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NEOLITHIC OCCUPATIONS ON THE SOUTHERN SLOPE OF THE MÜLLER MOUNTAINS: NANGA BALANG AND MUARA JOLOI

OKUPASI NEOLITIK DI LERENG SELATAN PEGUNUNGAN MÜLLER: NANGA BALANG DAN MUARA JOLOI

Abstract. A neolithic occupation in Kalimantan is marked by an open space near the water source and biodiversity which are potential for cultivation. Other characteristics of a neolithic occupation are the presence of archaeological items that suggest a sedentary lifestyle such as pottery, stone adzes, bark-cloth-beaters, and an indication of the arrival of the Austronesia-language-speaking people. Of the sites examined so far, there are two sites indicating open occupations in the southern slope of the Müller Mountains from around 3000-2000 years ago, the Nanga Balang and Muara Joloi. Both sites are practically located in the heart of Kalimantan in the dense interior of the tropical rainforest. This research discusses the characteristic of Neolithic culture in Nanga Balang and Muara Joloi to understand their variabilities. The research method used here is descriptive-comparative approach. The result of this research provides information on human strategies in interacting with the natural environment of the tropical rainforest.

Keywords: Kalimantan, tropical rainforests, Neolithic occupation, radiocarbon dating, occupation characteristic, human survival.

Abstrak. Okupasi neolitik di Kalimantan ditandai oleh ruang terbuka dekat sumber air dan keanekaragaman hayati yang potensial untuk perladangan. Karakteristik lain dari okupasi neolitik adalah keberadaan benda-benda arkeologi yang menunjukkan gaya hidup menetap seperti tembikar, adu batu, pemukul kulit kayu, dan indikasi kedatangan orang-orang berbahasa Austronesia. Dari situs yang diteliti sejauh ini, ada dua situs yang menunjukkan okupasi terbuka di lereng selatan Pegunungan Müller dari sekitar 3000-2000 tahun yang lalu, Nanga Balang dan Muara Joloi. Kedua lokasi tersebut praktis terletak di jantung Kalimantan di pedalaman hutan hujan tropis yang lebat. Penelitian ini membahas karakteristik budaya neolitik di Nanga Balang dan Muara Joloi untuk memahami variasinya. Metode penelitian yang digunakan di sini adalah pendekatan deskriptif-komparatif. Hasil penelitian ini memberikan informasi tentang strategi manusia dalam berinteraksi dengan lingkungan alam hutan hujan tropis pada masa lalu.

Kata kunci: Kalimantan, hutan hujan tropis, okupasi neolitik, pertanggalan radiokarbon, karakteristik okupasi, kelangsungan hidup manusia

INTRODUCTION

Human occupations are significant remnants of human activities that reflects the ideas and behaviour patterns of communities in the past. The distribution pattern of occupation remains, whether in a site or region, expresses human conceptions of space and efforts to change and take advantage of their physical environment based on human's perception and knowledge of the environment. Archaeological sites may reflect

human's decision in choosing a location to reside by considering aspects of ecology, technology, sociology, ideology, and cultural behaviour (Mundardjito 1995: 24). As social creatures apparently humans in the past had developed a symbolic thinking of a basic structure for a place to stay (Tattersall 2013: 70). Further, technological development in tool-making and shelter-building encouraged people to consider living more sedentary, and develop cultivation and animal domestication; however, without deserting hunting

completely. The significant technological advancement that characterised neolithic culture is pottery, either for food procurement, cooking or storage. Ecologically, Soejono (1993: 195) asserts that open spaces near the water source such as riverside, lakeside or the coast are potential for cultivation and animal domestication. Sometimes, dikes or ditches are found built around a settlement to protect its inhabitants from animal attacks. Willey (1956: 3-11) further suggests that the physical setting, including topography, potential of a land, and annual climate (Binford 1983: 110) is an important determinant whether a location will be used as a permanent settlement, semi-permanent, seasonal, temporal or ephemeral. In terms of economic perspective, Butzer (1971: 403) asserts that the availability and variability of animal and plant species is another substantial aspect to enable cultivation and animal domestication. However, Bellwood (2005: 130) suggests that concerning cultivation farmers prefer an open land that receives ample sunlight and high rainfall, but rarely wet.

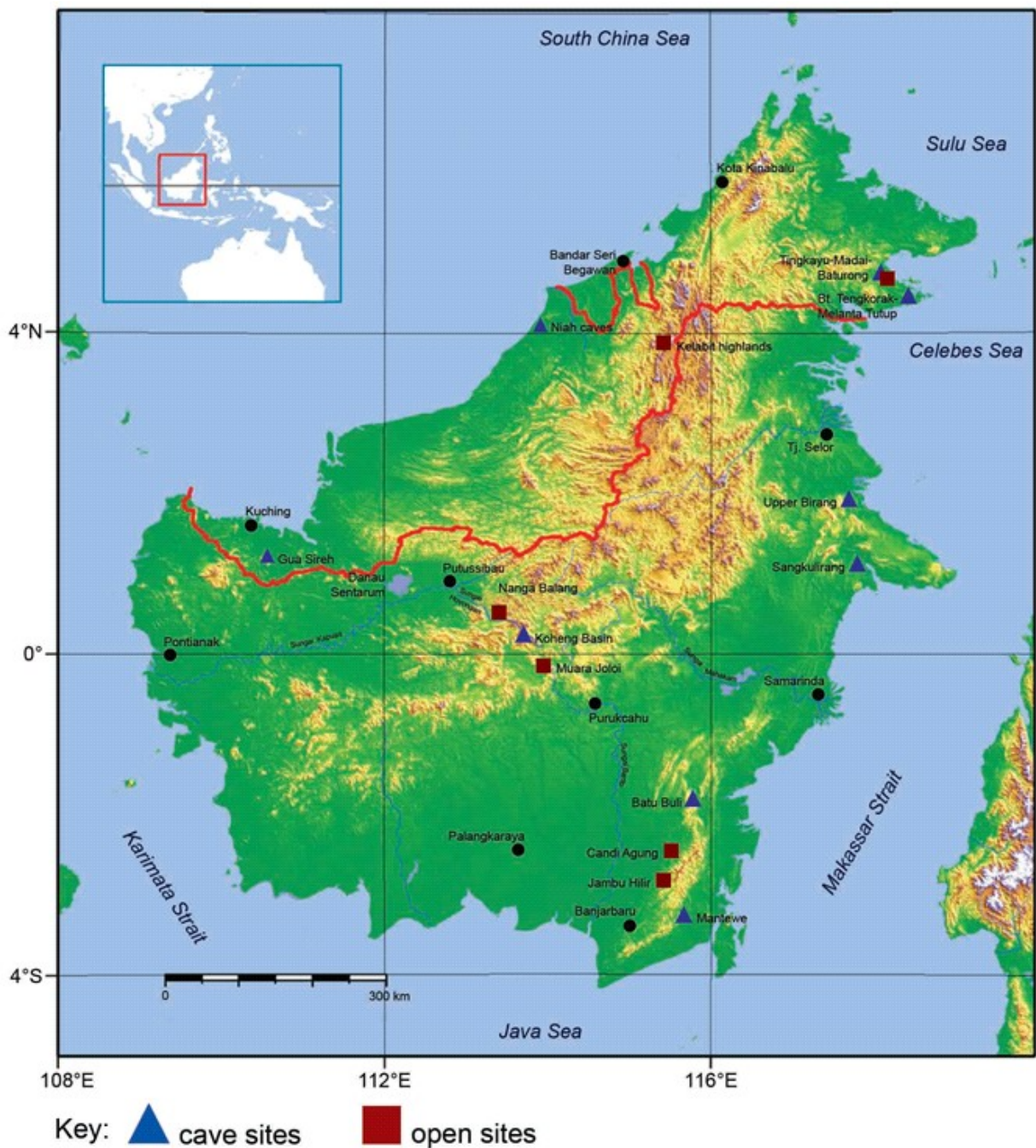
The neolithic culture in Island Southeast Asia (ISEA) regions is identical also to the arrival of the Austronesian-language-speaking people (ALSP) around 3500 BP (Bellwood 2013: 191). This arrival was marked by a significant transformation of cultivation culture, due to adaptation to the ever-wet equatorial climate of the Southeast Asian Archipelago. Instead of establishing an agricultural economy based on rice and foxtail millet which is the characteristic of Dapenkeng—a 5500 BP Neolithic site in Taiwan which is known also for its productions of pearl shell reaping knives, spindle whorl, and bark-cloth-beaters—the newcomers, in the eastern island of Indonesia, preferred to reproduce local taro, yams, breadfruit, coconuts, and banana (Bellwood 2005: 134; Bellwood 2013: 191-207). Regarding pottery, the ISEA pottery production was characterised by plain or red-slipped wares, sometimes with incised or stamped decoration or perforated ring feet (Bellwood 2005: 135).

The dynamics of a settlement may be represented by the spatial division according to types of activities, either communal such as

making hearth, food preparation, and performing ritual or individual like sleeping and crafting (Binford 1983: 144-179; Ferring 1984: 117; Feder and Park 1989; Bintarto 1995: 1-4; Oktrivia 2007: 30-31). Further, based on function such division can be divided into a main working area, and beyond this space are dumping and burial areas. Such spatial division in a landscape provides an overview of human interaction with the natural surroundings (Hodder and Orton 1976: 25-27; Oktrivia 2007: 30-31).

On a wider scale, Clarke (1977: 176) asserts it is important to recognize the impact of human on its surrounding by understanding land utilisation. Human intervention in the landscape reflects the socio-symbolic dimension of humans based on perceptions, experience, and the conditions they faced at the time (Knapp and Ashmore 2000: 12). Hence, such dimensions instigate human to construct a landscape either intentionally designed, involving religious aspects, socio-economic or organically evolved by choosing a particular geographical feature (associative cultural). Thus, the cultural landscape of a number of communities can be similar, but not exactly the same.

There are fourteen major prehistoric sites that have been investigated in Borneo, including Kalimantan (Indonesian Borneo), i.e. in Sarawak are Gua Sireh, the Niah caves complex, and the Kelabit Highlands; in Sabah the Tingkayu-Madai-Baturong complex and the Bukit Tengkorak-Melanta Tutup complex; in Kalimantan the Upper Birang complex, the Sangkulirang complex, the Koheng Basin complex, Nanga Balang, Muara Joloi, the Batu Buli complex, Candi Agung, Jambu Hilir, and the Mantewe complex. Amongst these are the open-sites Nanga Balang and Muara Joloi which are located inland, at 400 above sea level (asl), on the southern slope of the Müller Mountains (Figure 1). This paper discusses the characteristic of Neolithic occupation of Nanga Balang and Muara Joloi to understand human's basic adaptation strategies in a rainforest environment in Kalimantan. Is there a variability of Neolithic characteristic between Nanga Balang and Muara Joloi?



Source: Yeltsin 2016, modified by author 2018

Figure 1 Fourteen Major Prehistoric Sites in Borneo

METHODS

Two researches were conducted in two separate locations, Nanga Balang in West Kalimantan and Muara Joloi in Central Kalimantan.

Both sites lie on the southern flanks of the Müller Mountains, and roughly in the centre of the island Kalimantan, and could be reach only by rivers; Nanga Balang by Kapuas from Putussibau (the capital city of Kabupaten Kapuas Hulu), and Muara

Joloi by Barito from Purukcahu (the capital city of Kabupaten Murung Raya).

This research uses descriptive-comparative method (Tanudirdjo 1993: 213) which emphasised on problem-solving by systematically describing and recording the traits of data collected during fieldworks in Nanga Balang and Muara Joloi. Data were obtained by means of survey and excavation (Simanjuntak et al. 2008: 22-24, and 32-34; Renfrew and Bahn 2012: 21, 71, and 104), comprising a variety of lithics, sherds including terracotta beads, and ochre. The analyses were carried qualitatively by observing their characteristics and recognising the variability of their attributes. The characteristic of Nanga Balang artefacts was further compared to those of Muara Joloi to know whether significant similarities or differences of Neolithic characteristic exist between the two sites.

RESULT AND DISCUSSION

Archaeological Investigations in Nanga Balang and Muara Joloi

The Schwaner-Müller Mountains stretches approximately 800 kilometers from west to the middle of the island and meet the Iban Mountains to the northeast. Two open occupation sites Nanga Balang and Muara Joloi were discovered on the southern valley of the Muller Mountains. Nanga Balang is located on the upper Kapuas Basin, and Muara Joloi on the upper Barito Basin (Figure 1). Geodesically, the distance between the two is 130 km, and, geologically, the sedimentary rocks of both sites show Paleogene-Neogene origins (Setiawan et al. 2013: 15).

Nanga Balang

Nanga Balang (NB) is located at the confluence of rivers Kapuas and Balang, approximately 4.5 km to the southeast of Putussibau. It takes 7 hours to reach Nanga Balang by river. Dense forest borders the west, north, and east side of the site. Nanga Balang

was first reported in the early 1970s by the West Kalimantan Office for Education and Culture and examined in 1977 by the National Research Centre for Archaeology (NRCA). Soejono (1993: 125) and Nitihaminoto (1977: 2-4) from Balai Arkeologi Yogyakarta identified stone adzes, pottery, pottery making-paddles, and bolas (polyhedric stone). A single radiocarbon dating of a charcoal sample resulted 2781 uncal. BP (no details or laboratory numbers available; Lahagu 1991 in Simanjuntak 2002: 205). An archaeological excavation was carried out in 1984 by the NRCA and continued in 1986 (Kosasih 1984: 15; Anggraeni et al. 1992: 27). The excavations yielded stone adzes, hammer stones, anvils, grinding stones, pottery, and terracotta beads. In 2008, Balai Arkeologi Banjarmasin continued the excavation in Nanga Balang to further understand the characteristic of site setting and land utilisation.

The 2008 excavation opened three trenches NB1, NB2, and NB3 which ended at 70-155 cmbs (cm below surface). The stratigraphy of NB1 and NB2 shows undisturbed layers A, B, and C. At the bottom of layer C there was a thin band indicating a change of layer colour and texture which might have been an old topsoil. Archaeological artefacts were mostly discovered in layer C at 40-60 cm in NB1, and in layer C at 45-65 cm in NB2, comprising lithics, sherds (earthenware and stoneware), terracotta beads, ochre, charcoal, and pieces of glass (Table 1-2).

A posthole was found in NB1. The stratigraphy of NB3 shows two distinct and culturally sterile layers: a 15-cm thick topsoil (layer A), and a 140-cm undisturbed clay loam (layer D). Layer D might continue down below 140 cm depth (Kusmartono et al. 2008: 27). The qualitative analyses of the 2008 unearthed artefacts shows (Kusmartono et al. 2008: 15-25):

- **Pottery**, is fragmented and heavily weathered comprising a large number of body and a small number of rim and lid knob. Besides potsherds, four complete terracotta beads were recovered. The raw material of the sherds and bead is clay mixed with sand as the inclusion (temper). Sunarningsih (2011: 39)

Table 1 Distribution of Archaeological Items by Counts (c) and Weights (gm) in NB1

Depth (spit/ layer)	Lithics				Sherds				Terracotta beads		Total			
	Stone tools		Shatter		Plain earthenwares		Decorated earthenwares		Stoneware		c	gm	c	gm
	c	gm	c	gm	c	gm	c	gm	c	gm				
1/A	0	0.0	8	0.8	23	69.0	0	0	0	0	0	0	31	69.8
2/B	3	250.0	11	11.5	213	826.0	0	0	0	0	1	1.5	228	1089
3/B-C	11	693.0	53	180.0	922	2916.65	24	64.8	0	0	1	2.0	1011	3856.15
4/C	0	0	33	132.0	814	3174.60	10	30.7	0	0	0	0	857	3337.30
5/C	5	82.0	10	3.30	774	2262.00	1	5.6	1	17.2	1	2.7	792	2372.80
6/C	1	12.70	1	0.10	102	530.4	6	21.0	0	0	0	0	110	564.2
7/C	1	13.30	0	0	33	163.0	0	0	0	0	0	0	34	176.3
Total	21	1051	116	328	2881	9941.65	41	122.0	1	17.2	3	6.2	3063	11465.6

Source: Kusmartono et al. 2008: Appendix

Table 2 Distribution of archaeological items by counts (c) and weights (gm) in NB2

Depth (spit/ layer)	Lithics				Sherds				Terracotta beads		Recent glasses		Total	
	Stone tools		Shatter		Plain earthenware		Decorated earthenware		c	gm	c	gm	c	gm
	c	gm	c	gm	c	gm	c	gm						
1/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2/B	5	183.0	5	2.5	35	115.5	1	2.7	0	0	2	4.5	48	308.2
3/B	2	84.5	0	0	8	21.6	0	0	1	1.8	0	0	11	107.9
4/C	11	229.3	38	129.2	43	349.6	2	3.5	0	0	0	0	94	711.6
5/C	12	197.2	15	63.0	1365	4777.5	4	8.0	0	0	0	0	1396	5045.7
6/C	2	240.9	14	60.2	5	40.6	0	0	0	0	0	0	21	341.7
7/C	0	0	0	0	5	36.0	2	7.85	0	0	0	0	7	43.85
Total	32	934.9	72	254.9	1461	5340.8	9	22.05	1	1.8	2	4.5	1577	6558.95

Source: Kusmartono et al. 2008: Appendix

suggests that Nanga Balang produced two pottery types, both hand- and (slow?) wheel-made, combined with the use of a paddle and anvil. The hand-made pottery is recognizable from the presence of the indentations observable in the interior wall of the sherds as a result of the finger-pressure during the process of pot-making, while the exterior wall shows a slightly wavy texture. The hand-made pots were unrestricted bowls, such as small bowls and lidded containers, with unburnished surface or and shows no red-slip; nevertheless, vague incised, and cord-marked decorations are still observable (Figure 2). The characteristic of (slow) wheel-made pottery were striations (wide horizontal lines) on the

interior wall as result of using a potter's-wheel, while the use of paddle and anvil was shown by surface flatness of the exterior wall. Slow wheel-made pottery had everted rims and restricted profiles, sometimes red-slipped. Diagonal incisions are seen decorating the rim. The Nanga Balang pottery were well-fired and of an even colour from surface to core, indicating that carbon had been completely burned out by oxidation in the fire. This indicates the used an open-space (bonfire) yet controlled firing technology with a high temperature (Sunarningsih 2011: 43). Besides pottery, there were four terracotta beads (?) recovered from NB1 and NB2 (Figure 3). Surprisingly, a single fragment of a Chinese



Source: Kusmartono et al. 2008: Appendix

Figure 2 Sherds From Nanga Balang Showing Vague Incised and Stamped Decoration



Source: Kusmartono et al. 2008: Appendix

Figure 3 A Terracotta Bead(?) From Nanga Balang

stoneware was found in layer C at 50 cm in NB1. This fragment must have been pushed down by a post associated with the posthole (discussed later) found in the western part of trench NB1.

- **Lithics**, comprising massive stone tools and flakes. Bambang Sugiyanto from Balai Arkeologi Banjarmasin (Kusmartono et al. 2008: 29) identified the lithic items as anvils, pestles, grinding stones, adzes (Figure 4), bark-cloth beaters, cores, flakes, and debitage. The anvils and grinding stones are

of sandstone and show ochre smudge, whereas stone adzes are of basalt and polished. The Nanga Balang stone adzes have a rectangular shape and profile that are commonly found in the western islands of Indonesia, with a slanted sharp edge. The bark-cloth beaters are of river pebbles, that can be easily found on the banks of Kapuas Rivers, and of two shapes, i.e. cone-like and bell-like (Figure 5). The flat end of the cone-like bark-cloth beaters were engraved with criss-crossed grooves, while the other end was



Source: Kusmartono et al. 2008: Appendix
Figure 4 Stone adzes from Nanga Balang



Source: Author Doc. 2016
Figure 5 Bark-Cloth Beaters with a Pointed End from Nanga Balang

formed as point. Peter Bellwood (Kusmartono et al. 2017: 82) suggests that such pointed ends on the beaters could have been used for boring or grinding purposes, possibly in

stone bracelet manufacture (Figure 5). The stone flakes are of cherts of various colours gray, chocolate, and reddish chocolate. The striking platform is observable on the proximal, as well as flake scars, but no retouch is noticeable.

- **Ochre and posthole**, small lumps of ochre were found abundant in Nanga Balang. Smudges of ochre are found on anvils and grinding stones, and as red-slip on some incised pots. On the other hand, a posthole was found on the west side of NB1; it was 6 cm in diameter and 70 cm in height. The AMS ¹⁴C radiocarbon dating, conducted at the Australian National University, of the charcoal samples collected at 75 cm in NB2 (S-ANU 43239), gave 3074-2923 cal. BP (Table 3; Kusmartono et al. 2017: 85), similar to the date of c. 2871 BP from the 1984 excavation. Today, the Neolithic site of Nanga Balang lies beneath a contemporary village forming a linear settlement of wooden houses on stilts, along the rivers Kapuas and Balang. The present Nanga Balang inhabitants live by rain-fed cultivation, hunting, gathering forest products, and traditional gold panning (Kusmartono et al. 2008: 35).

Muara Joloi

Muara Joloi (MJL; see Figure 1) is located at the junction of the Barito, Murung, and Joloi Rivers, approximately 80 km geodesically northwest of Purukcahu, the capital city of Kabupaten Murung Raya in Central Kalimantan, which can be reached by river. Today, close to the site is a contemporary Muara Joloi Village which lies linear to the Joloi River. This village is inhabited by the Murung, Kereho, Ot Danum, and Bakumpai who depend on farming, gathering forest products, including swiftlet nest, and gold panning (Oktrivia 2011: 50-51).

A team from Balai Arkeologi Banjarmasin led by Ulce Oktrivia had initially investigated Muara Joloi in 2009. His survey team recovered lithics, sherds, and ochre. The excavation of one test-pit (MJL) in 2010 resulted an assemblage of plain

Table 3 AMS Radiocarbon Date from Nanga Balang

S-ANU Numb	Trench-Layer	Depth (cm)	Sample material	$\delta^{13}\text{C}$	Percent Modern Carbon (pMC)	F ¹⁴ C	D ¹⁴ C	¹⁴ C age (BP)	Calibrated date (B Two Sigma Range)
43239	NB2-7-C	75	Charcoal	-26.38±2.0	69.93	±0.20	-300.7±2.0	2875±25	2923-3074

Source: Analysed by Author at the Radiocarbon Laboratory, Australian National University

*Fallon, S.J., L.K. Fifield, J.M. Chappell, 2010. Calib Radiocarbon Calibration Program (Calib Rev. 7.0.4); Stuiver, M., and Reimer, P.J., 1993, Radiocarbon, 35, 215-230.

and decorated pottery, and a qualitative analysis resulted (Oktrivia 2011: 58-61; Table 4):

Table 4 Distribution of Archaeological items by Numbers (N) in MJL

Depth (spit)	Plain sherds	Decorated sherds	Total
1 (Topsoil)	47	2	49
2	6	2	8
3	5	0	5
4	0	4	4
5	0	0	0
6	3	0	3
7	0	0	0
Total	61	8	69

Source: Oktrivia 2011: 57

- **Pottery**, comprising rims, neck, body, and handle. Two types of rim were observable, straight and everted rims. All Muara Joloi pottery were hand-made, indicated by the indentations observable in the interior wall of the sherds (Oktrivia 2011: 60), comprising plain and decorated pottery. The decoration was applied by incision and basket-stamped techniques resulting in geometric pattern of straight and woven stripes (Figure 6). Oktrivia (2011: 61) suggests that the pottery was formed either by shaping a complete container or using appliqué technique by joining parts such as neck or handle onto a body. Contrary to that of Nanga Balang, Muara Joloi pottery was made using an open-space (bonfire) firing technology with a low temperature (Oktrivia 2011: 60).
- **Lithics**, comprising adzes, bark-cloth beaters, cores, flakes, and blade like flakes. The bark-cloth beaters are of andesite and cylindrical in shape. The distal plane of a

bark-cloth beater was incised by a sharp tool and created a net or rhombus pattern (Figure 7). Oktrivia (2011:58-60) reports the stone adzes were of andesites and basaltic andesites. One adze was categorised as a tapping adze (Figure 8), small in size, and burnished with a sharp edge, but no traces of use were found. The stone flakes and blade-like flakes were of cherts of ivory yellow, red, honey chocolate, and gray, and quartzites. These rocks could be found easily on the banks of Keramu River. The stone flakes were knapped in a unipolar direction linier to their axis. Such unipolar knapping was observable from the cortex that are still intact on the edge of the axis. Retouching was evident on the edges of the stone flakes, but no use-wear was apparent. There were only two cherts blade-like flakes found, retouched, and showed use-wears. The cores were of cherts showing traces of knapping allover the surface and leaving a small part of cortex.

- **Ochre**, two small lumps of ochre were found on site, but no evidence indicate an association with the sherd assemblages from Muara Joloi.

The MJL test pit ended at 70 cm below surface (cmbs), and the stratigraphy shows three alluvial layers A to C: A, a humus layer; B, a cultural layer; and C, a basal layer of deposits from of Rivers Joloi, Barito, and Murung (Oktrivia 2011: 58-61). Unfortunately, MJL has not been directly dated, therefore a relative dating was resolute based on the presence of stone adzes, bark-cloth beaters, and pottery, leading to an age estimation of approximately 3000-2000 BP.



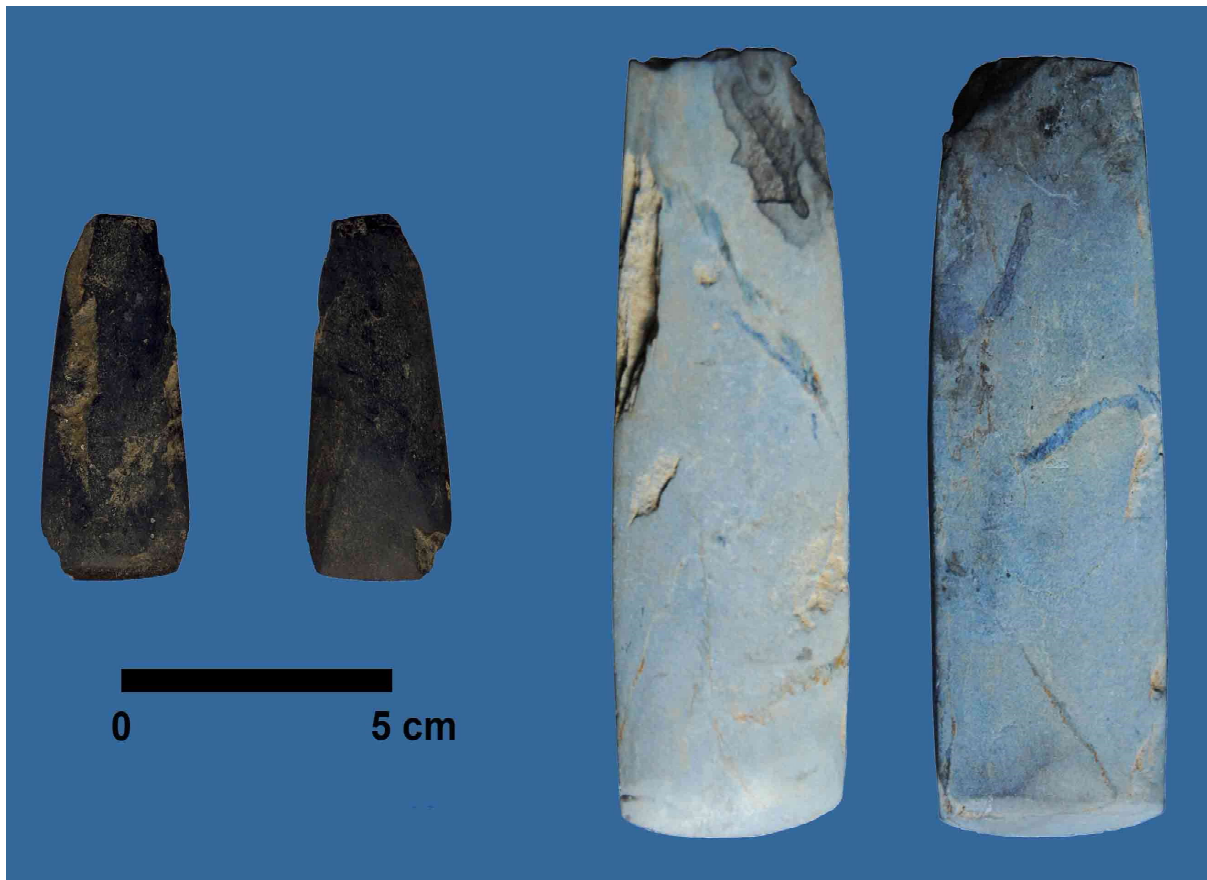
Source: Balai Arkeologi Bjm Doc. 2010

Figure 6 Matt-stamped decoration on sherds from Muara Joloi



Source: Balai Arkeologi Bjm Doc. 2010

Figure 7 A Bark-Cloth-Beater from Muara Joloi, Showing Crisscrossed Incision on Distal Plane



Source: Balai Arkeologi Bjm Doc. 2010

Figure 8 Tapping Adze from Muara Joloi

The Archaeological Characteristics of Nanga Balang and Muara Joloi

Site-wise, Nanga Balang and Muara Joloi show similar characteristic featured by the same residential location on a riverbank, sandwiched by a river and a backdrop of hills and dense forests. Such characteristic suggests that natural environment was a primary consideration for determining the potential of a place to be dwelled by human (Willey 1956: 3-11; Butzer 1971: 403; and Soejono 1993: 195-196). Rivers Balang, Kapuas, and Joloi-Murung-Barito, all provide abundant resources aquatic protein as well as lithic raw materials. These rivers also allow humans to transport from their occupation areas to other regions. However, remnants of water vessels for such movements in the past have not been found yet on both sites. This contradicts the facts that the only means to reach the present

villages, Nanga Balang and Muara Joloi, is by boat. An alternative to access the sites in the past must have been by trekking through the hilly terrain and dense forest, although the degree of difficulty and danger that confronts humans passing through such region on foot must had been higher than the rivers. Nevertheless, the forest environments surround both sites might had offered living comfort such as providing abundant biodiversity of fauna and flora which can be procured daily or seasonally, domesticated, and further cultivated.

Similar characteristics between the two sites are evidenced by the archaeological artefacts which indicate the existence of communities who produced cultures identified by stone adzes and bark-cloth beaters made of sandstones, basaltic andesite, and chert. Nevertheless, there are a slight variability of archaeological items between the two sites, i.e. First, the pottery characteristic

indicates a variability showing Nanga Balang produced incised, cord-marked, and red-slipped decoration which is typical to the Peninsular pottery decoration (Bellwood 2005: 133). On the other hand, Muara Joloi employed basket-stamp and appliqué technique decorations —neck and handle. The appliqué technique decoration suggests an advanced pottery-making indicating a technology used in the Metal Age. Further, Nanga Balang pottery was made using controlled open-space (bonfire) firing technology with a high temperature (Sunarningsih 2011: 43) resulting well-fired pottery with an even colour from surface to core, indicating that carbon had been completely burned out by oxidation in the fire. Contrary to that of Nanga Balang, Muara Joloi pottery was made using an open-space (bonfire) firing technology with a low temperature. Besides potsherds, terracotta artefacts were also discovered in Nanga Balang, i.e. a terracotta beads (Kusmartono 2006: 7), a terracotta fern-like fragment, and a crucible (Nitihaminoto 1977: 2-4; Soegondho 1985: 5; Anggraeni et al. 1992: 27; Kusmartono 2008: 4). Second, both Nanga Balang and Muara Joloi yielded massive and flake tools of basaltic andesite, sandstone, and chert, however, unlike Muara Joloi, flakes from Nanga Balang indicate no retouch.

The presence of these artefacts on Nanga Balang indicate that people who produced these items are culturally advanced in their technology in artefact-making. The presence of crucible further indicate that the inhabitant of Nanga Balang had recognised metal artefact-making. Based on these evidences, it could be inferred that the Nanga Balang site had been occupied continuously to the early Metal Age. There is a possibility that the Metal Age inhabitant of Nanga Balang still continuously produced stone tool and gathered food as a continuous tradition passed from one generation to the next since their hunting-gathering periods.

By recognising the variability of artefacts from Nanga Balang and Muara Joloi, three activities that had taken place in each site could be interpreted here, i.e. a) *an occupation*, evidenced by the high quantity of earthenware containers

which were produced by the inhabitants to support their day to day need to procure, process, serve, and store food in a permanent and active prehistoric open space settlements. I suspect the posthole recovered at NB1 was a component of a temporary tarpaulin tent or perhaps a post used for smoking meat or fish; b) *a workshop*, although indication of a hearth was not yet discovered, based on fabric analysis of Nanga Balang sherds (Sunarningsih 2011: 43-46), it can be inferred that raw material for pottery-making was obtained in close vicinity of the site. Soejono (1993: 171) reports the size of stone adzes varies, where the small ones are considered used as chisels, while the large ones are for larger wood-working. Lithic items recovered from both sites comprise massive tools and flakes. The riverbanks Kapuas, Balang, Barito, and Joloi provide abundant resources for such lithic production. However, it is debatable whether these lithics items were actually manufactured or at least polished on-site; and c) *a creativity or recreational activity* is represented by the terracotta beads and fern-like ornaments.

Besides the three main activities above, there are seven interweaved daily activities that might have occurred in the environs of each sites Nanga Balang and Muara Joloi, i.e.:

- a) *slaughtering*, both terrestrial and aquatic animals;
- b) *collect forest products*;
- c) *cultivation*, possibly grown in a patch of land behind the hills or forests or even across the river. Today, shifting cultivation is still practised by the community of Nanga Balang and Muara Joloi, but no indication of old cultivation around both sites was found. The most common evidence of old rice cultivation may be found as pottery temper, but apparently, sherds discovered in both sites show sand as inclusion, instead of rice grains or rice husks. Hence, weather the old inhabitants of either Nanga Balang or Muara Joloi practised cultivation is still debatable. Nevertheless, based on location, Nanga Balang and Muara Joloi fits the setting of a cultivation mental-template of a rice-culture community who tends

to choose open land with high rainfall, but not always wet (Bellwood 2005: 130), and gets a good intake of sunshine. Thus, if evidence of rice is found on both sites, it is highly probable that the rice varieties cultivated in this region are mountain species (a variety which is presently cultivated by the inhabitants of the highlands of Iban Mountains in eastern Kalimantan, instead of wet-paddy rice;

- d) *procuring, processing, serving, and storing food*;
- e) *burning (hearth)*, both for cooking and garbage disposal;
- f) perhaps *animal domestication*, although many *Suidae* sp. bones were found, they have not been identified whether they came from wild or domesticated pigs; and
- g) *burials*, have not been found yet, hence the identity of the 3000 cal. BP Nanga Balang and Muara Joloi inhabitants are not yet known.

Whether these seven interlaced daily activities occurred simultaneously then could only be verified by further laboratory analyses, such as use-wear analysis on lithics, geoarchaeology of sediments, petrography of ceramics or ancient-DNA on pigs. Nevertheless, hypothetically, based on such variability of activities, the Nanga Balang and Muara Joloi indicate multi-component sites.

The Neolithic Occupation in the Tropical Rainforest Lowlands during c. 3000-2000 BP

The cultural landscape of Nanga Balang and Muara Joloi suggests human's idea of a landscape as a comfortable and safe habitable space that reflects the perception and experience of the inhabitants of Nanga Balang and Muara Joloi. In other words, the cultural landscape of Nanga Balang and Muara Joloi was conceptualised and intentionally constructed (Ashmore and Knapp 2000: 10) by their inhabitants so that environmental conditions are favourable for the survival of the communities of the two sites.

On a micro-scale, the natural environment has guided human to take advantage of the valleys along the banks of Rivers Balang-Kapuas and Joloi-Murung-Barito as activity areas. Observable

activity areas here relate to technical or practical activities such as mentioned above comprising workshop activities (artefact making) and supporting creativity or recreational activities (making terracotta beads). However, the present study could not suggest yet whether these activity spaces were tended for individual, social, economic, ritual or disposal activities (human burial and garbage).

On a semi-macro scale, the site setting shows the 3000 cal. BP Nanga Balang is located on a landscape of the north valley of Kapuas River and protected by hills to its north and northwest, whereas Muara Joloi lies on the west valley of Joloi Rivers and protected by dense forest to its west. A total of nine units were excavated in Nanga Balang (1984 and 2008), approximately aligned with Sungai Kapuas, yielded important archaeological items of Neolithic culture distinguished by pottery, stone adzes, and bark-cloth beaters. Thus, indicating that such geographical setting was favourable and benefitted by the inhabitants of Nanga Balang 3000 years ago. Such geographical setting allows the Nanga Balang settlers to obtain aquatic resources easily for the fulfillment of daily alimentation, in addition to sources which perhaps also obtained from the hinterland regions. However, surprisingly no terrestrial animal bones were recovered from the excavation units. Further, the environment of both sites provides natural resources of rocks (igneous, sediment, and metamorphic) that can be worked into tools to support the survival of the inhabitants of Nanga Balang and Muara Joloi. A number of bark-cloth beaters were also discovered on small tributaries about 2 km upstream and downstream of Nanga Balang. On the other hand, the presence of traditional gold mining activity around Kapuas watershed today may suggest that metal ore (iron) was obtained by digging a quarry on the riverbanks or in shallow waters of the Kapuas (Kusmartono et al., 2008:25). Although there is not enough data to explain about Muara Joloi, basically I suggest that based on a similar geographical backdrop, Muara Joloi has a similar setting to that of Nanga Balang.

On a macro scale, both sites Nanga Balang and Muola Joloi are located in the same region, the south valleys of Müller Mountains at an altitude of 100-400 meters asl with an everwet environment of tropical rainforest ecosystem and climate that has not changed since 15,500 cal. BP (Partin et al. 2007: 5). Nanga Balang and Joloi Muara is separated by a geodesic distance (straight line) of 130 km and a number of hills as high as 700-1000 m, but they share common spatial setting and material culture of pottery, stone adzes, and bark-cloth beaters. Thus, I suggest both sites, either had been inhabited by two different communities that shared common cultural mental-template or the same community that had been going back and forth from one site to the other who recognised the regions surround Nanga Balang and Muara Joloi as both communities' hunting ground. Such cultural mental-template is the basic way of human's instinct to choose an inhabitable area.

Since no burials are found yet in Nanga Balang and Muara Joloi, there is no direct evidence of the identity of the inhabitants of both sites. However, since the Neolithic material culture recovered from Nanga Balang and Muara Joloi represented the arrival of the Austronesian-language-speaking people, I suggest two possibilities with regard to the inhabitant of both sites, i.e. 1) the Austronesian-language-speaking people; or 2) indigenous communities who had been influenced by or performed intermarriage to the agriculturalist newcomers. Either the Austronesian-language-speaking people who arrived in the deep interior or the mixed marriage community must had employed a survival strategy to adjust themselves to inhabit the ever-wet tropical rainforests of Kalimantan around 3000-2000 years ago, because rice and millet agriculture cannot grow in such environment. In order to survive, they had to make several adjustments and adaptations to interact with nature to survive including to exploit more tubers and tree crops such as aroids and *tarap* (native Bornean *Artocarpus odoratissimus*).

Since Nanga Balang and Muara Joloi are located in the deep interior of a irregular terrain,

both communities must had sought open spaces of land near streams where they could exploit the biodiversity of the rainforest, practice slash and burn, and further established cultivation. I suggest such decision is still taken into account today by the people of Borneo who live on the hillside or mountainside. This community might (or might not) be the ancestor of the presentday (indigenous) habitants of Borneo who still continue to live dependently on their surrounding environment in the deep interior of the tropical rainforest in accord to the mental-template and teachings of their ancestors.

CONCLUSION

The landscape on the southern lowlands of the Müller Mountains was culturally shaped by the inhabitants of Nanga Balang and Muara Joloi as open space residential areas which showed similar characteristics, i.e. occupying an activity space closest to the river, and are geographically enclosed by hills with dense tropical rainforests. Such similar characteristic suggests a possibility that both sites were occupied by the same community. Although Nanga Balang and Muara Joloi are geodesically separated 130 km, I suggest that such distance would not prevent intensive human mobility from Nanga Balang to Muara Joloi and vice versa.

The discovery of pottery, stone adzes, and bark-cloth-beaters is an evidence of a cultural process that had taken place on the lowlands of the Müller Mountains which involved the Austronesian-language-speaking people from the Neolithic to Early Metal Age around 3000-2000 BP. Such cultural process was represented by open space occupations on the banks of the Kapuas River (Nanga Balang) and Joloi River (Muara Joloi). This cultural process was also evidenced by a number of technical activities involving manufacturing survival tools. These tools were a necessity to enable the inhabitants of Nanga Balang and Muara Joloi to adjust and adapt themselves to the rugged terrain of the ever-wet rainforest of Kalimantan. Therefore, instead of an ordinary agriculture, the inhabitants of Nanga

Balang and Muara Joloi must have sought open spaces to exploit and even cultivate tubers and tree crops such as aroids and *tarap* (native Bornean *Artocarpus odoratissimus*). Ample wild aroids and *tarap* are still grown in the regions of upper Kapuas Basin today.

No burial was found, hence the identity of the inhabitants who occupied Nanga Balang and Muara Joloi 3000-2000 years ago is still questionable, whether they are the actual Austronesian-language-speaking people (ALSP) who arrived in the deep interior of Kalimantan and adjusted themselves to their new environment in the deep interior rainforest or intermarried communities between the indigenous population and the newcomers who created a new mental-template of exploiting and cultivating the biodiversity of the rainforest by employing the ALSP technology of producing pottery, stone adzes, and bark-cloth-beaters.

The archaeological resources of Nanga Balang and Muara Joloi are invaluable cultural assets which can be considered as the cultural identity of the regions of Balang-Kapuas and Joloi-Murung-Barito basins. In general, the cultural

development that took place in Nanga Balang and Muara Joloi can further represent the root of the cultural identity of the people of Kabupaten Kapuas Hulu (West Kalimantan) and Kabupaten Murung Raya (Central Kalimantan). Further, these archaeological resources underline the significance of Nanga Balang and Muara Joloi's role in Indonesia's prehistoric framework, especially the cultural history of Borneo. The potential of the Müller Mountain regions presents a treasured source of prehistoric studies and civilization development in Kalimantan (Indonesia Borneo), and further in Asia and the Pacific. It is therefore important to undertake further research supported by interdisciplinary studies in a macro scale covering geographical areas including the Kapuas sub-basins, highland sub-regions of the Müller Mountains, and the Barito sub-basins, to obtain comprehensive information of the cultural development in the deep interior rainforest of Kalimantan, especially during Late Pleistocene and/or Early Holocene. Last but not least, this information may further be used by stakeholders for both academic (research and education) and practical (policy and economic) objectives.

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