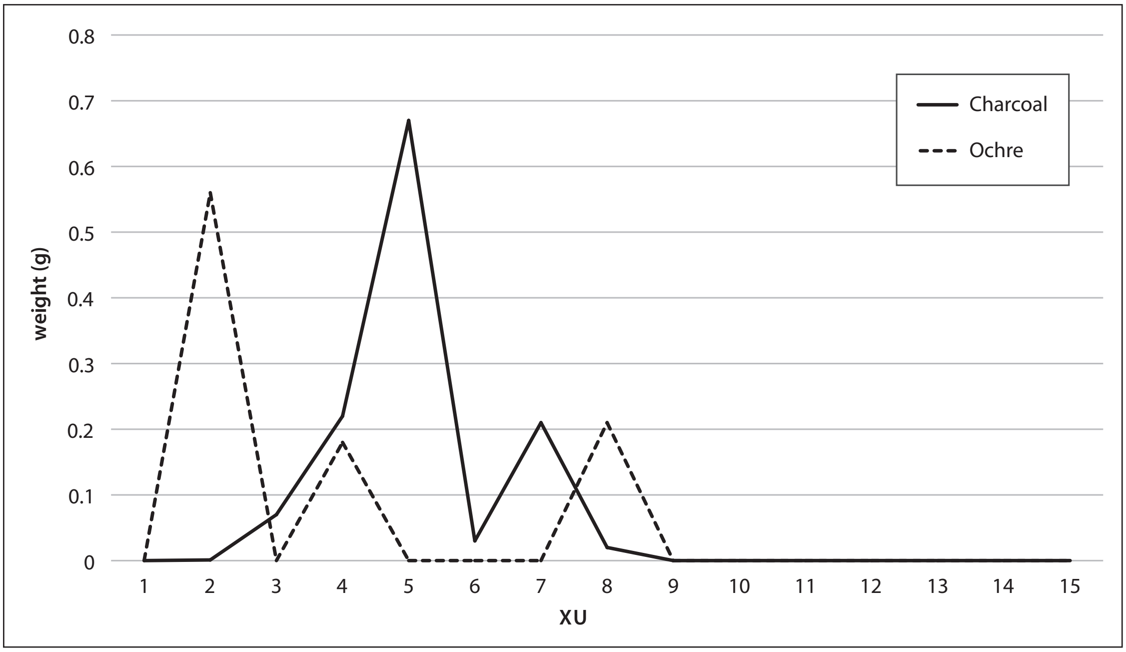

Figure 6. Discard of charcoal and ochre.

FAUNAL ASSEMBLAGE

Faunal remains were weighed and each specimen was examined using a low-powered stereomicroscope (Olympus sz61) for taphonomic features, including burning, root etching, carnivore marks, and cut and percussion marks. Where possible, terrestrial faunal remains were identified using modern reference skeletons that were collected by Garrick Hitchcock in the lowlands of the Western Province, Papua New Guinea and held at the University of Queensland.

The faunal assemblage had a total weight of 68.66 grams and consisted of 700 specimens (Figures 7 & 8). Of these, only 18 were identifiable below the level of order.

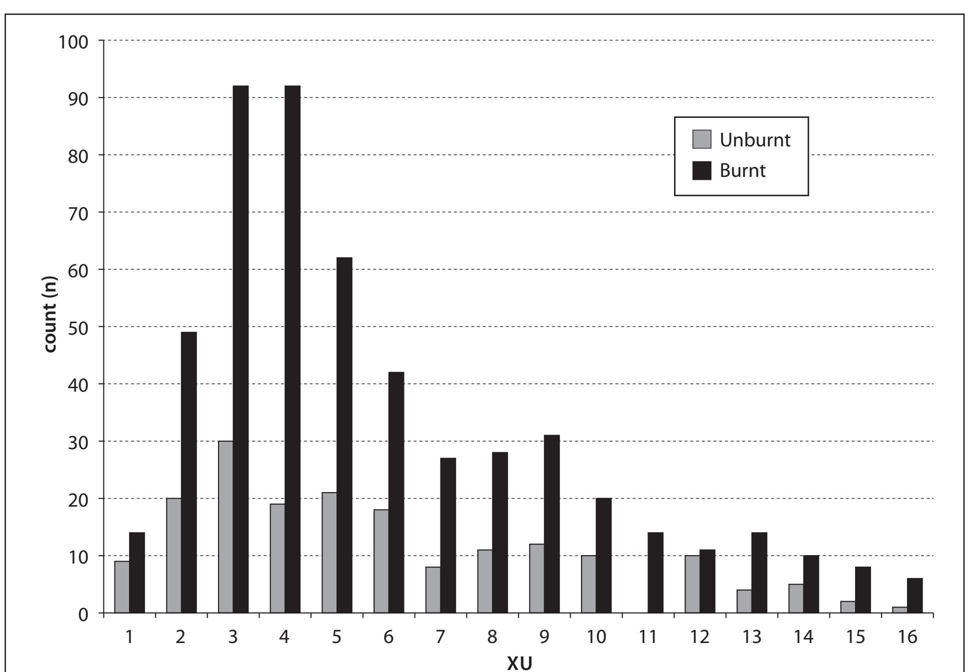

Figure 7. Counts (n) of unburnt and burnt bone..

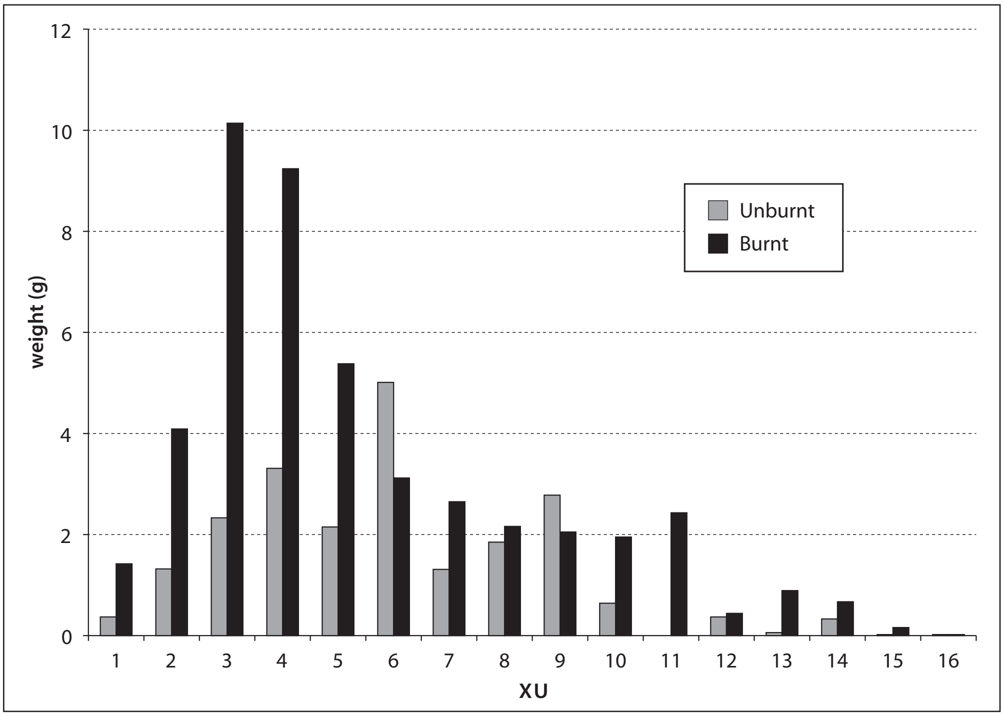

Figure 8. Weight (g) of unburnt and burnt bone

Eight specimens were identified to family Macropodidae (XUs 2, 4, 5, 8, 9 and 14) and consisted of small-medium sized animals. Of these, two mandibular specimens were tentatively designated as forest wallaby (*Dorcopsis* sp. in XUs 4 and 9) and one maxilla fragment as tree kangaroo (*Dendrolagus* sp. XU8). A partial femur of a small rodent was present in XU10. Two right deciduous lower 4th premolars of *S. scrofa* were located in XU6. One of the specimens was completely unerupted and still located within a fragment of the mandible, suggesting either a feotal or neonate individual, as pig deciduous teeth generally erupt and start to be used at birth or immediately after (Hillson 2005). The second dP_4 was lightly worn, indicating a slightly older individual, although within the age range of 4–6 months. In addition to the mammalian remains, there was a partial humerus of a small bird and one fragment each of mandible of a small varanid (XU2) and skink (XU5), as well as a single fragment of a mandibular tooth from a shark within the family Carcharhinidae (XU9). Only eleven specimens displayed signs of surface damage in the form of pitting, punctures and small drag marks. These specimens consisted of the humerus of the small bird and several mammal long bone fragments and vertebrae. Pitting and thinning of the humerus is consistent with an avian predator, while small dragmarks on the long bone fragments resemble those of a small carnivorous marsupial (Andrews 1990; Glue 1970; Miscamble and Manne in press). A high percentage of burning is evident in the assemblage, with 67.7% (by weight) of the assemblage exhibiting signs of burning (Figure 9). When examining the nature of the burnt bone within the profile, there is no evidence of a decrease in unburnt bone and an increase in calcined bone with increasing depth (Aplin and Manne in press). This suggests that unburnt bone has not been preferentially lost due to chemical or microbrial attack and that patterns within the profile are related to burning activities (Aplin and Manne in press).

Calcined bone is prevalent and comprises over half of the assemblage by weight (Table 4 & 5). The heavily burnt nature of the remains suggests that bones were disposed directly into the fire. Experimental research has demonstrated that bone becomes first blackened and then grey, when exposed to temperatures between 300–500°C and finally calcined above 600°C (Stiner *et al.* 1995; Etok *et al.* 2007; Munro *et al.* 2007). Ethnographic fire-pit assemblages collected by Aplin in the Western Province of Papua New Guinea indicate that in these modern assemblages, 70% of bones by weight are calcined (Aplin and Manne in press). The high percentage of calcination of the Baina assemblage (56.6% by weight) suggests that fire-pits may have also been employed here. In their experimental work on burnt bone, Kalsbeek and Richter (2006) noted that since calcined bone increases in hardness, it consequently becomes more brittle and susceptible to damage. The heavily burnt nature of the Baina assemblage, particularly the high proportion of calcined bone, may explain the low proportion of identifiable bone.

Five specimens of worked bone were present in the assemblage and were located in XUs 2, 3, 4, 5 and 6. All five specimens exhibited polish and contained fine parallel

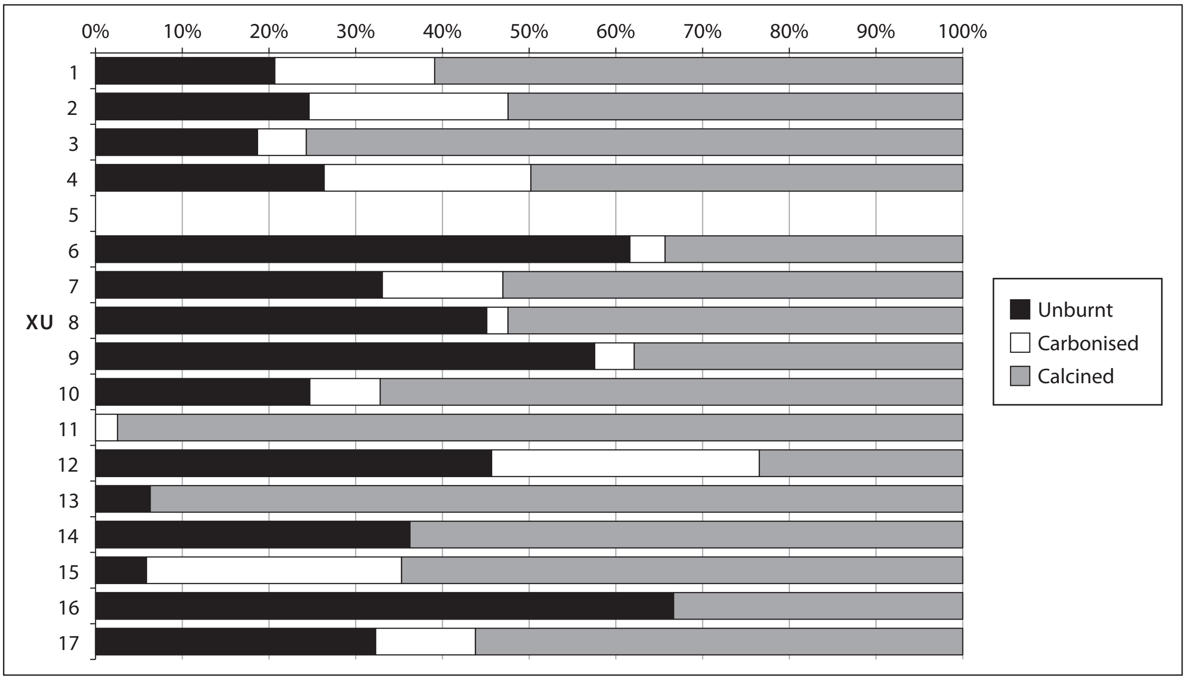

Figure 9. Proportions of unburnt, carbonised and calcined bone by weight.

Table 4. *Unburnt and burnt specimens by weight (g).*

Exc. Unit	Unburnt (g)	Burnt (g)
1	0.37	1.42
2	1.32	4.09
3	2.33	10.14
4	3.31	9.24
5	2.15	5.38
6	5.01	3.12
7	1.31	2.65
8	1.85	2.16
9	2.78	2.05
10	0.64	1.95
11	0.00	2.43
12	0.37	0.44
13	0.06	0.89
14	0.33	0.67
15	0.01	0.16
16	0.02	0.01
Total	**21.86**	**46.80**

Table 5. *Unburnt and burnt bone by weight (g), following Stiner* et al. *(1995). Category 1: < half carbonised; Category 2: > half carbonised; Category 3: fully carbonised; Category 4: < half calcined; Category 5: > half calcined; Category 6: fully calcined.*

Exc.	Burning Categories (g)						
Unit	Unburnt	Cat. 1	Cat. 2	Cat. 3	Cat. 4	Cat. 5	Cat. 6
1	0.37			0.33		0.51	0.58
2	1.32	0.20	0.82	0.21	0.62	1.28	0.91
3	2.33		0.70		0.74	4.07	4.63
4	3.31	0.11	2.53	0.35		2.32	3.93
5	2.15		0.56	0.17	0.38	1.67	2.60
6	5.01		0.06	0.27		1.17	1.62
7	1.31		0.55			0.97	1.13
8	1.85	0.10				1.31	0.84
9	2.78		0.22		0.27	0.45	1.11
10	0.64		0.19	0.02		1.27	0.47
11	0.00			0.06		1.30	1.00
12	0.39		0.21	0.04		0.09	0.10
13	0.06				0.19		0.70
14	0.33					0.32	0.26
15	0.01		0.05			0.08	0.03
16	0.02						0.01
Total	**21.88**	**0.41**	**5.89**	**1.45**	**2.20**	**16.81**	**19.92**

striations. The specimen from XU2 is a small fragment of worked bone containing polish and striations. The specimens from XU3 and XU6 are longitudinally broken and may have been mid-shaft fragments of uni- or bi-points. The specimen from XU4 is the distal end of a uni-point. Three notches have been cut into the very distal end, likely for hafting, which also exhibits light blackening from being burnt. The specimen from XU5 is a fragment of long bone with rounding on the longitudinal edges and four facets on the surface of the bone. The striations on the two outer facets are in parallel with the longitudinal axis of the bone, while the two medial facets contain striations at 45° angle to one another, in a herringbone pattern. In addition to the worked bone, a portion of a tooth from a juvenile *Carcharocles megalodon* shark, extinct over 2.5 million years ago was located in XU7 (identified by M. Sivverson, Western Australia Museum). This fragment, identified as a hunting charm by Max Haipa, is probably a remnant fossil, from the limestone geology of the region.

HUMAN BONE

Human bone was present in XUs 1 to 5 only, dating from after approximately 200 calBP (Table 6). The single small piece of bone in XU6 has been tentatively identified as human but its identification is considered problematic. Most of the assemblage consists of adults, with some evidence on at least one vertebrae of mild osteoarthritis. Unlike the non-human faunal assemblage, none of the human bone was burnt. Because of the reluctance of Kesele clan for a larger sample of bone material other than that excavated to be taken away for analysis, a detailed palaeo-osteological/pathological analysis of the human remains was not possible and is in any case considered to be outside the scope of this paper.

SHELLFISH

Two species of freshwater shellfish, a gastropod and a bivalve were present in the assemblage (Murray 1975, Michael Klunzinger Department of Aquatic Zoology, Western Australian Museum, pers. comm. 2015). Freshwater species in New Guinea are relatively poorly known however the gastropod is identified as *Melanoides turberculata*, a small burrowing shellfish with an adult size range between 1.3–2.5 cm. The bivalve Westralunio sp. is a freshwater mussel found in rivers and streams with soft sediments and slow running water along the banks of rivers. Westralunio is commonly eaten wherever it occurs, although shellfish consumption was abruptly halted among Kesele with the influence of the Seven Day Adventist mission in the late 1950s. Both species are present today and would most likely have come from a branch of Keip Creek approximately 250 m to the west of the Baikaboria shelter. *M. tuberculata* is present throughout the sequence with a slightly greater discard in SU2 and Westralunio is found in SU1 and 2 only (Table 7).

Table 6. *Human bone*

XU	Element	Portion of Element	Side	Age	Wt (g)
2	metatarsal 4	Nearly complete	right	Adult	4.13
3	metatarsal 1	Complete	right	Adult	9.88
4	calcaneus	Complete	right	Adult	28.79
1	radius	Complete	right	Adult	22.34
1	rib	mid shaft fragment			0.56
1	scapula	fragment			0.69
1	thoracic 9	Complete		Adult	7.29
2	2nd lower molar	Complete	left	Adult	2.26
2	3rd lower premolar	Complete	right	Adult	1.13
2	metacarpal 5	Complete	right	Adult	1.83
2	rib	fragment			0.75
2	rib (5)	Complete	right	Adult	7.60
2	sacrum	facet for coccyx		Adult	0.48
2	thoracic 10	Complete		Adult	6.23
3	4th lower premolar	Complete	right	Adult	1.40
3	cervical (5)	complete		Adult	4.40
3	cervical 3	Complete		Adult	3.38
3	lumbar 1	Complete		Adult	13.13
3	rib (6)	proximal half	left	Adult	3.33
3	thoracic 8	Complete		Adult	10.03
5	3rd Phalanx (5th digit)	Complete	(right)	Adult	0.45
5	cuboid	Complete	left	Adult	3.75
5	metacarpal 2	Complete	right	Adult	1.89
5	metacarpal 5	Complete	right	Adult	1.64
6	Unknown long bone	Diaphysis			6.77

Table 7. *Shellfish*

	Melanoides tuberculata		Westralunio sp.	
XU	MNI	gm	MNI	gm
1				
2	4	0.23	1	0.06
3	3	0.09	3	5.64
4	13	1.95	1	8.33
5	6	0.45	1	4.83
6	6	1.83	1	3.l9
7	6	2.80	3	9.04
8	4	1.54	1	0.92
9	3	0.70	1	0.25
10	4	1.85		
11				
12				
13	4	0.20		
14	3	0.75		
15	2	0.13		
16				
Total	**58**	**12.52**	**12**	**29.07**

LITHICS

The Baikaboria lithic assemblage consists of 88 pieces of flaked stone, distributed through 16 excavation units (Figure 10). The composition of the general assemblage is dominated by flakes (65%), followed by flaked pieces (19%) and potlids (4%). The entire assemblage consists of chert, which according to external morphological characteristics such as colour (dominated by N3 – dark grey, Figure 11) and texture, appears to be sourced from the nearby Sikikare quarry, 1 km to the north-east. The fact that all stages of reduction are represented in the Baikaboria assemblage, supports the notion of local provisioning of the raw material from the Sikikare source (Figure 12).

When the assemblage is examined through time, according to dated blocks, which largely coincides with the designated stratigraphic units, it appears that the period of greatest deposition occurs from 0–150 calBP, in terms of the number of artefacts deposited (Figure 13). Because breakage can distort this pattern, it is pertinent to look at complete flakes only, which are deposited at the rate of 15.3/100 years from 0–150 calBP and 4.0/100 years from 150–600 calBP (Figure 14). Data for numbers after 600 calBP are not relevant in this instance, because they cannot be quantified at a rate of deposition. When the weight (g) of artefacts deposited through time is examined, we see that the greatest amount of deposition occurs from 0–150 calBP with a deposition rate of 73.7 g/100 years, followed by 26.2 g/100 years from 150–600 calBP (Figure 15). Thus, although the differences are reasonably small, the data for number of all artefacts, number of complete flakes and weight of stone deposited through time, all indicate that 0–150 calBP was the period of greatest stone artefact deposition.

A number of tests were conducted on the morphological and technological attributes of the assemblage in order to determine if there were any changes corresponding with the increase in discard per 100 years that was observed in the period 0–150 calBP. When mean weights

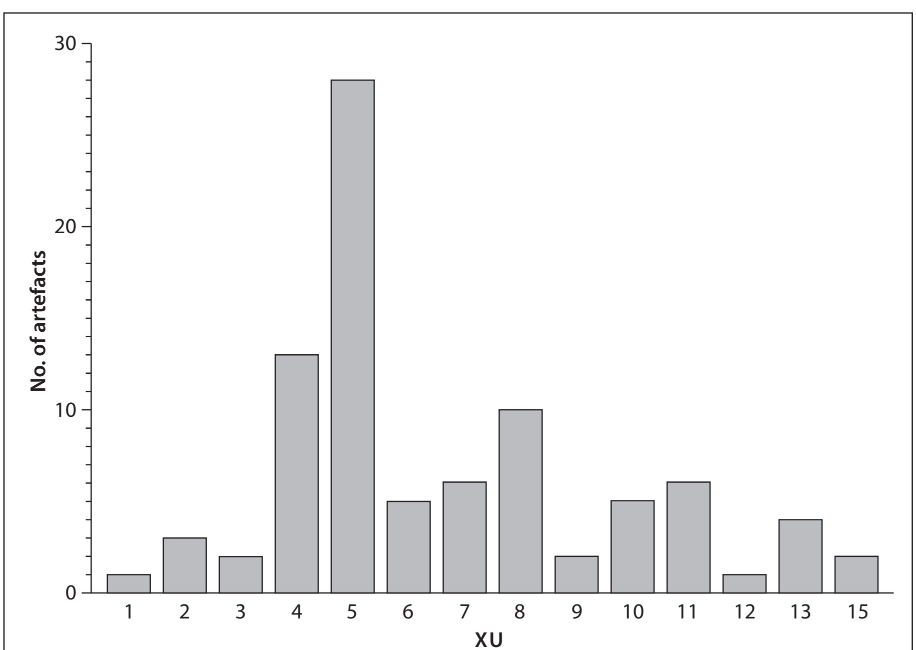

Figure 10. Distribution of stone by XU.

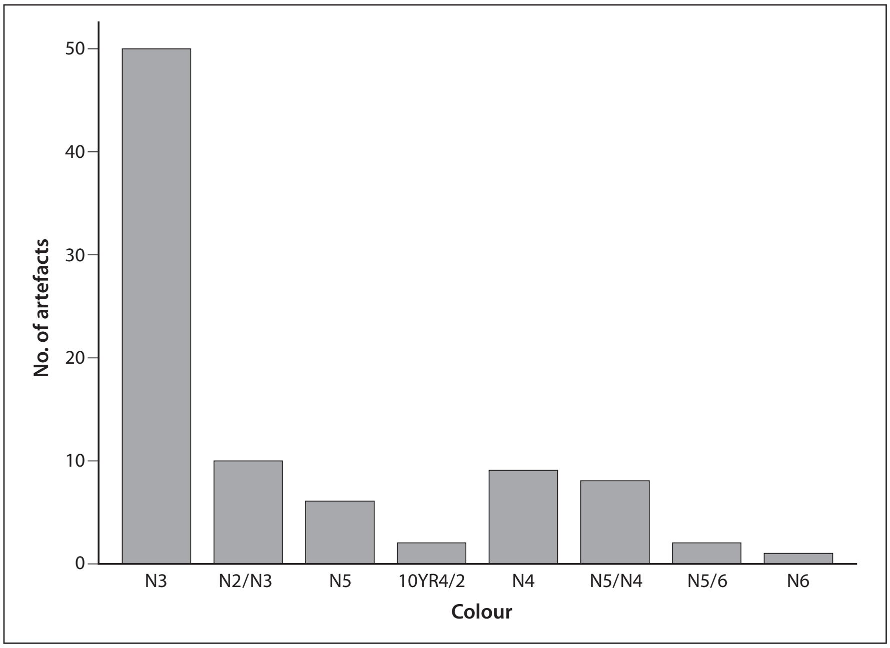

Figure 11. Munsell colour across the assemblage.

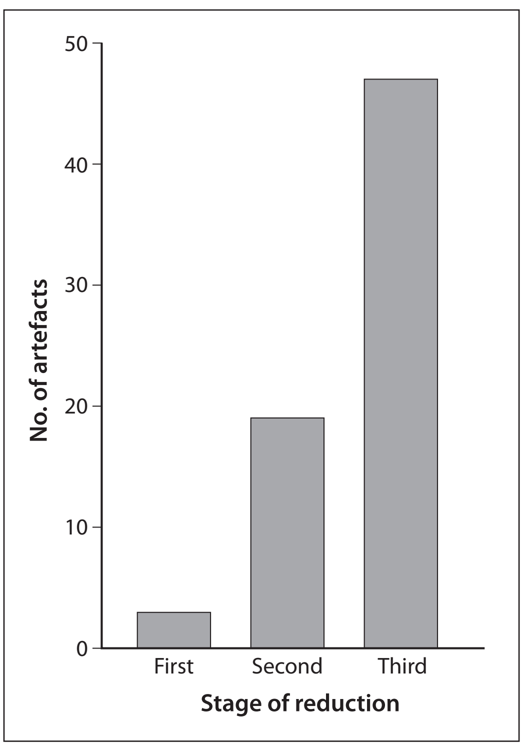

Figure 12. Stage of reduction across the assemblage.

were examined for 0–150 calBP and 150–600 calBP, they were 2.5 g and 3.9 g respectively (p=0.37) and the variation was not statistically significant. There was a greater variation for >600 calBP and 150–600 calBP of 0.16 g and 3.9 g respectively, but small sample size was an issue (N=7 and 30 respectively) and this result was also not statistically significant (p=0.26). A similar result was returned when examining maximum dimension for 0–150 calBP and 150–600 calBP. Mean dimensions of 20.3 mm and 19.8 mm were returned (p=0.86) between 0–150 calBP and 150–600 calBP respectively. The mean maximum dimension for >600 calBP was 9.7 mm which approaches significance when compared with the mean of 19.8 mm for 150–600 calBP (p=0.07), but sample size remains an impediment to assessing significance.

Mean length, width and thickness of flakes between 0–150 calBP and 150–600 calBP are identical to within 0.05 of a mm. Variation is greater between >600 calBP and the upper phases (see Table 8) but are not statistically significant (p=0.10 for length, p=0.11 for width and p=0.19 for thickness). Mean platform widths for 0–150 calBP and 150–600 calBP were 14.6 mm and 13.2 mm respectively (p=0.68). The mean platform width in the phase >641 calBP is 5.9 mm which when compared to the phase from 150–600 calBP returned a p value of 0.40. Platform thickness follows a similar pattern (Table 9).

When stage of reduction is examined as a percentage of the assemblage within dated phases, we see a decrease in second stage reduction from 150–600 calBP to 0–150 calBP and a corresponding increase in third stage reduction flakes (Table 10). While the differences in percentages are not significant (p=0.18) it provides something of a substantive commentary on the assemblage. When considered together with the decrease in mean weight from 150–600 calBP to 0–150 calBP from 3.9 g to 2.5 g, an argument could be made that while the amount of stone discarded per 100 years increased from 150–600 calBP to 0–150 calBP, the

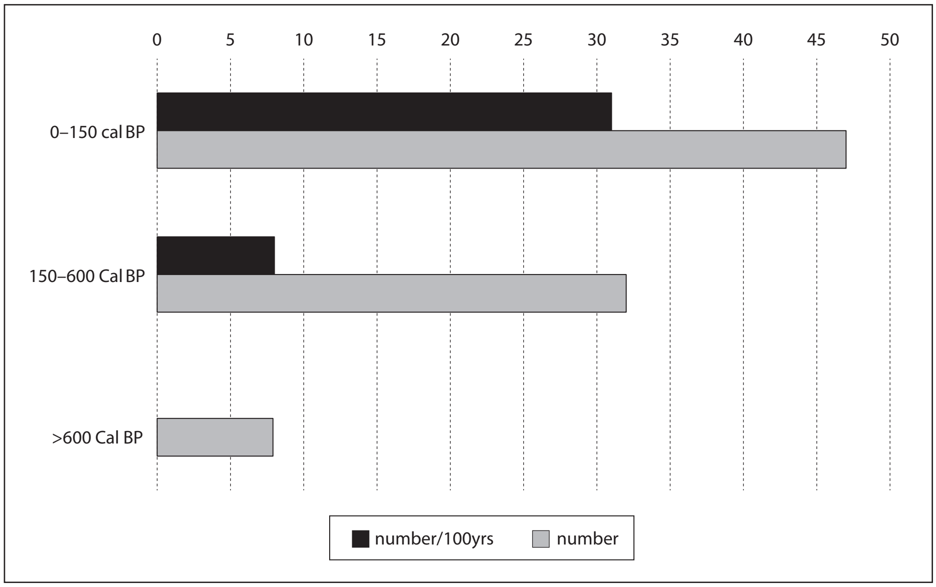

Figure 13. Artefact numbers and number/100yrs per dated phase.

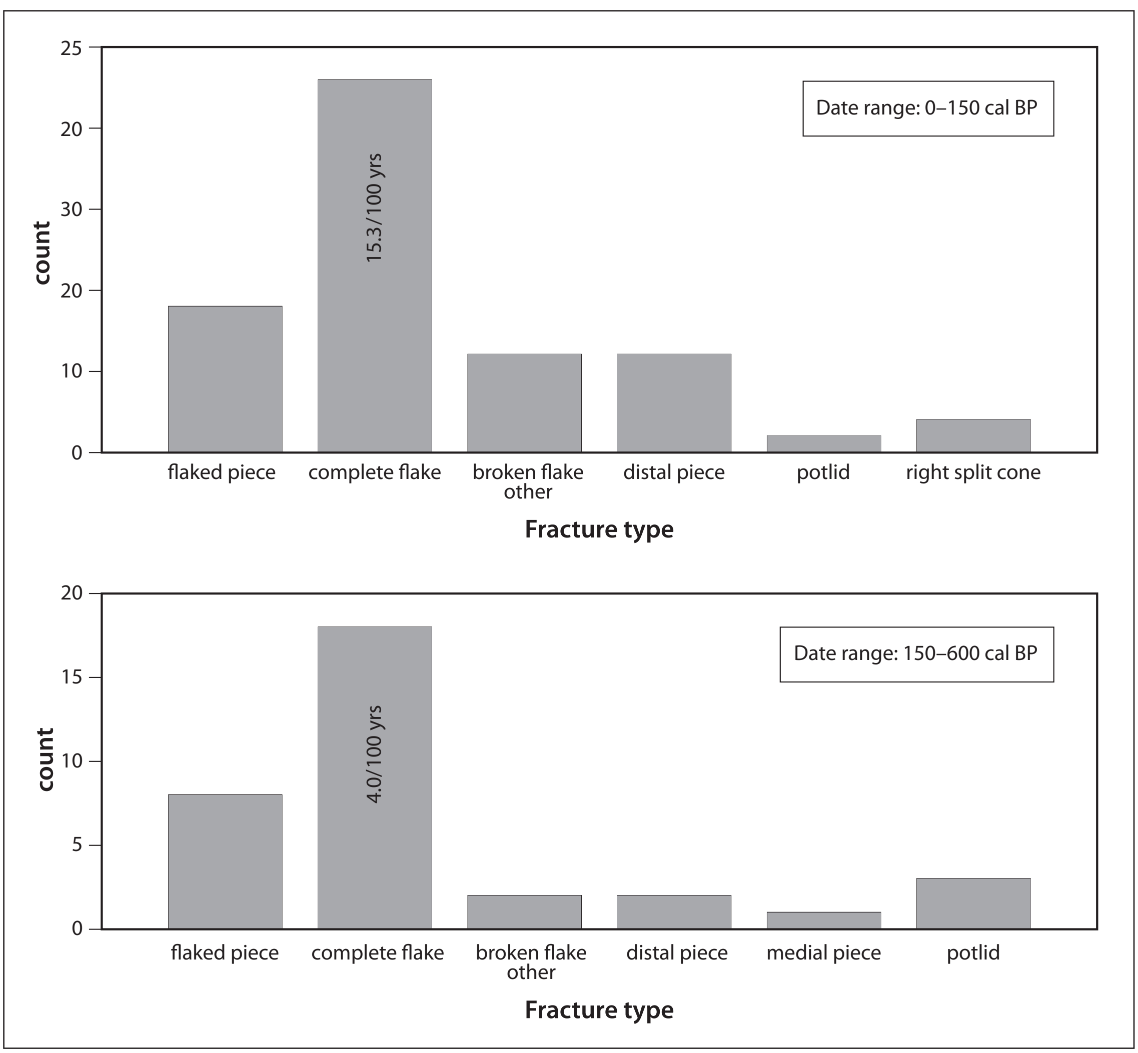

Figure 14. number of complete flakes per dated phase.

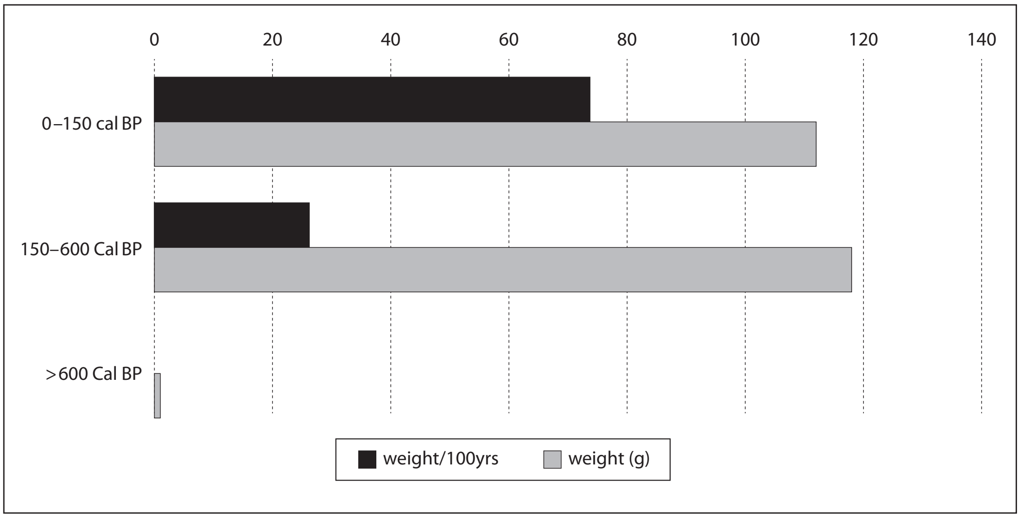

Figure 15. sum weight (g) and weight (g)/100yrs per dated phase.

Table 8. *Descriptive statistics on lithics length, width and thickness.*

Date Range		N	Minimum	Maximum	Mean	Std. Deviation
0–150 cal BP	Length (mm)	42	4.04	40.80	15.4695	8.39287
	Width (mm)	30	3.12	39.59	17.0680	10.00061
	Thickness (mm)	33	0.64	11.85	4.6461	3.37881
150–600 cal BP	Length (mm)	30	3.40	54.58	15.3673	11.69185
	Width (mm)	18	3.60	40.57	17.4389	11.58990
	Thickness (mm)	20	0.55	16.96	4.2105	4.23474
>600 cal BP	Length (mm)	6	4.11	11.19	7.3483	2.92788
	Width (mm)	3	2.96	9.38	6.1767	3.21002
	Thickness (mm)	5	0.66	3.42	1.6100	1.10820

Table 9. *Descriptive statistics on flake platform length, width and thickness.*

Date Range		N	Minimum	Maximum	Mean	Std. Deviation
0–150 cal BP	Platform Width (mm)	20	3.1	37.8	14.616	8.6397
	Platform Thickness (mm)	24	0.8	14.9	5.027	4.3013
150–600 cal BP	Platform Width (mm)	16	2.6	38.0	13.233	11.7828
	Platform Thickness (mm)	16	0.9	13.0	4.223	3.8757
>600 cal BP	Platform Width (mm)	2	5.0	6.8	5.900	1.2869
	Platform Thickness (mm)	3	0.6	2.6	1.627	1.0232

material being deposited was increasingly of a tertiary stage of reduction and generally of lesser weight. The link between third stage reduction and smaller flakes (in terms of weight and metrics) is consistently observed in all dated phases (Table 11). This is similar to the trend found at the Keipte Kuyumen clan origin village site of Waredaru, dating to approximately 200 calBP and identified as a 'systematic sago pounder manufacturing site'. The Waredaru assemblage is also characterised by an absence of cores, small artefact size and a predominance of tertiary decortication (David *et al.* in press).

Overall, this pattern could indicate a possible shift in reduction strategy between the two phases from being generalised and incorporating all stages of manufacture in the phase between 150–600 calBP, to more task-oriented work that produced a greater percentage of smaller, third stage flakes in the period from 0–150 calBP.

Table 10. *Stage of reduction as percentage of assemblage per date phase.*

Date Range			Frequency	Percent
0–150 cal BP	Valid	first	1	2.1
		second	9	19.1
		third	29	61.7
		Total	**39**	**83.0**
	Missing		8	17.0
	Total		**47**	**100.0**
150–600 cal BP	Valid	first	2	5.9
		second	10	29.4
		third	13	38.2
		Total	**25**	**73.5**
	Missing		9	26.5
	Total		**34**	**100.0**
> 600 cal BP	Valid	third	5	71.4
	Missing		2	28.6
	Total		**7**	**100.0**

DISCUSSION

Initial occupation of the Baikaboria rock shelter commenced some time before approximately 580–600 calBP in SU4 with discard of cultural material indicating ephemeral, very low intensity use. From 580–600 calBP to approximately 180–220 calBP in SU3 there is evidence of greater intensity of site use through increased discard of cultural material, including bone, lithics and shell. The high degree of burnt and calcined mammal bone and the lack of human bone material in (SU3) indicates the use of the shelter as an occasional hunting camp and a shelter possibly related to its proximity to the Sikikare chert source. From 180–220 calBP (SUs 1 & 2) there is a further significant increase in discard of cultural material including the appearance of human bone, establishing the timing of the use of the site as an ossuary. The increase in the discard of lithics after 180–220 calBP is accompanied by some indication of a decrease in artefact size and an increase in third stage reduction indicating a possible change in reduction strategies. This is similar to the concomitant trend at the Keipte Kuyumen clan origin village site of Waredaru, described as a site for the production of sago pounders (David *et al.* in press). Combined with the presence of worked bone material, including evidence for bone points from after 180–220 calBP, this provides evidence for technological changes most likely related to the altered use of the site from a hunting camp to an ossuary. The continuous presence of burnt and calcined mammal bone, usually associated with fire pits for cooking throughout the sequence indicates that although used as an ossuary after 180–220 calBP, people continued to use the shelter as a camp either when visiting, as part of kin obligations to the dead or possibly activities related to Sikikare.

David (2008: 479) found that on the mid Kikori River, 80 km south of Baina, settlement systems were dynamic and not very stable with occupation best seen as a series of pulses rather than long term settlement. He argued that this pattern was associated with long distance trade networks such as the Motu *hiri* pottery trade from sometime around 600 years ago (David *et al.* 2010; David *et al.* 2015). The evidence from the mid Kikori also demonstrates that although rockshelters/caves provided evidence of prior occupation as hunting camps, they were not used as ossuary sites until after 500 years ago (David 2008: 477). It is reasonable to assume that the large scale manufacture and trade of sago pounders dates to the beginnings of the *hiri* as the demand for sago to trade for pots intensified (David 2008). We argue that the intensified use of the Baikaboria shelter after approximately 600 years ago (580–600 calBP) could potentially relate to its proximity to the Sikikare stone source and its increasing importance as part of this wider trade network.

The establishment of the site as a repository for human bone began at approximately 180–200 calBP and fits very well with the oral tradition which recounts 10 generations of ancestors marking Kesele clan history (based on 10 generations of 20-year generation spacing); thus dating the timing of fissioning into a separate clan entity from Kuyumen at approximately 200 calBP. Excavation of the origin village site relating to Kesele's clan neighbours the Keipte Kuyumen, directly to the north of Kesele clan lands, also show the establishment of the first Keipte Kuyumen ancestral village at 200 calBP; indicating a broader pattern of fissioning from the main Kuyumen entity at this time (David *et al.* in press). Fissioning is part of a relatively normal practice of segmentation of larger clan groups into smaller entities in this part of the PNG lowlands (Weiner 2007). Reasons for this are variously given as relating to factors such as conflict and disputes over land ownership, land access and access to resources, all possibly exacerbated by such factors as population pressure, intensified social relations and regional climatic variations. Sago pounders from the Sikikare chert source, were traded for hundreds of kilometers to all parts of the lowlands, from the Gulf of Papua to the Papuan Plateau. For Kuyumen, the presence of this relatively rare chert stone source in a landscape with few usable stone raw materials must have presented opportunities as well as tensions in regard to use and control of this valuable resource; particularly as demand for sago pounders intensified over time, thus providing a possible catalyst for fissioning.

CONCLUSION

The timing of the greater use of the Baikaboria shelter from approximately 600 years ago and further changes to intensity and use from 200 years ago can only tentatively be attributed to participation in the wider large scale *hiri*

Table 11. *Mean weight and metrics on flakes at each stage of reduction, for each dated phase.*

Date Range	Stage of Reduction		N	Minimum	Maximum	Mean	Standard Deviation
0–150 cal BP	first	Maximum Dimension	1	27.45	27.45	27.4500	–
		Weight	1	2.07	2.07	2.0700	–
		Length	1	11.38	11.38	11.3800	–
		Width	1	22.65	22.65	22.6500	–
		Thickness	1	4.31	4.31	4.3100	–
		N	1				
	second	Maximum Dimension	9	21.70	54.00	35.6689	11.25597
		Weight	9	0.85	25.83	7.6267	8.24868
		Length	8	15.61	38.50	22.9913	7.14256
		Width	9	14.67	39.59	25.5500	9.18659
		Thickness	9	2.76	11.85	7.5967	3.16561
		N	8				
	third	Maximum Dimension	29	6.32	43.96	17.4459	10.49440
		Weight	26	0.01	7.96	1.4238	2.17220
		Length	25	4.04	40.80	14.0944	8.67277
		Width	20	3.12	33.95	12.9720	7.98356
		Thickness	23	0.64	11.02	3.5061	2.83483
		N	16				
150–600 cal BP	first	Maximum Dimension	2	24.26	38.53	31.3950	10.09041
		Weight	2	1.86	14.81	8.3350	9.15703
		Length	1	24.29	24.29	24.2900	–
		Width	0				
		Thickness	0				
		N	0				
	second	Maximum Dimension	10	5.75	57.44	31.9010	15.48112
		Weight	9	0.05	43.90	9.6044	14.10993
		Length	10	4.73	54.58	23.4010	14.36558
		Width	10	4.34	40.57	21.9320	11.18788
		Thickness	10	1.34	16.96	6.3580	4.71990
		N	9				
	third	Maximum Dimension	13	6.73	38.62	14.8000	10.96291
		Weight	12	0.01	8.48	1.0183	2.45168
		Length	10	3.68	24.33	10.2100	7.86016
		Width	8	3.60	34.45	11.8225	10.01990
		Thickness	10	0.55	7.81	2.0630	2.30930
		N	7				
>600 cal BP	third	Maximum Dimension	5	6.45	19.35	10.5080	5.31780
		Weight	5	0.02	0.58	0.1660	0.23713
		Length	4	4.11	10.12	7.0950	2.57214
		Width	3	2.96	9.38	6.1767	3.21002
		Thickness	5	0.66	3.42	1.6100	1.10820
		N	3				

trade network and more work needs to be done in order to substantiate this hypothesis. However, the initiation of the site as a clan ossuary at approximately 200 cal BP, which according to the oral history also dates the establishment of the Kesele as a separate land holding clan entity can be more clearly demonstrated. Factors such as tensions and conflict over access to the increasingly important high quality chert resource could be argued to be instrumental in effecting the fragmentation of the large main Kuyumen clan into smaller sub-clan entities. Future work on origin villages, ossuary sites and stone sources in the Baina region is needed to further support these conclusions.

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