SPAFA JOURNAL

Early Metal Age Dentate-stamped Pottery and Jars in Wallacea: A case of the Goa Topogaro Complex in Central Sulawesi
Gerabah Motif Cap Bergerigi dan Tempayan Zaman Logam Awal di Wallacea: Studi Kasus Kompleks Goa Topogaro di Sulawesi Tengah

Rintaro Ono,[1&2] Harry Octavianus Sofian,[2] Nasrullah Aziz,[3] Sriwigati,[3] Nico Alamsyah,[2] Ni Luh Gde Dyah Mega Hafsari,[2] Aisyah Arung Qalam,[4] and Adhi Agus Oktaviana[1&2]
[1] National Museum of Ethnology, Osaka, Japan
[2] National Research and Innovation Agency (BRIN), Jakarta, Indonesia
[3] Balai Pelestarian Kebudayaan Wilayah (Regional Cultural Preservation Office) XVIII, Indonesia
[4] Balai Pelestarian Kebudayaan Wilayah XIX, Indonesia

Correspondence:
onorintaro@minpaku.ac.jp

PEER REVIEWED
Received December 8, 2023
Accepted June 17, 2024
Published December 31, 2025
DOI:
https://doi.org/10.26721/spafajournal.4pe2377vb4

Abstract
Dentate-stamped pottery is identified as one of the earliest types of Austronesian pottery found in Maritime Southeast Asia, the Mariana Islands in Micronesia, the Bismark Archipelago, and other islands in Melanesia. Lapita pottery in Melanesia is one of the most famous types of dentate-stamped pottery. Throughout Maritime Southeast Asia, however, this specific type of pottery has currently only been excavated from Northern Luzon in the Philippines with a few pieces reported from Sulawesi (Kamassi, Minanga Sipakko, and Mansiri) in Indonesia. The possible dates of dentate-stamped pottery in Northern Luzon might go back as early as Neolithic times, around 4000 years ago, while the exact dates of Sulawesi dentate-stamped pottery are unclear and might date from 3500 to 2000 years ago. In such a situation, the excavation we recently conducted at the Goa Topogaro Complex in Central Sulawesi uncovered considerable amounts of high-quality dentate-stamped pottery, but these are associated with the Early Metal age burials in cave and rock-shelter sites. In this article, we synthesize the significant outcomes from our archaeological findings, such Early Metal age burials and dentate-stamped pottery from the Topogaro 2 cave and Topogaro 7 rock shelter among the complex, and discuss the possible continuation of dentate-stamped pottery tradition of the Early Metal age in Central Sulawesi and its meaning.

Gerabah motif cap bergerigi (dentated stamp) diidentifikasi sebagai salah satu jenis gerabah Austronesia paling awal yang ditemukan di Asia Tenggara Kepulauan, Kepulauan Mariana di Mikronesia, serta Kepulauan Bismarck dan pulau-pulau lainnya di Melanesia. Gerabah Lapita di Melanesia merupakan salah satu jenis gerabah motif cap bergerigi yang paling terkenal. Namun, di seluruh Asia Tenggara Kepulauan, jenis gerabah khusus ini saat ini hanya diekskavasi dari Luzon Utara di Filipina, dengan beberapa pecahan dilaporkan dari Sulawesi (Kamassi, Minanga Sipakko, dan Mansiri) di Indonesia. Kemungkinan pertanggalan gerabah motif cap bergerigi di Luzon Utara dapat ditarik hingga masa Neolitik, sekitar 4000 tahun yang lalu, sementara pertanggalan pasti gerabah motif cap bergerigi Sulawesi belum jelas dan mungkin berkisar antara 3500 hingga 2000 tahun yang lalu. Dalam situasi tersebut, ekskavasi yang baru-baru ini kami lakukan di Kompleks Goa Topogaro di Sulawesi Tengah menyingkap sejumlah besar dan variasi gerabah cap bergerigi berkualitas tinggi, namun temuan ini berasosiasi dengan penguburan Zaman Logam Awal baik di situs gua maupun ceruk (rock-shelter). Dalam artikel ini, kami menyintesis hasil signifikan utama dari temuan arkeologis kami, terutama penguburan Zaman Logam Awal dan gerabah motif cap bergerigi dari gua Topogaro 2 dan ceruk Topogaro 7 di kompleks tersebut, serta mendiskusikan kemungkinan keberlanjutan tradisi gerabah motif cap bergerigi pada Zaman Logam Awal di Sulawesi Tengah beserta maknanya.

Keywords: dentate-stamped pottery, secondary burial, Goa Topogaro, Sulawesi, Lapita |
gerabah motif cap bergerigi, penguburan sekunder, Goa Topogaro, Sulawesi, Lapita

Introduction

Dentate-stamped pottery is identified as one of the earliest types of Austronesian pottery found in Maritime Southeast Asia, the Mariana Islands in Micronesia, the Bismarck Archipelago, and other islands in Melanesia (Anggraeni et al. 2014; Bellwood 2017; Carson et al. 2013; Hung et al. 2011; Summerhayes 2000; Tanaka 2002, 2021). Currently, the earliest Lapita dentate-stamped pottery is found in the Bismarck Archipelago, dated to 3300-3200 BP (e.g. Kirch 1997; Summerhayes 2000) and appeared in Vanuatu and New Caledonia as Western and Southern Lapita pottery styles by around 3000 BP (Bedford 2003, 2006; Sand 2000). Archaeological sites with Lapita pottery also appear in Fiji and West Polynesia, including Tonga and Samoa, by 2900 BP (Burley and Connaughton 2007; Nunn et al. 2004). Lapita pottery includes a variety of jars, bowls, pedestal vessels, and cylinder stands with dentate-stamps and other decorations (Burley and Dickinson 2010). This style of pottery rapidly spread from the Bismarck Archipelago to West Polynesia, over 4000 km of distances, within 300-400 years. However, dentate-stamped decorations among Lapita pottery disappeared within a relatively short period of time. For example, such decorations ended around 2800-2600 BP in New Caledonia, Vanuatu, and Fiji (Anderson and Clark 1999; Bedford 2006; Sand et al. 2011).

On the other hand, the early dates of red-slipped and dentate-stamped pottery in the Mariana Islands, Micronesia (Figure 1) are reported to around 3500 BP, or 1500 BC (Carson 2014, 2020), while others propose the possible appearance of humans and similar styles of pottery after 3300 BP, or 1300 BC (Petchey and Clark 2021; Petchey et al. 2017, 2018). Thus, the exact date dentate-stamped pottery appeared is still controversial, though the dentate-stamping tradition in the Marianas is also short-lived, similar to the Lapita case, as finely decorated varieties of pottery seem to have ended around 3100 BP, or 1100 BC (Carson 2018). Technologically, the Marianas pottery contains less variation in decoration and is also claimed to have less similarity compared with Lapita pottery (Clark and Winter 2019). Although it is unclear the exact relationship between Lapita pottery and Marianas pottery by early Austronesian groups, it is generally believed that the ultimate origin of such red-slipped and dentate-stamped pottery is somewhere between Taiwan and island Southeast Asia since the linguistic and archaeological hypothesis argues the regions were the origin paces of Austronesian speaking groups (e.g. Bellwood 2017; Blust 2013).

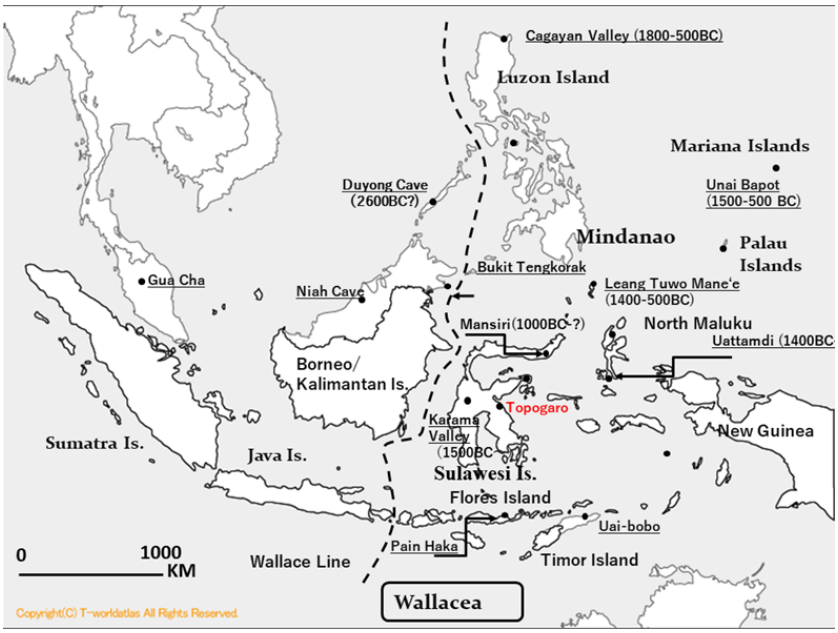

Fig. 1 Locations of major Neolithic sites and Goa Topogaro in island SEA.
Sites colored in red are known with dentate-stamped and lime infilled pottery. Source: Map by R.Ono

ISSN 2586-8721

Figure 1 shows the major Neolithic sites in island Southeast Asia. Among these sites, dentate-stamped pottery has only been excavated and reported from sites in the Cagayan Valley in Northern Luzon, the Mansiri site in Northern Sulawesi, and sites in the Karama Valley in Western Sulawesi. Earlier dated dentate-stamped pottery is reported from Nagsabaran and Magapit shell midden sites along the Cagayan Valley in Northern Luzon, dating to between 3800 and 2500 BP, or 1800 and 500 BC (Hung et al. 2011; Ogawa 2005; Tanaka 2002, 2021). Along Northern Luzon in the Philippines, another island where dentate-stamped pottery has been found is Sulawesi in Indonesia. It is interesting that Neolithic dentate-stamped pottery is only found on these two large islands, but no examples have been reported from other Neolithic sites or other islands in island Southeast Asia.

In Sulawesi, the Kamassi site and the Minanga Sipakko site along the Karama Valley (better known as the Kalumpang area) have yielded red-slipped potsherds and a few possible dentate-stamped potsherds dating widely between 3500-2900 BP, or 1500-900 BC (Anggraeni et al. 2014; Bulbeck and Nusruddin 2002; Simanjuntak 2008). The Mansiri site in Northern Sulawesi has also yielded a small amount of dentate-stamped and red-slipped pottery, dating back to possibly pre-3000 BP, or 1000 BC, but the exact dates are yet unclear (Aziz et al. 2019).

With these sites, our excavation of the Goa Topogaro complex in Central Sulawesi recovered numerous examples of dentate-stamped pottery from both cave and rock-shelter sites. However, these mainly date to around 2000 BP, during the Early Metal age, and might be the youngest dentate-stamping pottery tradition both in island SEA and Oceania (Ono et al. 2019). Since the details of these newly excavated examples of dentate-stamped pottery from the Goa Topogaro complex have not yet been reported except a morphological analysis of selected pottery rims from Topogaro 7 (Qalam et al. 2020), in this article we present the detailed excavation results of dentate-stamped pottery from two burials site of Topogaro 2 and Topogaro 7. We also discuss the Austronesian migration into Sulawesi and East Indonesia based on pottery decoration techniques and variations of ceramic typology.

Materials and Methods

Excavation of the Goa Topogaro Complex

Goa Topogaro is located around 3.5 km from the coast, in the Morowali District of central Sulawesi (Figure 1), at an elevation of about 75 m above sea level. The Pusat Arkeologi Nasional Indonesia (The National Research Centre of Archaeology, currently BRIN) and Ono (National Museum of Ethnology, Japan) conducted excavations between 2016 and 2019. The complex is composed of three large caves (Topogaro 1-3) and four rock-shelters (Topogaro 4-7) situated along the wall of the upper doline, at 90 m above sea level. Our initial surveys in the complex revealed that the two caves Topogaro 1 and 2 seem to have the greatest potential for Pleistocene archaeological deposits, while the four rock-shelters contain secondary burials and jars with dentate-stamped and other decorated pottery together with possible burial goods, including shell ornaments (Ono et al. 2019). Another large cave, Topogaro 3, located next to Topogaro 2, has a small entrance and is therefore rather dark. The absence of any surface findings suggested there being little potential for archaeological investigation. Here, we offer a report the details pertaining to our excavations of burials in Topogaro 2 cave and Topogaro 7 rock-shelter.

Excavation of Topogaro 2 burials

Topogaro 2 is located southwest of Topogaro 1. The two caves are connected from within by a narrow passage. Topogaro 2 faces north, and is 15 m wide and 24 m deep, with a maximum height of approximately 12 m. The floor size of Topogaro 2 is approximately 360 m² (Ono et al. 2020, 2021; Ono, Pawlik, Fuentes 2020). Two 2x3 m trenches (Sector A and Sector C) were opened along the eastern wall, and a 2x2 m trench (Sector B) was excavated along the western wall (Figure 2). During our excavation from 2016 until 2019, Sector A exposed eighteen layers, to a depth of 510 cm (Spit 102), while Sector B was excavated to a depth of 300 cm (Spit 60) in square B-1, with the other squares (B-2,3,4) reaching to only 225 cm (Spit 45) (Ono et

al. 2023a, 2023b). All excavated sediments were dry-sieved using 5 mm and 2 mm mesh screens. The artefacts recovered were mainly chert flakes, as well as a variety of animal remains and shells. The results of the C14 dating in Sector A indicated four occupation phases: Phase 1, during the Late Pleistocene (c. 42-26ka cal BP/ Layer 9-17); Phase 2, after the Last Glacial Maximum (LGM; c. 16ka cal BP/ Layer 6-8); Phase 3, during the Early Holocene (c. 10ka cal BP/ Layer 3-4); and Phase 4, during the Early Metal Age (c. 2300 cal BP/ Layer 1-2; see Ono et al. 2020, 2021,2023a, 2023b).

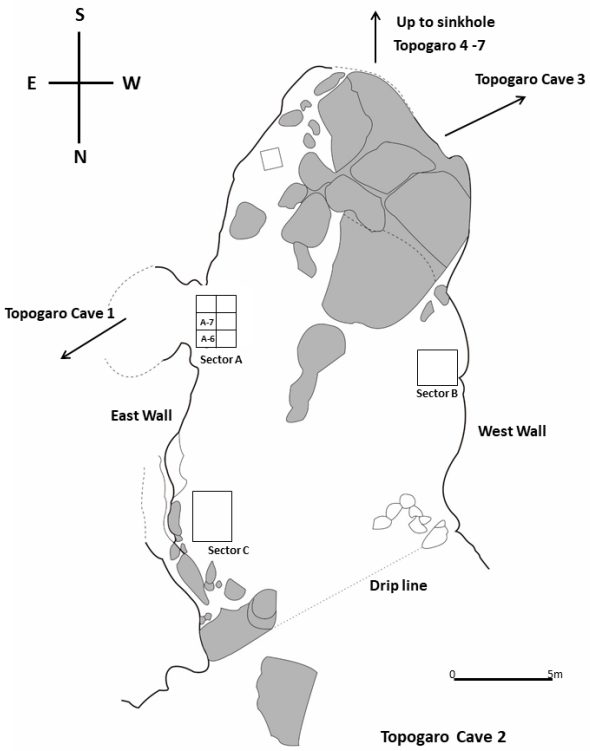

Fig. 2 Plans of Topogaro 2. Source: Map by R. Ono and H.O. Sofian

A new trench, Sector C (6m²) was also excavated in 2018, along the east wall of the cave, near the entrance (Figure 2). This excavation uncovered several early Metal Age burials with large numbers of human remains, dentate-stamped pottery, metal objects, and shell rings. The sector was partially excavated down to 200cm (C-2,4 /Spit 40) and to 140cm (C-1,3/ Spit 28), while two squares extended down to only 40cm (C-5,6/ Spit 8). This article mainly addresses the excavation of Sector C in details. The upper layers (Layer 1 and 2) produced an abundance of human remains and potsherds, and could be recognized as burial layers (Figure 3, 4). Deeper layers (Layer 3-5) produced less or none of these human remains and pottery, but a large amount of shells (especially Layer 3), stone tools and animal remains (C-1,2,3,4) as similar to Sector A and B (Ono et al. 2020a, 2020b, 2021a, 2024). Based on our previous study in Sector A and B, Layer 3 (Figure 4), which is composed of high volumes of compacted mangrove shell remains (Thiaridae and Cyraenidae) dated to the middle Holocene, between 9000 and 8000 BC after calibration (Ono et al. 2020a, 2020b, 2021a), and is therefore likely much older than Layers 1 and 2.

ISSN 2586-8721

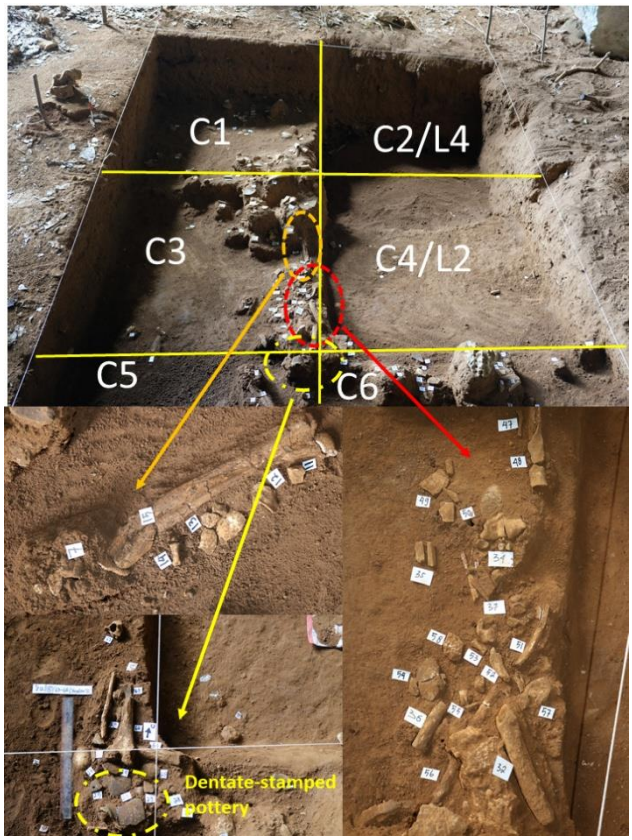

Fig. 3 Picture of Sector C and human remains with pottery. L2 denotes Layer 2, and L4 denotes Layer 4. Source: Photo by R. Ono

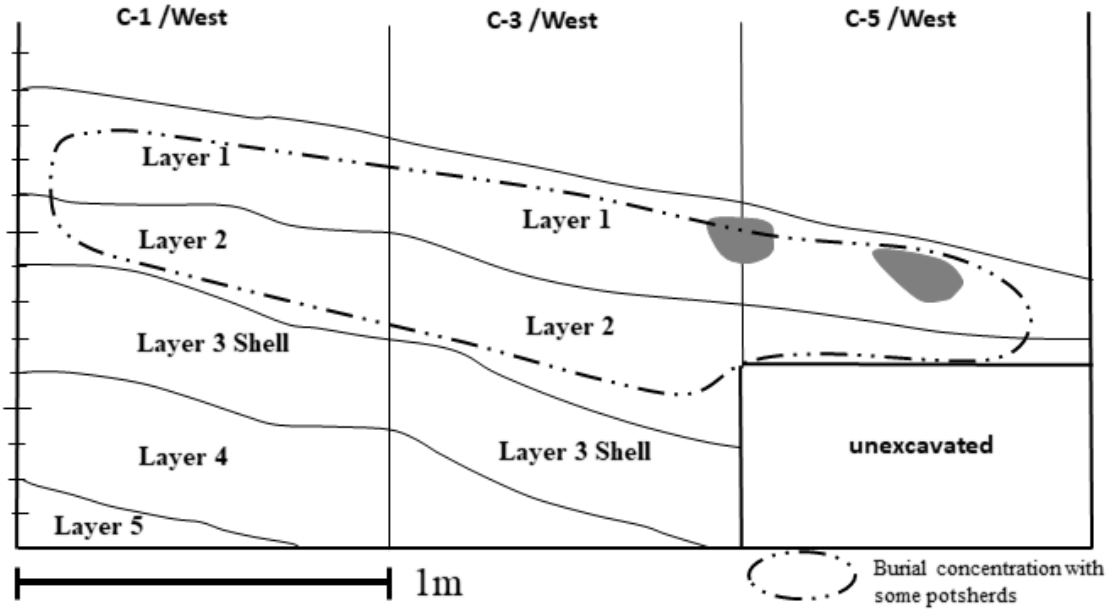

Fig. 4 Wall profiles of Sector C in Topogaro 2. Source: Drawing by R. Ono

Excavation of Topogaro 7 burials

Topogaro 7 is one of the four rock shelters along the upper large sinkhole of Goa Topogaro. Similar to Topogaro 4, finds included human remains and potsherds in large numbers on the surface, indicating its function as a burial site. When we first visited Topogaro 7 rock-shelter, a large amount of human remains and numerous potshards, including red-slipped and dentate-stamped with lime infilled decorations, were found scattered on the surface. All of these human remains and potsherds seemed to be associated with each other, although they are all fragmentary, thus we assigned a number (ID No.1 to 28) to each set of human remains and potsherds in order to collect them within each location (see Figure 5,6). The total number of potsherds collected as surface finds were 382 sherds, with a total combined weight of 12,711 grams (Table 1). The surface find pottery included a great variety of sizes and types with decorations including flask typed rims, many red-slip rims and body tsherds with dentate-stamped and lime infilled decoration, a few of painted rims and body sherds, some with lime infill., Among them, the most interesting finds are a few of red-slipped sherds with human faces and dentate-stamped decorations, which belong to one large pottery (or jar) and as identified by sample No. 12. Some sherds were relatively thick and large, with estimated diameters of rims being larger than 30cm. Thus, we identified them as fragments of jars, while there were no human bones found inside the jars as all of these ceramics were fragmented.

After recording and collecting all surface finds, we settled on two test pits in Topogaro 7. A 1 x 1 m test pit (TP1) is located on the southern end of the rock-shelter, , and another 1 x 1.5 test pit (TP2) is located on the middle part of the site. TP2 is slightly larger than at TP, because this area contained a larger number of potsherds.

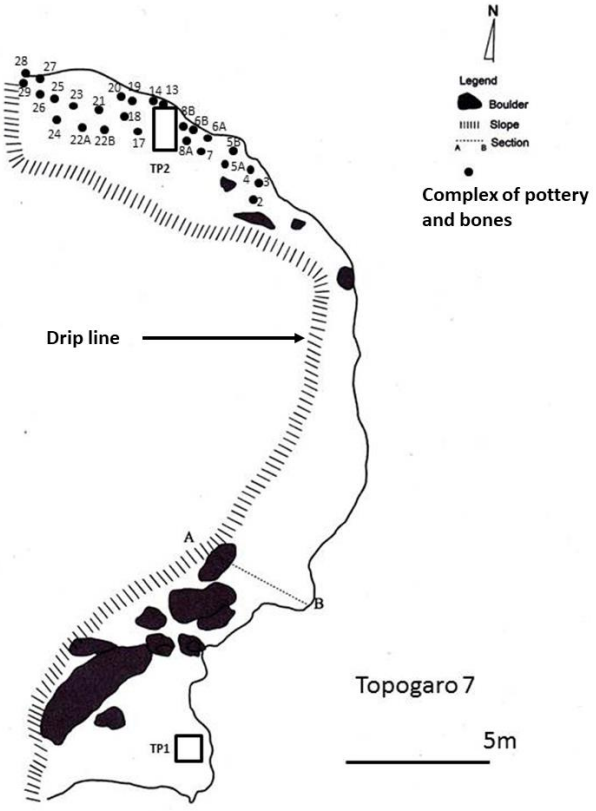

Fig. 5 Plans of Topogaro 7 and excavations conducted in 2017. Source: Drawing by R. Ono and N. Alamsyah

ISSN 2586-8721

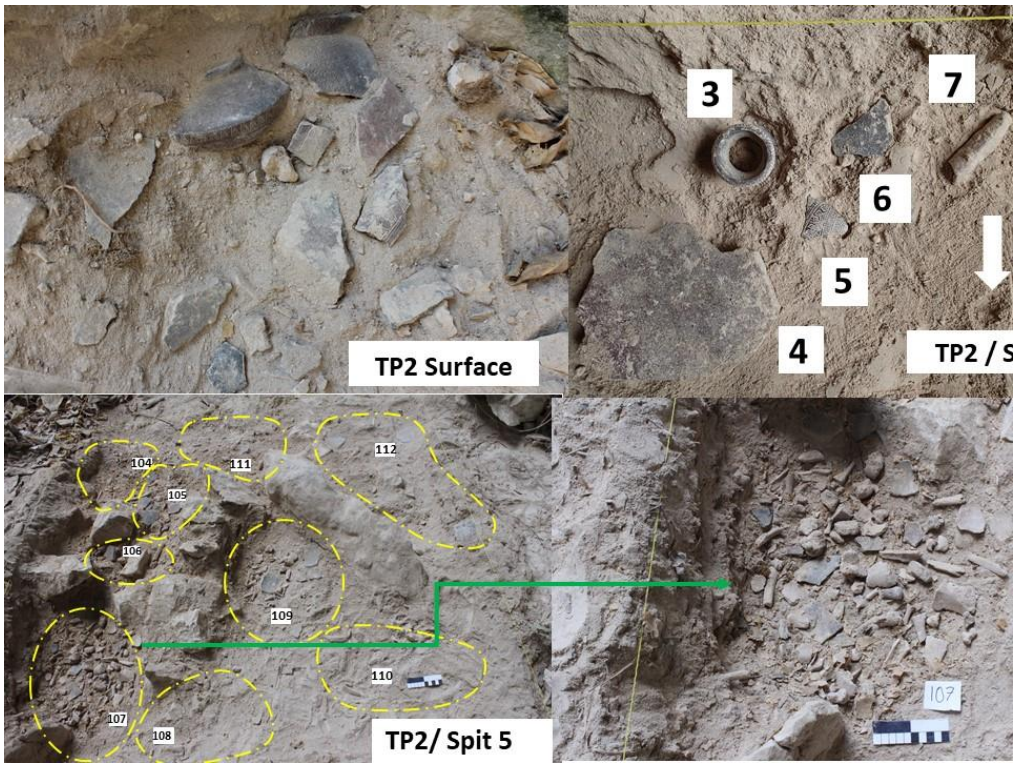

Fig. 6 Surface of Topogaro 7 with pottery complex. Source: Photo by R. Ono

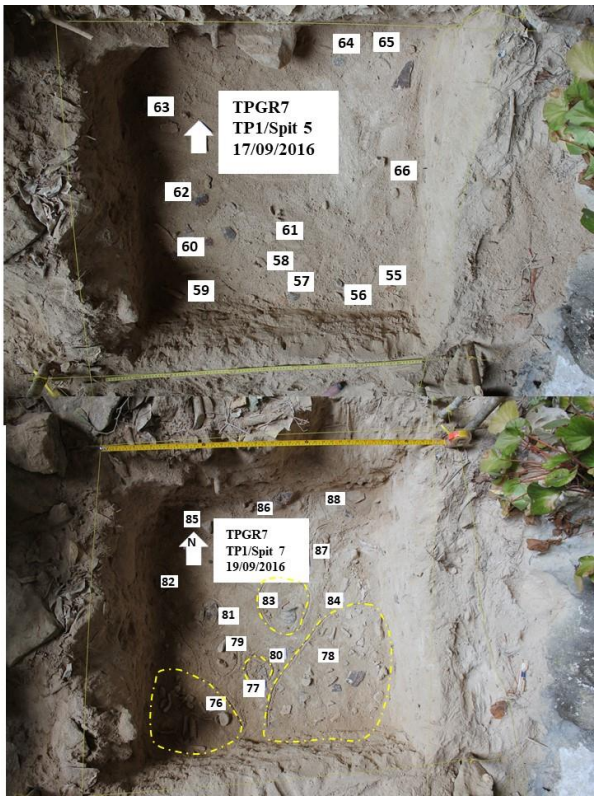

Fig. 7 Excavated plan and in-situ artefacts of Spit 5 and Spit 7 at TP1 (Topogaro 7). Source: Photo by R. Ono

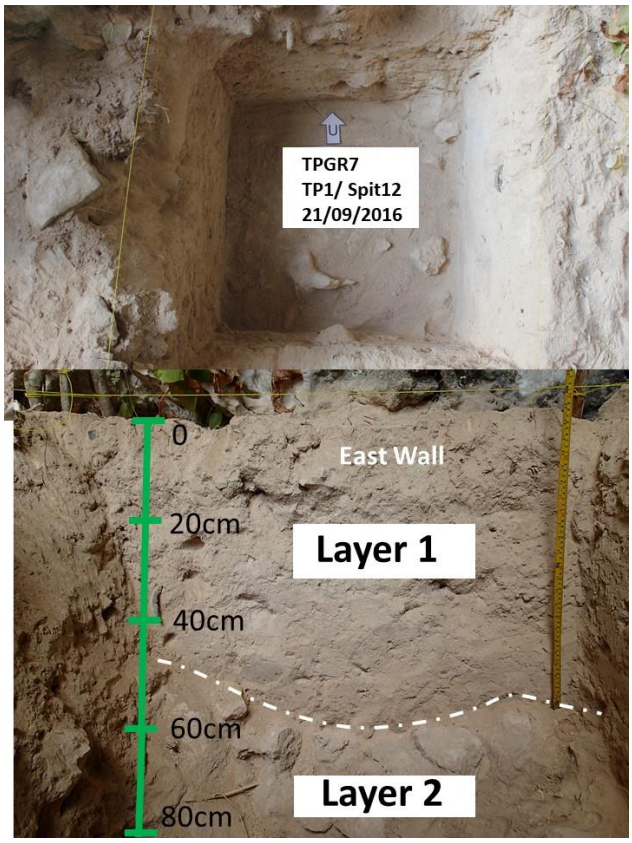

Fig. 8 Excavated plan and wall section at TP1 (Topogaro 7). Source: Photo by R. Ono

Complex	Decorated	Plain		Complex	Decorated	Plain
No.1	19	11		No.13	10	9
No.2	2	0		No.14	0	3
No.3	2	0		No.15	5	4
No.4	44	1		No.16	2	2
No.5A	2	3		No.17	8	3
No.5B	5	4		No.18	3	1
No.6A	0	1		N0.19	7	8
No.6B	1	4		N0.20	5	4
No.7	2	10		N0.21	24	5
N0.8	7	11		N0.22A	20	4
No.8B	0	13		No.22B	14	0
N0.9	2	2		N0.23	4	1
N0.10	9	0		N0.24	6	3
No.11A	4	7		N0.25	6	4

ISSN 2586-8721

No.11B	1	0		N0.26	4	20
No.12A	9	0		N0.27	1	0
No.12B	5	5		N0.28	6	0
Total	114	72		Total	125	71

Tab. 1 List of pottery complex and the number of surface finds in Topogaro 7.

TP1 (1 m) was excavated down to Spit 15, with a depth of 75cm, and producing large numbers of potsherds and human remains. Since the volume artefacts in each spit level was high and both potsherds and fragmented bone remains were mixed together. We assigned numbers to each set, similar to surface findings (ID No.1 to 112 in total) to record and collect by hand, while large numbers of potsherds and human remains were also collected by sieving (see Figure 7). The excavation at TP1 confirmed that the area of TP1 was formed of two sedimentary layers (Figure 8), with most of pottery and human remains concentrated in Layer 1.

TP2 (1.5 m²) was excavated down to Spit 16, with a depth of 80 cm, producing larger numbers of potsherds and human remains. Similar to TP1, the volume of artefacts in each spit level was quite large, so we assigned number to each set to record and collect by hand (see Figure 6), while large numbers of potsherds and human remains were also collected by sieving.

Results

Result of C14 and AMS dates

Both C14 and accelerator mass spectrometry (AMS) radiocarbon measurements were conducted at the Radiocarbon Dating Centre of the University of Tokyo. Calibrations were made using OxCal v4.3.2 and the IntCal13 curve for charcoal and human remains, while the Marine13 curve for marine shell. ΔR corrections were not applied on the marine shell samples as the local reservoir effect is unknown and elsewhere it only affects the ages These new samples were also dated at the Radiocarbon Dating Centre of The University of Tokyo by AMS/C14 methods and calibrated against Marine13 (Reimer et al.,2013) using OxCal v.4.2.4 (Bronk Ramsey and Lee, 2013).

A human tooth excavated from the burial concentration associated with some dentate-stamped potsherds in Layer 2 of Sector C (C-3/Spit 9) is dated to 1886-1820 cal BP, or 64-130 AD, based on calibration by Intcal 2019 (Table 2). Another human tooth from the burial remains in Layer 2 of Sector A (A-2/ Spit 11) was dated to 1900-1810 cal BP, or 50-140 AD (Ono et al. 2019, see also Table 1). Table 2 shows both calibrated and non-calibrated C14 dates of each sample.

Site	ID	Area	Spit	Depth (cm)	Material	C14 Date	Cal (2SD)
TPGR 2	TKA-17404	Sector A	11	55	human tooth	1900 ± 20 BP	50-140AD
	TKA-20188	Sector C	9	45	human tooth	1903 ± 17 BP	64-130AD
TPGR 7	TKA-17416	TP2	3	15	charcoal	1540 ± 19 BP	427-499AD
	TKA-17411	TP2	6	30	shell ring*	2153 ± 34 BP	105-317AD

	TKA-17411	TP1	14	70	charcoal	8377 ± 29 BP	7527-7422BC

Tab. 2 C14 dates of human teeth, charcoal, and shell ornament from Topogaro 2 and 7. Note that human teeth are calibrated by use of δ13C (TKA-17404 =-20.1 ± 0.3 ‰, TKA-20188=-16.9 ± 0.3 ‰ for correction)

The approximate dates from the human teeth in both sectors along the east wall of the cave strongly indicate that burial or funerary practices during this period included dentate-stamped and lime infilled pottery as burial accessories. In addition, all charcoal samples from upper layers in Sector B along the west wall of the cave are dated to around 2300 cal BP, or 300 BC (Ono et al. 2019, 2021a), and these examples of charcoal may indicate possible traces of heavy burning activities during the Metal Age in Layer 1 and 2, which produced some pottery sherds (Ono et al. 2021a). However, it is still unclear whether these charcoal dates are contemporary with the burials associated with the dentate-stamped pottery since both burials in Topogaro 2 and 7 have so far not been dated before 2000 BP, thus we exclude these charcoal dates for the moment.

At Topogaro 7 rock-shelter, a conus shell ring associated with human burials in TP2 is dated to 1846–1634 cal BP or 105-317cal AD after calibration by Marine 2013 (Reimer et al. 2013). This shell ring and human remains are also associated with some potsherds with dentate-stamped and lime infilled decorations. Charcoal from Spit 3 of TP2 was dated to 1523-1452 cal BP, or 427-499 AD, after calibration by InCal 2019. These dates are slightly more recent than the human burials with dentate-stamped pottery in Topogaro 2, though the similarity of pottery types among both sites shows that both the burials and pottery belonged to the same tradition, possibly from the Early Metal age. Aside from these, three human teeth from Topogaro 7 were analyzed for dating; unfortunately, the dating of these teeth failed due to lacking sufficient collagen. Although the total number of acquired C14 dates are limited, we can now confirm that the Topogaro human burials associated with accessory pottery, including dentate-stamped and lime infilled examples, were part of the Early Metal age tradition, currently dated to 50-500 cal AD.

Sector C burial and pottery from Topogaro 2

Table 3 shows the number of recovered human remains are larger in lower part of Layer 1 and upper part of Layer 2 of grid C-3,4,5 and 6, while dramatically decreasing in Layer 3 (mainly below Spit 8). These human remains are anatomically not in their original positions, but some bone elements, including a femur, humerus, and sacrum, were excavated essentially intact, although in a fragile state and broken into pieces. While being fragmented, other elements, including skulls, tibias, ulnas, vertebrae were also found together, mainly from the same level, and these remains could have originated from a single adult. A total of three human teeth were also excavated from Layer 1 and the upper part of Layer 2, including one sample from Layer 2 utilised for C14 dating (TKA-20188, see Table 2).

Spit (interval 5 cm)	Layer	C1	C2	C3	C4	C5	C6	Total
Spit 1 (0 – 5 cm)	1	0	0	0	0	1	1	2
Spit 2 (5 – 10 cm)	1	0	0	3	0	3	3	9
Spit 3 (10- 15 cm)	1	0	2	8	0	1	3	14
Spit 4 (15 – 20 cm)	1	0	6	4	0	7	9	26
Spit 5 (20 – 25 cm)	2	0	4	10	0	12	19	45
Spit 6 (25 – 30 cm)	2	10	14	1	0	0	9	34
Spit 7 (30 – 35 cm)	2	4	7	9	1	2	3	26

ISSN 2586-8721

Spit 8 (35 – 40 cm)	2	2	1	26	1	0	0	30
Spit 9 (40 – 45 cm)	3	5	2	3	1	0	0	11
Spit 10(45 – 50 cm)	3	3	0	0	8	0	0	11
Spit 11 (50 – 55 cm)	3	0	0	0	14	0	0	14
Spit 12(55 – 60 cm)	4	0	0	0	12	0	0	12
Spit 13 (60 – 65 cm)	4	0	0	0	5	0	0	5
Total		24	36	64	42	26	47	239

Tab. 3 The number of excavated human remains in-situ from Sector C, Topogaro 2

Table 4 shows the number of sieved potsherds from Sector C (n=214), clearly demonstrating that potsherds were mainly excavated from Layer 1 and the upper part of Layer 2. In Sector C, pottery was basically fragmented, though it seems to be associated with human remains as burial accessories, and some are decorated. Table 5 shows the number of excavated potsherds classified by type from each grid of Sector C (n=315). They include a few rim and body sherds with dentate-stamp and lime infilled decorations, while the largest concentration being to plain and undecorated sherds. Only one example with paddle impressed decorations was found. A large, red-slipped potsherd with dentate-stamped and lime infilled decorations was thought to be associated with some human remains along the division between squares C3 and C5, as shown in Figure 6. The total number of potsherds collected during excavation and by sieving was 529. Among these, the total number of dentate-stamped potsherd was 12 pieces (3.8% of the total amount of pottery from Sector C). For human remains, the detailed anthropological analysis and identification of each bone is now underway and will be reported in a future publication.

Spit (interval 5 cm)	Layer	C1	C2	C3	C4	C5	C6	Total
Spit 1 (0 – 5 cm)	1	0	0	0	0	0	0	0
Spit 2 (5 – 10 cm)	1	0	2	0	0	0	8	10
Spit 3 (10- 15 cm)	1	0	1	6	0	1	22	30
Spit 4 (15 – 20 cm)	1	0	5	6	0	0	11	22
Spit 5 (20 – 25 cm)	2	11	0	7	0	3	44	65
Spit 6 (25 – 30 cm)	2	5	2	12	0	1	5	25
Spit 7 (30 – 35 cm)	2	8	3	4	0	1	6	22
Spit 8 (35 – 40 cm)	2	15	1	0	0	0	12	28
Spit 9 (40 – 45 cm)	3	3	0	0	0	0	0	3
Spit 10(45 – 50 cm)	3	0	0	0	0	0	0	0
Spit 11 (50 – 55 cm)	3	4	0	0	0	0	0	4
Spit 12(55 – 60 cm)	4	0	0	0	1	0	0	1
Spit 13 (60 – 65 cm)	4	0	1	0	3	0	0	4
Total		29	46	15	35	4	6	108	214

Tab. 4 The number of sieved potsherds excavated from each spit in Sector C, Topogaro 2

Pottery Type	Element & Decoration	C1	C2	C3	C4	C5	C6	Total
Decorated Pottery	Rim		2	1		2	1	6
	Rim + D + L*			1		1		2
	Body	8		11			11	30
	Body + D + L				1	1	7	9
	Body + L*	1		2	1	2	4	10
	Body + paddle impress			1				1
	Carination	1					1	2
	Carination+ D+L						1	1
	Bottom							0
Plain pottery	Rim		1	9			16	26
	Body	47	21	31	18	6	102	225
	Carination				1		1	2
	Bottom		1					1
Total		57	25	56	21	12	144	315

Tab. 5 The number of each type of potsherd excavated in-situ from Sector C, Topogaro 2. Note that D denotes dentate-stamped, and L denotes lime infilled.

Topogaro 7 burial and potteries

The excavations of TP1 and TP2 also revealed large numbers of fragmented human bones in the context of secondary burials which were associated with various types of pottery and other burial goods, including glass beads, shell ornaments, and metal ornaments (Figure 9). A relatively higher number and percentage of dentate-stamped pottery was excavated from Topogaro 7 as compared to Topogaro 2. With the acquired C14 dates (Table 2) and existence of glass and metal ornaments, the Topogaro 7 rock-shelter could arguably be a Metal age secondary burial site.

Results of the TP1 Excavation

Table 6 shows the number of each type of excavated pottery and human remains, labelled with ID numbers and collected in-situ, while Table 7 shows the number and weight of each type of pottery as well as the total weights of human remains acquired by dry sieving in each spit level. In TP1, the number of in-situ potsherds excavated was 143 pieces, and the number of sieved potsherds was 327 pieces, weighing a total of 1815 g; thus, the total number of excavated potsherds from TP1 was 468. Among the in-situ potsherds, decorated sherds bear dentate-stamped decorations, and some are infilled with lime. The percentage of the dentate-stamped potsherds among the total in-situ pottery is 44%. However, the number of dentate-stamped potsherds recovered from the sieving is only 3 sherds in total, and the percentage of dentate-stamped potsherds among the total excavated pottery is 14%. For human remains, the in-situ human bones had a combined weight of 1,057 g, while a total volume of fragmented human remains collected by sieving had a

ISSN 2586-8721

combined weight of 4,989 g, demonstrating the high volume of human remains being excavated from just a 1x1 m square at Topogaro 7. For the excavated human teeth, a total of 27 teeth were excavated by sieving as recorded in Table 8.

Fig. 9 Glass beads, shell ornaments, and metal ornaments from Topogaro 7. Source: Photo by R. Ono

Artefact/ ID No		ID Number		ID Number		ID Number		ID Number		Total
Type	Element	1 -14	15 - 28	29 - 42	43 - 56	57 - 70	71 - 84	85 - 98	99 - 112	
Decorated Pottery	Flask+L		2						1	3
	Rim	0	1	1	0	0	0	0	0	2
	Body	10	8	0	8	5	7	2	0	40
	Body+L	0	4	7	0	0	0	0	0	11
	Bottom	1	1	0	0	0	0	0	0	2
	Cover	0	1	2	0	0	0	0	0	3
	Carination	1	1	0	0	0	0	0	0	2
Plain Pottery	Rim	0	1	3	0	1	1	2	1	9
	Body	7	6	11	9	11	12	6	5	67
	Bottom	2	1	0	0	0	0	0	0	3

	Carination	3	1	0	0	0	0	0	0	4
Total		24	27	24	17	17	20	10	7	146
Human remains (g)		34g	198g	99g	114g	112g	346g	101g	53g	1057g
Human teeth		2	2	1	0	0	0	0	1	6

Tab. 6 The number of each type of excavated pottery and the weight of human remains at TP1 (in-situ).

Pottery	Spit	Surface	1	2	3	4	5	6	7	8	Total	Weight (g)
Decorated Pottery	Rim	1				1					2	8
	Rim+L	1									1	18
	Body+L	1	28	7	7	14	10	7	10	2	86	531
	Body+D	1		1				1			3	62
	Carination+L							1			1	15
	Others			1							1	4
Plain Pottery	Rim		4				2	1			7	66
	Body	4	66	35	30	28	24	21	11	4	223	1088
	Bottom						1				1	8
	Others		1	1							2	15
	Total		99	45	37	43	37	31	21	6	327	1815

Tab. 7 The number and weight of each type of pottery at TP1 obtained through sieving.

Spit	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
Human remains (g)	627	26	379	3018	530	250	57	85	0	0	16	0	1	4989
Human teeth (NISP)	5	5	9	1	5	1	1	0	0	0	0	0	0	27

Tab. 8 The number of excavated human teeth and weight of human remains sieved at TP1.

As shown in Table 7, no pottery was excavated by sieving below Spit 9, which was still part of Layer 1. The number of in-situ artefacts collected during excavation dramatically decreased between Spit 9 and Spit 15. On the contrary, a few possible stone flakes excavated from Layer 2 and a piece of charcoal associated with this layer was dated to 8377 ± 29 BP (Table 2), indicating that Layer 2 was associated to the human burial layer and possibly contained older human traces in Topogaro 7. In fact, the possible age of Layer 2 is basically contemporary to the lower layers of Topogaro 1 and Layer 3-5 of Topogaro 2, which were dated between 10,000 and 8,000 cal BP (Ono et al. 2020, 2021a, 2021b).

Results of the TP2 Excavation

Table 9 shows the number of each type of excavated pottery and human remains, labelled with ID number (ID No. 1-179 in total) and collected during excavation. Table 10 shows the number and weight of each type of pottery, while Table 11 shows the total weights of human remains collected by sieving in each spit at TP2. Among the in-situ potsherds, decorated rim and body sherds had dentate-stamped decoration (n=221), and

ISSN 2586-8721

some also had lime infilled (see Table 9). The percentage of the dentate-stamped potsherds among the total in-situ pottery was 30.4 %. The number of dentate-stamped potsherds collected by sieving was 80 sherds in total, and the percentage of dentate-stamped potsherds among the total excavated pottery is 22.6 %. In summary, the total number of excavated pottery from TP2 is 1327 sherds. The total volume of fragmented human remains collected by sieving weighed 16,252 g and the total number of human teeth was 716 teeth, recovered from a 1x1.5 m square, Thus the volume of human remains is far larger at TP2.

Pottery Type		No. 1 to14	No. 15 to 28	No. 29 to 42	No. 43 to 56	No. 57 to 70	No. 71 to 84	No. 85 to 98	No. 99 to 112	No. 113 to 126	No. 127 to 140	No. 141 to 154	No. 155 to 168	No. 169 to 179	NISP
Decorated Pottery	Rim+D	2	1	4	4	5	1	1		3	2	2	3		28
	Body+D	24	18	25	20	9	18	8	18	16	14	8	13	2	193
	Bottom			4											4
	Others									1		1		1	3
Plain Pottery	Rim	1			2		1		1		3		2		10
	Body	18	23	42	52	34	47	31	42	44	32	32	65	13	475
	Bottom			1	2		1			1	2		1		8
	Others	1			1				2						4
Total		46	42	76	81	48	68	40	63	65	53	43	84	16	725
Human remains (g)		117	142	270	529	407	527	455	296	478	497	501	594	116	4929
Human teeth (NISP)		4	1	1	14	6	12	8	2	7	8	10	6	4	83

Tab. 9 The number of each type of excavated pottery and the weights of human remains at TP2 (in-situ).

Type	Type/Spit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	No	Weight(g)
Decorated Pottery	Rim					1			2								3	6
	Rime+L		3	4	2	2	1	1									13	26
	Flask+L				1												1	3
	Body D+L	8	7	10	17	22		7	5	2		1					79	228
	Body+L			1		4	1										6	19
	Carination					1											1	1
	Carination D+L			1													1	5
Plain Pottery	Rim			2		1				2							5	19
	Body	9	14	57	97	118	52	49	61	17	6	7	3	1	1		492	1063
	Carination				1												1	8
Total		17	24	75	118	149	54	57	68	21	6	8	3	1	1	0	602	1378

Tab. 10 The number and weight of each type of pottery at TP2 (sieving).

Spit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Human remains (g)	160	247	1391	2033	3437	3669	3117	1500	531	159	0	0	0	6	2	16252
Human teeth (NISP)	7	17	44	131	218	64	64	64	64	24	9	4	5	1	0	716

Tab. 11 Number of excavated human tooth and weight of sieved human remains at TP2.

Morphological Characteristics of Topogaro Pottery

Many of the excavated dentate stamped pottery from Topogaro 2 and Topogaro 7 are infilled with lime or possible shell powder. Some fragments are very thin and small, while others could be parts of larger jars (Figure 10, 11). Many rim sherds show parallel horizontal line, possibly indicating that these vessels were turned on a slow wheel and finished by wiping (see also Bulbeck and Nasruddin 2002: 91). Since both Topogaro 2 and Topogaro 7 contain huge volumes of human bones together with pottery items, we can assume that these dentate stamped pots were used as accessory materials for secondary burials during the Early Metal age. As Table 1 shows, the number of decorated potsherds (n=239) is larger than that of plain pottery (n=143) among the surface find pottery in Topogaro 7.

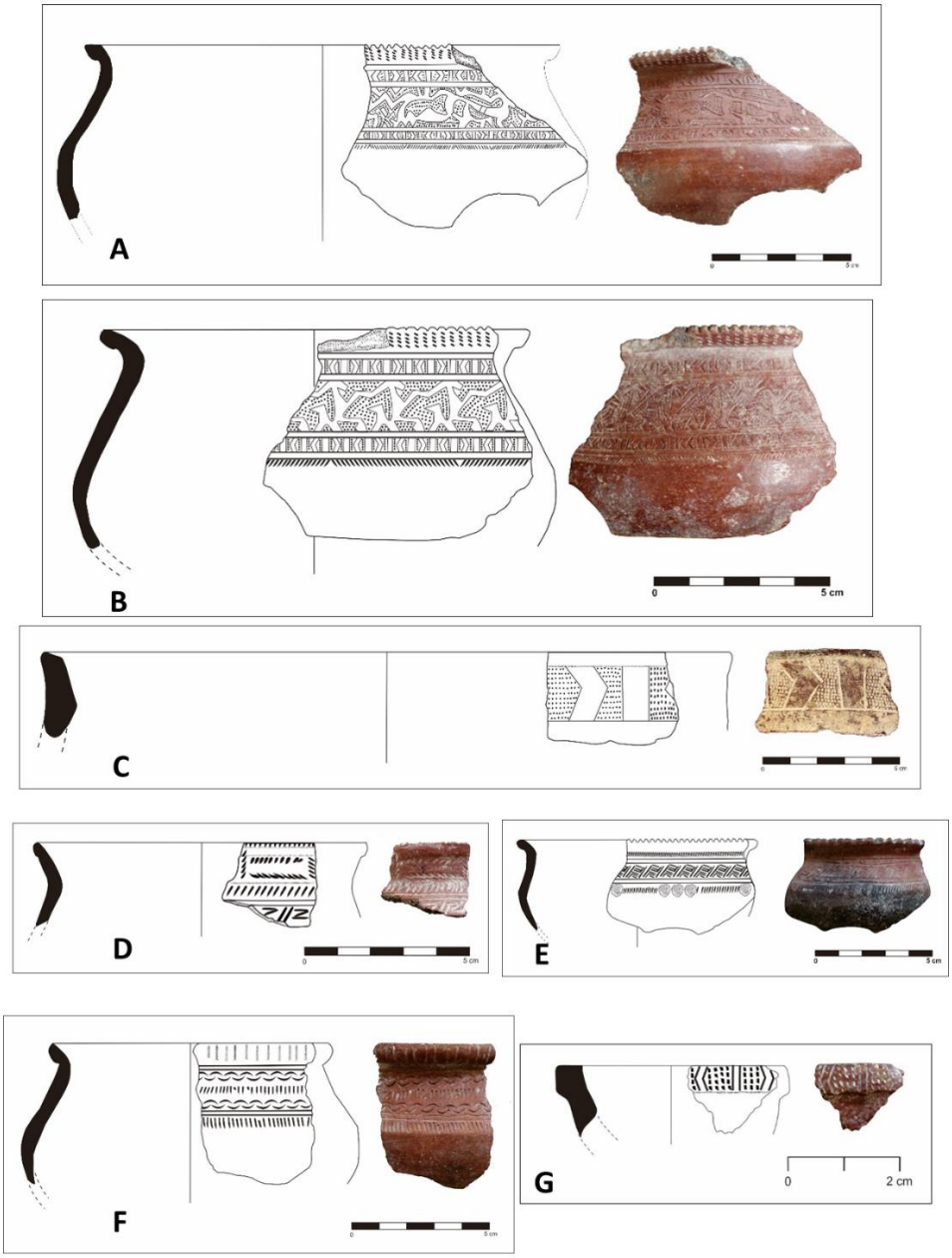

Fig. 10 Variations and rims of dentate-stamped pottery from Topogaro 7. Source: Photo by R. Ono and A. Qalam

ISSN 2586-8721

In terms of the forms of Topogaro pottery, there are mainly five types of pottery, identified as small jars/pots, large jars, bowls, flasks or cylindrical jars/vases, and jar covers (Figure 11-12). For large jars and possible covers, diameters range from 18-42 cm and vessel thickness ranges from 6-11 mm. The possible covers are classified into two types, being triangular top or conical shaped (Figure 11A-B) and box shaped (Figure 11C). It is worth noting that all the decorated jar rim fragments have dentate-stamped decorations, and a large jar has dentate-stamped, circle-stamped and lime infilled decorations with multiple human figures depicted and human face knobs on the shoulder (Figure 11D-E). Although the exact position is not yet clear, there are some possible rim knobs with animal figure depictions, as well (Figure 11F-G). Flask or cylindrical jar/vase type is defined as being a long-necked container with a narrow mouth with dentate-stamped and lime infilled (Fig12H). Such types of pottery were excavated from both Topogaro 1 and Topogaro 7 (Figure 12, Ono et al. 2023b). Since no human bones were found inside the excavated pottery or jars, it is still unclear whether these jars were used as burial jars as bone containers. In Topogaro 2, no large potsherds were excavated, and most of the dentate-stamped potsherds are very fine and small (Figure 13). These are thought to have been used as accessory pottery associated with human burials.

Fig. 11 Jar covers, dentate-stamped potsherd with human face figured knobs, flasks, and animal figured rim knobs from Topogaro 7. Source: Photo by R. Ono

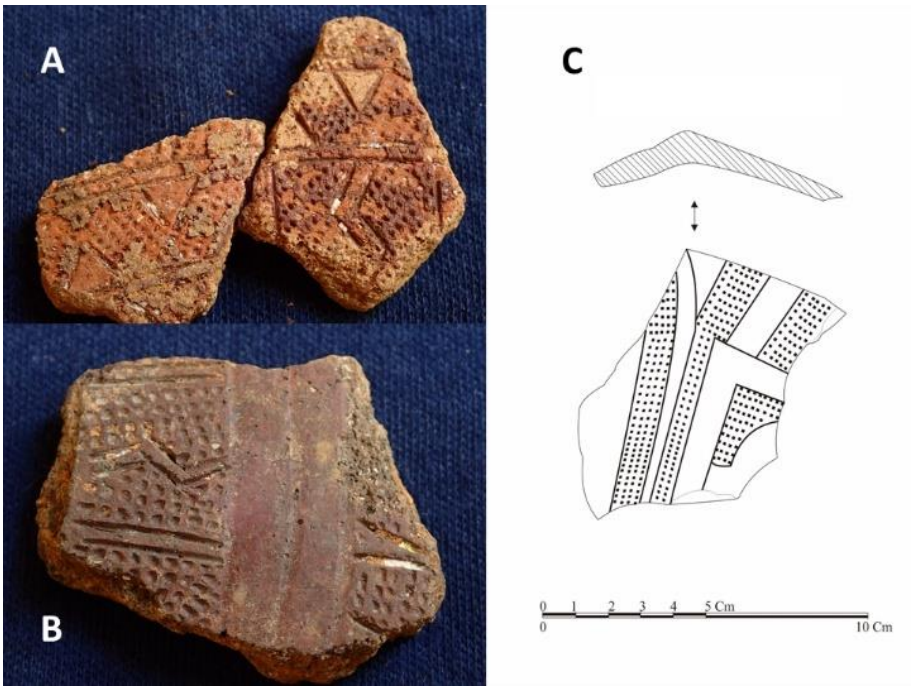

Fig. 12 Dentate-stamped potsherds from Topogaro 2. Source: Photo by R. Ono

Manufacture and Technological Character of Topogaro dentated pottery

The decoration of incisions is made by scratching the surface of pottery while the ware is still soft using either sharp or blunt object such as a single edged tool to produce various shapes of slices with unequal depths or a multi-edged tool like comb resulting in slices with the same depth and images facing the same direction (Figure 10-13). Impressed decorations are made by using fingers, fingernails, stamps, and the like to impress the surface of pottery while the ware is still soft, before firing (Figure 10F, G). The impressed technique covers hitting, puncturing, and stamping (Rangkuti et al., 2008). The basic formation techniques of Topogaro pottery is slab-building, and modelling by hands and fingers as well as by paddle beating in some cases. Although the number is limited, there are some potsherds with paddle-impressed traces (Figure 13A).

Fig. 13 Examples of paddle impressed, red slipped, and black-ware pottery. Source: Photo by R. Ono

ISSN 2586-8721

Most of the Topogaro 7 pottery has slips, mainly being red slip, on the surfaces (see Figure 11-13). The red slip is a kind of red paint over the surface of the pot (Carson et al. 2013: 22) and slipping is basically applied to visible parts of the vessels, especially exterior surfaces of the rim and neck (Figure 10A, 10B, 11C). The common slip colours of the Topogaro pottery are weak red, reddish brown, dark red, and greyish brown, while a few black colour slip or painted potsherds were also recorded (Figure 12F). Such black-ware could also have been made by a similar process of red-slip as well as cooling the burnt pottery by using rice husks based on ethnographic observations in Northern Luzon (Tanaka 2002).

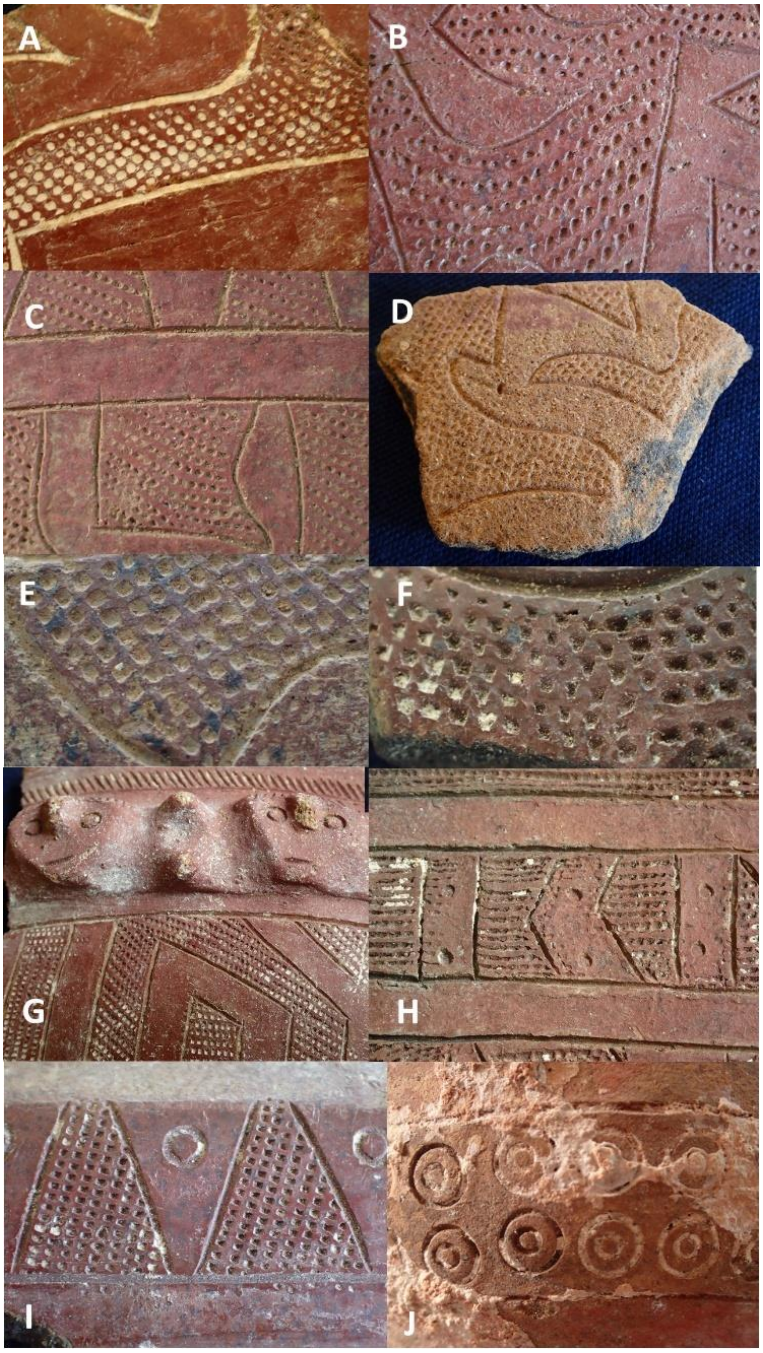

Fig. 14 Variety of dentate-stamping, circle stamping, and an example of human face motif. Source: Photo by R. Ono and A. Qalam

In terms of dentate-stamp technique of Topogaro, decorations were made by a variety of round-tipped tools (Figure 14A, 14B) and rectangular tipped tools. The latter decorations are more common and with greater variation of tools (Figure 14C - 14I). The round dentate decorations could also have been made by using a single tipped tool (Figure 10-B), while most of the rectangular dentate decorations were made by multi-tipped tools, possibly like a wooden fork or comb tools. Dentate-stamps are also combined with appliques of human faces and notched decorations (Figure 14G) as well as circle stamps of various sizes (Figure 11E, 13B,14H-J). Circle stamps could be made by various sizes of plant stems, such as bamboo. One example of pottery found on the surface in Topogaro 2 contains two lines of double circle stamps with large and small sized circles (Figure 14J). The final decoration was lime infilling and lime powder made from limestone or shell, used to fill decorations of dentate-stamps, circle stamps, and incisions. Lime infilling is very common in Topogaro pottery assemblages. (see Figures 13 and 14)

Discussion

In terms of archaeological evidence of early Austronesian migration, the dentate-stamped and lime infilled pottery constitute key evidence of the material culture since such pottery has been reported from early Austronesian sites in the northern Philippines, Mariana Islands and Melanesian Islands, dated to between 4,000 to 3,000 BP (Carson et al. 2013; Hung et al. 2011). Our excavations in Topogaro 2 and 7 recovered considerable amounts of beautifully made red-slipped pottery with dentate-stamps and incised decorations. Most human bones excavated from Topogaro 7 were fragmentary and could be recognized as secondary burials from the early Metal age, between 1900-1500 BP, or 105-500 AD, based on acquired C14 dates. A few examples of dentate-stamped and lime infilled pottery were also excavated from Sector C of Topogaro 2. These are associated with burial remains dated to between 2000-1800 BP, or 50-140 AD (see Table 1).

The character of Topogaro dentate-stamped pottery with most rectangular-tipped dentation designs (see Figure 14) shows similarities with Lapita dentate-stamped pottery where the majority also has rectangular-tipped dentation designs (e.g. Ambrose 1997). Horizontal, vertical, or curved lines on the sherds were incised to make various shapes and the boundaries (Ono et al. 2019). Filled triangles and circle-stamps were a common motif, which is also evident among the Neolithic pottery from the Lalo shell midden sites on Northern Luzon in the Philippines, the Karama Valley in West Sulawesi, Mansiri in North Sulawesi, and Lapita pottery from the early Lapita phase (e.g., Anggraeni et al. 2014; Aziz et al .2018; Carson et al. 2013; Summerhayes 2000; Tanaka 2002, 2005). Lime infilled decorations on red-slipped surfaces were also observed among pottery assemblages from Lalo sites on Northern Luzon, the Mariana Islands, Mansiri in Northern Sulawesi, and Lapita sites in Oceania.

However, Topoagro dentate-stamped pottery clearly lacks motifs of point-impressed chevrons and lozenge patterns, all of which are observed in collections from the Philippines, the Marianas, and Lapita (Carson et al. 2013:25-27). The absence of vertical or crossed dentate-stamped lines is a clear difference between Topogaro pottery and other early dentate-stamped pots found in other regions. On the other hand, many motifs decorated on Topogaro pottery are similar to decorative motifs reported from the Karama Valley, including at the Minanga Sipakko site (e.g., van Heekeren and Soejono 1972; Simanjuntak 2008) that are considered to be Late-Neolithic (e.g., Bellwood 1997:229), dating to between 1500 / 1300 and 1000 BC (Anggraeni et al. 2014: 751). The comparative analysis of pottery decorations of Topogaro 7 and the Minanga Sipakko site shows the similarity in 15 types of decorations among the 19 decorations observed (Qalam et al. 2020).

Additionally, triangular hat or conical shaped jar covers of Topogaro (Figure 11A - 11B) shows similarity with jar burial pottery from Tadyaw Cave, while human and animal figured knobs and rim parts (Figure 11D - 11F) resemble burials jars from Manunggul Cave, including a famous jar with depictions of a boat and two

ISSN 2586-8721

human. Both sites belong to the Tabon Cave complex on Palawan Island and are estimated to date between 800 and 200 BC (e.g., Fox 1970, Figure 23, 28, 33). The Topogaro triangular hat or conical shaped jar covers also show some similarity with contemporary burial jars found along the central coast of Vietnam, mainly belong to Sa Huynh Culture (Yamagata 2006).

Among other pottery motifs and types, Topogaro 7 produced flask type pottery with dentate-stamped, incised, or point decorations with lime infill (Figure 12H), as well as fingernail-impressed decorated pottery (Figure 3A). The shape and motif of the flask is very similar to the Late Neolithic to Early Metal age decorated flasks reported from Melolo and Lambanapu burials sites on Sumba Island (Handini et al. 2018; van Heekeren and Soejono 1972). The pottery decorations and burial goods from the Goa Topogaro complex support the assumption that Austronesian groups with a strong relation to populations on some Philippine Islands as well as other regions in Sulawesi, particularly along the Karama Valley or Kalumpang area in West Sulawesi, during the Metal Age. Flask or cylindrical type pottery are also common among Lapita sites in Melanesia (e.g. Burley and Dickinson 2010), thought their shapes are dissimilar to the Topogaro flasks and other Late Neolithic to Early Metal age flask pottery in East Indonesia.

In sum, the Topogaro dentate-stamped pottery assemblage or tradition is partly the descendent of early Austronesian pottery tradition with a combination of dentate-stamped, circle stamped, red-slipped and lime infilled decorations observed in Northern Luzon, the Mariana Islands, Sulawesi, and Lapita sites in Oceania. However, there is a notable influence of Early Metal age pottery traditions, including the Sa Huynh-Kalanay tradition, with most burial jars with triangular hat and conical shaped jar covers, anthropomorphic and zoomorphic decorations, and a variety of decorations including zig-zag and geometric patterns, which are observed among pottery from the Karama Valley in West Sulawesi.

Secondary burials with jars, pottery, shell ornaments, and metal objects interred as grave goods in cave and rock shelter sites become commonly widespread across eastern Indonesian islands by the early Metal Age (Bellwood 2019; Ono et al. 2018). Since all the jar remains in the Topogaro assemblage are fragmentary, these are difficult to define as burial jars for containing human remains, though it is clear as these pots and jars are associated with human remains and were at least used as burial accessories. DNA analysis of human remains from Aru Manara and Tajung Pinang in the Northern Maluku, which date to around 2000 BP, confirm that about half of the individuals were related to Austronesian/Asian populations while the other half were of Papuan origin (Oliveira et al. 2022). The same study analyzed mtDNA samples from the Topogaro 1 and 7 human remains, although so far only the younger individuals from Topogaro 1, dated to around 300-200 BP, could be identified as related to Austronesians/Asians, while all the selected human remains from Topogaro 7 lacks enough collagen for DNA analysis. Future DNA studies of human remains from Topogaro 2 or other potential samples from Topogaro 7 will hopefully provide additional details regarding the main actors of these mortuary practices and dentate-stamped pottery production in Goa Topogaro, as well as in Sulawesi and Wallacea.

Acknowledgements

This research was supported by the Japan Society for the Promotion of Science Research Grant (Grant Number: 16H06409, 20K20504). This project would not have been possible without the support and administrative personnel of Dr. I. Made Geriam, the former head of Pusat Penelitian Arkeologi Nasional (ARKENAS) by 2019, and Drs. Marlon Rrimasse, the head of BRIN, in Indonesia. Lastly, we would like to thank the anonymous reviewers for their valuable comments and suggestions.

References

Anderson, A., and G. Clark. (1999) The age of Lapita settlement in Fiji. *Archaeology in Oceania* 34(1): 31–39.

Anggraeni, Simanjuntak, T., Bellwood, P. and Piper, P. (2014) Neolithic foundations in the Karama valley, West Sulawesi, Indonesia. *Antiquity* 88(341): 740–756

Azis, N., Reepmeyer, C., Clark, G., Sriwigati and Tanudirjo, D. A. (2018) Mansiri in North Sulawesi: A new dentate-stamped pottery site in Island Southeast Asia. In: S. O'Connor, D. Bulbeck and J. Meyer (eds), *The archaeology of Sulawesi: Current research on the Pleistocene to the Historic period*. Canberra: ANU Press, 191–205.

Bedford, S. (2003) The timing and nature of Lapita colonisation in Vanuatu: the haze begins to clear. In: C. Sand (ed) Pacific Archaeology: assessments and prospects. Nouméa: Département Archéologie, Service des Musées et du Patrimoine de Nouvelle-Calédonie, 147-158.

Bedford, S. (2006) Pieces of the Vanuatu Puzzle (Terra Australis 23): Archaeology of the North, South and Centre. Canberra: ANU Press.

Bellwood, P. (2017) First islanders: prehistory and human migration in Island Southeast Asia. Oxford: Wiley Blackwell.

Bellwood, P. (ed.) (2019) The Spice Islands in Prehistory: Archaeology in the Northern Moluccas, Indonesia. Canberra: ANU Press.

Bulbeck, D. and Nasruddin (2002) Recent insights on the chronology and ceramics of the Kalumpang site complex, South Sulawesi. Indonesia. Bulletin of Indo-Pacific Prehistory Association 22: 83-99.

Bulbeck, D. (2017) Traditions of jars as mortuary containers in the Indo-Malaysian Archipelago. In: P. J. Piper, H. Matsumara and D. Bulbeck (eds.) *New Perspectives in Southeast Asian and Pacific Prehistory*. Canberra: ANU Press, 141– 164.

Burley, D.V. and Connaughton, S.P. (2007) First Lapita settlement and its chronology in Vava'u, Kingdom of Tonga. *Radiocarbon* 49(1): 131–136.

Burley, D. V. and Dickinson,W. R. (2010) Among Polynesia's first pots. *Journal of Archaeological Science* 37(5): 1020–1026.

Carson, M. (2014) First settlement of remote Oceania: Earliest sites in the Mariana Islands. London: Springer Cham.

Carson, M. T., Hung, H., Summerhayes, G., & Bellwood, P. (2013) The pottery trail from Southeast Asia to Remote Oceania. *The Journal of Island and Coastal Archaeology* 8(1):17–36.

Carson, M. T. (2020) Peopling of Oceania: clarifying an initial settlement horizon in the Mariana Islands at 1500 BC. *Radiocarbon* 62(6):1733–1754.

Clark, G. and Winter, O. (2019) The ceramic trail: Evaluating the Marianas and Lapita West Pacific connection. In: S. Bedford and M, Spriggs (eds.) *Debating Lapita: Distribution, Chronology, Society and Subsistence*. Canberra: ANU Press, 37-59.

Fox, R. B. (1970) The Tabon Caves: Archaeological Explorations and Excavations on Palawan Island, Philippines. Manila: National Museum.

ISSN 2586-8721

Fuentes, R. (2019) Detecting microscopic aspects of Late Pleistocene to Early/Mid Holocene lithic technology in Island Southeast Asia: Perspectives from North and Central Sulawesi. PhD Thesis, University of Tübingen, Tübingen.

Fuentes R. and Pawlik A. (2020) Not formal but functional: Traceology and the Lithic Record in the Philippines. In: J. F. Gibaja, J. Marreiros, N. Mazzucco, I. Clemente (eds.) *Hunter-Gatherers tool kit: a functional perspective*. Newcastle upon Tyne: Cambridge Scholars Publishing, 290-308.

Fuentes, R., Ono, R., Carlos, J., Kerfant, C., Miranda, T., Aziz, N., Sofian, H.O. and Pawlik, A. (2020) Stuck within notches: Direct evidence of plant processing during the last glacial maximum to Holocene in North Sulawesi. *Journal of Archaeological Science*: Reports 30: 102207.

Handini, R., Sofian, H. O., Simanjuntak, T., Prasetyo, B., Artaria, M. D., Prasetyo, U., Wibowo and Geria, I. M. (2018) Situs Lambanapu: Diaspora Austronesia di Sumba Timur. *AMERTA* 36(2):1-14.

Hung, H. C. (2005) Neolithic interaction between Taiwan and northern Luzon: The pottery and jade evidence from the Cagayan Valley. *Journal of Austronesian Studies* 1(1):109–134.

Hung, H. C., Carson, M. T., Bellwood, P., Campos, F. Z., Piper, P. J., Dizon, E., Bolunia, M. J. L. A., Oxenham, M. and Zhang, C. (2011) The first settlement of Remote Oceania: The Philippines to the Marianas. *Antiquity* 85(329): 909–926.

Kirch P.V. (1997) The Lapita peoples: Ancestors of the oceanic world. Oxford: Wiley-Blackwell Publishers.

Nunn, P. D., Kumar, R., Matararaba, S., Ishimura, T., Seeto, J., Rayawa, S., Kuriyawa, S., Nasila, A., Oloni, B., Rati Ram, A., Saunivalu, P., Singh, P. and Tegu, E. (2004) Early Lapita settlement site at Bourewa, southwest Viti Levu Island, Fiji. *Archaeology in Oceania* 39(3):139–143.

Ogawa, H. (2005) Typological chronology of pottery assemblages from the Lal-lo shell middens in northern Luzon, Philippines. *Journal of Southeast Asian Archaeology* 25:1–31.

Oliveira, S., Nägele, K., Carlhoff, S., Pugach, I., Koesbardiati, T., Hübner, A., Meyer, M., Oktaviana, A. A., Takenaka, M., Katagiri, C., Murti, D. B., Putri, R. S., Mahirta, Petchey, F., Higham, T., Higham, C. F. W., O'Connor, S., Hawkins, S., Kinaston, R., Bellwood, P., Ono, R., Powell, A., Krause, J., Posth, C., and Stoneking, M. (2022) Ancient genomes from the last three millennia support multiple human dispersals into Wallacea. *Nature Ecology & Evolution* 6: 1024-1034.

Ono, R. (2016) Human History of Maritime Exploitation and Adaptation Process to Coastal and Marine Environments – A View from the Case of Wallacea and the Pacific. In Maged Marghany (ed.) *Applied Studies of Coastal and Marine Environments*. InTech Publisher, 389-426.

Ono, R, Oktaviana, A., Ririmase,M., Takenaka, M., Katagiri, C., and Yoneda, M. (2018) Early Metal Age interactions in Island Southeast Asia and Oceania: jar burials from Aru Manara, northern Moluccas. *Antiquity* 92(364): 1023-1039.

Ono, R., Sofian, H.O., Aziz, N., Sriwigati, Alamshya, N., Yoneda, M. (2019) Traces of early Austronesian expansion to East Indonesia? New findings of dentate-stamped and lime infilled pottery from central Sulawesi. *The Journal of Island and Coastal Archaeology*. 14(1): 123-129.

Ono, R., Fuentes, R., Pawlik, A., Sofian, H.O., Aziz, N., Alamsyah, N., and Yoneda, M. (2020) Island migration and foraging behaviour by anatomically modern humans during the late Pleistocene to Holocene in Wallacea: new evidence from central Sulawesi, Indonesia. *Quaternary International* 554: 90–106.

Ono, R., Pawlik, A., Fuentes, R. (2020) Island Migration, Resource Use, and Lithic Technology by Anatomically Modern Humans in Wallacea. In: R. Ono and A. Pawlik (eds.) *Pleistocene Archaeology*, London: IntechOpen.

Ono, R, Fuentes, R., Noel, A., Sofian, H.O., Sriwigati, Aziz, N., and Pawlik, A. (2021) Development of bone and lithic technologies by anatomically modern humans during the late Pleistocene to Holocene in Sulawesi and Wallacea. *Quaternary International* 596: 124-143.

Ono, R., Sofian, H.O., Fuentes, R., Aziz, N., Ririmasse, M., Geria, I.M. Katagiri, C., and Pawlik, A. (2023) Early Modern Human Migration into Sulawesi and Island Adaptation in Wallacea. *World Archaeology* 54(2): 229-243.

Petchey, F. and Clark G. (2021) Clarifying the age of initial settlement horizon in the Mariana Islands and the impact of hard water: A response to Carson (2020). *Radiocarbon* 63(3): 905–913.

Petchey, F., Clark, G., Winter, O., O'Day, P., Litster, M. (2017) Colonization of remote Oceania: new dates for the Bapot-1 site in the Mariana islands. *Archaeology in Oceania* 52(2):108–126.

Petchey, F., Clark, G., Lindeman, I., O'Day, P., Southon, J., Dabell, K., Winter, O. (2018) Shellfish Isotopic insight into changing sea-level and associated impact on the first settlers of the Mariana Archipelago. *Quaternary Geochronology* 48: 180–194.

Prasetyo, B. (2008) Pottery from the Neolithic Sites at the Banks of Karama River. In: T. Simanjuntak (ed.) *Austronesian in Sulawesi*. Depok: Center for Prehistoric and Austronesian Studies, 77–92.

Qalam, A. A., Hasanuddin, Duli, A., Ono, R. (2020) The Pottery from Gua Topogaro, Morowali Regency, Central Sulawesi Province. *WALENNAE: Jurnal Arkeologi Sulawesi Selatan dan Tenggara* 18(1): 37-50.

Ramsey, C. B., and Lee, S. (2013) Recent and Planned Developments of the Program OxCal. Radiocarbon 55(2): 720-730.

Rangkuti, N., Pojoh, I., Harkantiningsih, N. (2008) Buku Panduan Analisis Keramik. Jakarta: Pusat Penelitian Arkeologi Nasional.

Reimer, P.J., Bard, E., Bayliss, A., Beck, J.W., Blackwell, P.G., Bronk Ramsey, C., Buck, C.E., Cheng, H., Edwards, R.L., Friedrich, M., Grootes, P.M., Guilderson, T.P., Haflidason, H., Hajdas, I., Hatte, C., Heaton, T.J., Hoffmann, D.L., Hogg, A.G., Hughen, K.A., Kaiser, K.F., Kromer, B., Manning, S.W., Niu, M., Reimer, R.W., Richards, D.A., Scott, E.M., Southon, J.R., Staff, R.A., Turney, C.S.M., van der Plicht, J. (2013) IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. *Radiocarbon* 55(4): 1869–1887.

Sand, C. (2000) The specificities of the Southern Lapita Province: the New Caledonian case. *Archaeology in Oceania* 35(1): 20–33.

Sand, C., Bolé, J., Ouetcho, A. (2011) A Revision of New Caledonia's Ceramic Sequence. *Journal of Pacific Archaeology* 2(1): 56-68.

ISSN 2586-8721

Simanjuntak, T. (2008) Austronesian in Sulawesi: Its Origin, Diaspora, and Living Tradition. In: Truman Simanjuntak (ed.) Austronesian in Sulawesi. Depok: Center for Prehistoric and Austronesian Studies, 215–237.

Summerhayes, G. (2000) Lapita Interaction (Terra Australis 15) Canberra: ANU Press.

Tanaka, K. (2002) Ceramic Chronology in Northern Luzon: Typological Analysis of the Pottery from the Lal-lo Shell-middens. Ph.D. Dissertation, University of the Philippines, Quezon City.

Tanaka, K. (2005) "From "the Age of Red" to "the Age of Black" - Chronological Study of the Pottery from the Late Neolithic to the Iron Age in the Lal-lo Shell-midden Sites in the Lower Reaches of the Cagayan River, northern Luzon-," Journal of Sophia Asian Studies 23:313-401. (In Japanese)

Tanaka, K. (2021) Chronology and Origins of Pottery in Northern Luzon, the Philippines, from the late Neolithic to the Metal Age. *Journal of Austronesian Studies* 7(1): 11-59.

Tsang, C. H., Santiago, R., and Hung, H. C. (2002) Fei le bin lu son dao bei hai an kao gu diao cha fa jue bao gao, 1996–2002 [Report in archaeological exploration in northern Luson, Philippines, 1996–2002] Annual report for the Program of Asian and Pacific Study. Taipei: Academia Sinica.

van Heekeren, H. R, and Soejono, R.P. (1972). The Stone Age of Indonesia (Verhandelingen van Het Koninklijk Instituut Voor Taal-, LandEn Volkenkunde, 61), 2nd edition. The Hague: Martinus Nijhoof.

Yamagata, M. (2006) Chapter 17: Inland Sa Huynh Culture along the Thu Bon River Valley in Central Vietnam. In: I. Glover, V. V. Pigott and E. A. Bacus (eds.) *Uncovering Southeast Asia's Past: Selected Papers from the 10th International Conference of the European Association of Southeast Asian Archaeologists*. Singapore: NUS Press,168-183.