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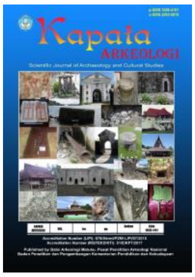

A GEOLOGICAL AND SPATIAL APPROACH TO PREHISTORIC ARCHAEOLOGICAL SURVEYS ON SMALL ISLANDS: CASE STUDIES FROM MALUKU BARAT DAYA, INDONESIA

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Abstract

Archaeological surveys are essential to the discovery and interpretation of remains left by past human activities. While remote sensing and predictive models have greatly improved the reach and success of archaeological survey, pedestrian surveys to develop model parameters and ground-truth predictions is still imperative for successful discoveries. Here we present the results of the 2017 archaeological survey of islands Babar Besar and Wetang in the Babar Island Group, Maluku Barat Daya, Indonesia. A total of 62 archaeological sites were recorded between the two islands; seven of which represent new rock art sites on Wetang island. Our survey results indicate the successful use of geological and topographic maps alongside satellite images in detecting prospective regions for survey. Results also indicate however that a more detailed and comparative understanding of the regions geology is required before more advanced forms of remote survey are conducted in the Maluku Barat Daya region.

Keywords: Survey; Babar; Maluku; Archaeology; Prehistory

INTRODUCTION

The discovery of archaeological sites is influenced by a range of variables including (but in no way limited to) site age and preservation, geology, proximity to roads, towns or other archaeological sites; and in no small proportion, serendipity. A number of significant scientific discoveries were precipitated by local, non-scientist findings recognised to be of some importance, and then brought to the attention of relevant researchers (see the discoveries at Sangiran, Java; Arif et al., 2002; Jacob, 1964; Tyler & Sartono, 2001). For the majority of archaeological discoveries however, the scientific methods of archaeological survey are regularly employed to improve understanding of known sites as well as for new discoveries. Archaeological survey techniques can be divided into two separate, although connected, categories: remote sensing and pedestrian surveys. While remote sensing survey techniques are an increasingly used and advanced form of survey for archaeologists, White and King (2016) suggest that pedestrian survey techniques are still the dominant form of archaeological survey and are actually on the increase. Thus pedestrian survey is currently the primary means by which archaeologists detect, define and record all kinds of human activity throughout the past. This is particularly the case in Indonesia where remote sensing survey techniques are rare in archaeology and limited to a few temple studies (e.g. Suwardhi et al., 2016), unlike the extensive work conducted in neighbouring Southeast Asian countries such as Cambodia (e.g. Evans, 2013; O'Reilly et al., 2017), Laos (e.g. Sherden & Pile, 2016) and Thailand (e.g. Lertlum & Mamoru, 2009).

There have been numerous attempts to construct predictive models that employ various remote sensing techniques to locate archaeological sites, with mixed results (Mehrer & Wescott, 2006; Vaughn & Crawford, 2009). While no comprehensive predictive model, or remote sensing method has yet been developed that

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allows any archaeologist to conduct their entire survey from their office, for some select regions and time periods, this scenario is rapidly approaching reality (e.g. Alexakis et al., 2011; Aronson & Berger, 2012; Balla et al., 2013; Berger et al., 2010; Meredith-Williams et al., 2014; Parcak et al., 2017; Pringle, 2011). Notably however, most of the regions where remote sensing is successful have already experienced extensive pedestrian surveys, at least in a subset of the area, that have allowed for the development of detailed parameters with which to locate the archaeological sites of interest (i.e. Alexakis et al., 2011; Aronson & Berger, 2012; Balla et al., 2013; Berger et al., 2010; Jaime, 2006; Meredith-Williams et al., 2014; Vaughn & Crawford, 2009). The only known attempt at predictive modelling of archaeological site localities in Indonesia was done by Kealy et al. (2017). Their attempt to detect statistical trends in site locations based on known archaeological sites, distance to the coast, elevation and island size; was inconclusive due to the limited sample size. Thus while remote sensing and predictive models may have the potential to expedite the archaeological survey process, the development of these models and interpretation of remote sensing data still requires initial archaeological survey in the field followed by ground-truthing of the predictions.

Pedestrian or conventional archaeological survey methods concern physical surveys by individuals, on the ground. Two key distinctions between types of pedestrian surveys are exclusive and non-exclusive surveys. Exclusive surveys are where certain areas are focused upon, and other areas excluded from the survey based on various assumptions or prior knowledge. Non-exclusive surveys as the term suggests is where nothing is excluded and survey is conducted with the minimum of anthropogenic bias (Silberman, 2012). While ultimately non-exclusive surveys can be expected to discover the 'true' distribution of surface archaeological sites in the landscape, they will not detect buried sites and are often impractical in terms of time, cost and accessibility (e.g. dense forests, remote regions or private property). Thus for archaeological surveys with a particular research interest, exclusive surveys are often the most feasible option. Exclusive surveys can either be uncontrolled-exclusive surveys, whereby areas are excluded based on intuitive or unverified (uncontrolled) assumptions, or controlled-exclusive surveys whereby particular areas may be confidently excluded based on previous research findings (controlled variables) (White & King, 2016). It is at this exclusion phase where remote sensing techniques and data along with survey results from other scientific disciplines (e.g. geology) can greatly aid archaeologists in the planning and implementation of their pedestrian survey. In addition, three sampling strategies exist that allow archaeologists to investigate regions without surveying the area in its entirety; systematic sampling, random sampling, and preferential sampling (Orton, 2000). The use of preferential sampling strategies enables the combination of probabilistic strategies with human intuition.

Here we present the results of a Controlled-Exclusive Pedestrian archaeology survey, employing preferential sampling, of the islands of Babar Besar and Wetang in the Babar Island Group, Maluku Barat Daya, Indonesia. We discuss the use of satellite imagery, and topographic and geological maps to identify areas of high potential based on previous archaeological surveys in the region. The survey findings are interpreted based on their correlation to initial assumptions and geospatial data, as well as method shortcomings and key conclusions for future surveys.

Prehistoric Archaeological Research in Maluku Barat Daya

The province of Maluku in Indonesia is located in the country's southeast and incorporates some of Indonesia's smallest and most remote islands. Previous research into prehistoric archaeology has focused on the larger (and more accessible) islands of Ambon, Seram and Aru (Bintarti et al., 1977; Ellen & Glover, 1974; Glover & Ellen, 1975; Lape et al., 2016; Latinis & Stark, 2003, 2005; O'Connor et al., 2005; Ririmasse, 2016b; Röder, 1938; Spriggs, 1990; Spriggs & Miller, 1979; Stark & Latinis, 1996). Of the smaller Maluku islands, Lape (2000; 2002) has conducted extensive survey and excavation in the Banda Islands, although much of his work has a more historical focus. For the other islands of Maluku, small survey expeditions led mostly by researchers from the Balai Arkeologi Maluku office, based in Ambon, have investigated the Kai Islands (Ballard, 1988; Spriggs & Miller, 1988), Tanimbar Islands (Ririmasse, 2016a; 2010; 2007), Babar Islands (Ririmasse, 2013; Sudarmika, 2000), Leti Islands (Sudarmika, 2001a; 2001b), and Kisar Island (Ririmasse, 2006; O'Connor et al., 2017; 2018). As a result of this research the following prehistoric maximum occupation dates are known from five islands in the Maluku region (radiocarbon dates calibrated here using OxCal v4.3.2; Ramsey, 2009); Pulau Buru: 6,894 – 7,310 cal BP (6,600 ± 90 *lab code unpublished*; Latinis & Stark, 2005), Pulau Seram: 3,414 – 3,586 cal BP (3,607 ± 27 D-AMS 013931; Lape et al., 2016), Pulau Kobroor (Aru): 27,020 ± 290 cal B.P. [LC28-flowstone] (O'Connor et al., 2002; 2005), Pulau Ay (Banda): 2,887 – 3,827 cal BP (3,150 ± 180 AA-33117; Lape, 2000; 2002), and Pulau Kisar: 15,327 - 15,730 cal BP (13,395 ± 33 Wk 43368; O'Connor et al., 2018).

Within the province of Maluku, the regency of Maluku Barat Daya (MBD) which incorporates the southern islands from Pulau Wetar to the Babar Islands has until recently experienced some of the least archaeological research. The remote locations of these small MDB islands has simply made further research, particularly for local archaeologists alone, too expensive. Recent work by the authors and collaborators as part of a joint Australian-Indonesian project on Pulau Kisar, is however beginning to change this situation. Extensive survey and multiple test excavations have greatly increased our understanding of early human activities on small islands in the region (O'Connor et al., 2017; 2018). The survey work described here was conducted as a continuation of this joint archaeological research project.

METHODS

Babar Island Group: Location and Geology

The Babar Island Group (Babar IG) incorporates the main island of Pulau (island) Babar Besar and its satellite islands of Pulau (P.) Dai, P. Dawera, P. Daweloor, P. Marsela and P. Wetang (clockwise from north). The Babar IG is composed primarily of coralline limestone,

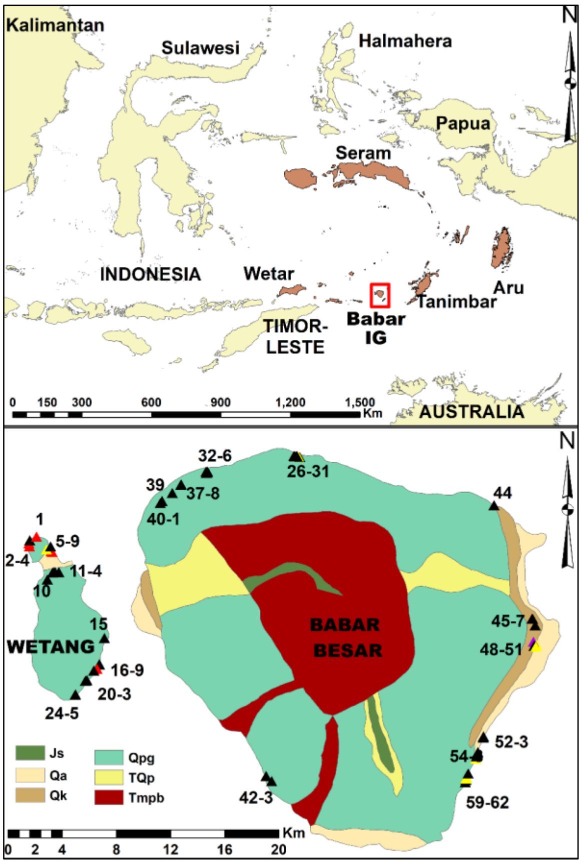

Figure 1. Maps showing regional location of Babar IG and the survey results in a geological context. A) Maluku Province shaded in with the Babar IG outlined. B) Islands Babar Besar and Wetang, showing surface geology (following Agustiyanto et al., 1994) and archaeological sites as listed in Table 1; coloured red for rock art, yellow for forts and black for caves & rockshelters. Geology codes are as followes: *Js* = Shale, *Qa* = Alluvium, *Qk* = Conglomerate, *Qpg* = Coralline Limestone, *TQp* = Quartz Sandstone, *Tmpb* = Melange Complex
(Source: Authors, 2017)

with the core of P. Babar Besar formed of an uplifted melange complex estimated to be Miocene in age (Agustiyanto et al., 1994). The encompassing ring of limestone on P. Babar Besar along with the limestone that makes up the entirety of P. Dawera, P. Daweloor, and P. Marsela's surface geology, and the majority of P. Dai and P. Wetang, is known to be Quaternary in age (Agustiyanto et al., 1994). In addition to coralline limestone terraces, P. Wetang has a small alluvial deposit that has accumulated in the gulf between its northern and southern heights, during a period of lower tectonic uplift and higher sea-level. While the limestone on P. Wetang forms multiple, clear terraces, the terraces on P. Babar Besar are fewer, less distinct and extend much further horizontally. While classified generally as Quaternary coralline limestone by Agustiyanto et al. (1994), in comparison with other deposits bearing the same classification (P. Kisar and P. Alor), the limestone of the Babar IG is significantly less consolidated, containing extensive massive fossil reef assemblages within a course sand matrix that's structure is particularly susceptible to the forces of erosion.

Survey Strategies

Survey for prehistoric archaeological sites was conducted by the authors in the Babar IG during the month of October, 2017. The survey had the following key goals; 1) Find and identify rockshelter or cave sites with suitable potential for future archaeological excavation, 2) identify and record caves and rockshelters displaying evidence of early human occupation or use, 3) Locate, identify and record other areas of archaeological interest such as forts and burials.

Remote/Preliminary Survey

Following significant success in the archaeological survey of P. Kisar, southeast MBD (see O'Connor et al., 2017; 2018), geological and topographic maps were used to identify other islands in the region with similar characteristics to P. Kisar. Notably, islands ringed by uplifted limestone terraces. Thus islands which recorded substantial limestone deposits (Agustiyanto et al., 1994) where topography showed increases in elevation, were flagged as potential survey localities. To further refine the survey, these potential islands and the limestone regions identified within, were remotely surveyed using high-resolution satellite imagery available from Google Earth (Google Earth Pro v.7.3.0.3832. 2017. Satellite images. Available from http://www.google.com/ [Accessed January 2017]). Terrace formations are quite distinctive on satellite images. The presence of limestone terraces was thus identified by combining geological, topographic and satellite datasets. Visual comparisons between archaeologically rich sites previously identified on P. Kisar (O'Connor et al., 2017; 2018) were made to assist with distinguishing sections of terraces most likely to contain rockshelters and caves. Based on this preliminary survey of Maluku Barat Daya using remote techniques, we selected the limestone terraces of P. Wetang and P. Babar Besar in the Babar Island Group as the focus of our pedestrian survey.

Pedestrian Survey

The pedestrian, controlled-exclusive survey of P. Wetang and P. Babar Besar employed the following assumptions to preferentially select sites for investigation: caves at or near sea-level are unlikely to preserve long term records of human occupation (due to both long and short term climatic and oceanic events; e.g. sea-level changes and storm surges, respectively); areas with zero or very low degrees of slope are unlikely to form caves suitable for human occupation; and limestone formations and limestone terraces in particular, are more likely to form caves than any other formation. Large focus areas matching these criteria were identified in the preliminary survey from the geological and topographic maps, and satellite images (see above).

Once in the field, the team travelled to the key areas identified in the remote analysis and then interviewed local villagers regarding the existence of caves and other archaeological features within the boundaries of their lands. Other archaeological features included rock art, burials and "negeri lama" sites. Literally translated as "old village" or "ancient kingdom", negeri lama's (also referred to interchangeably as "kampung lama's") are sites of past occupation, readily identified by the remains of stone walls that surrounded the settlement. If local villagers had information about the location of sites, the most appropriate people; landowners or people nominated by the village head, were employed to lead the team to the locality for further identification and recording. A total of 62 archaeological sites were recorded on the two islands as a result of this survey (Table 1). In order to safeguard the archaeological sites identified in this survey, GPS coordinates are not provided for these locations but can be obtained from Balai Arkeologi Maluku in Ambon.

Table 1. Archaeological sites on P. Wetang and P. Babar Besar islands. Type codes as follows: C = cave, S = rockshelter, R = rock art, N = negeri lama/fort, B = burial.

Island	*No*	*Desa/Village*	*Name*	*Type*	*Findings*
Wetang	1	Nusiata	Tawuwun	R; C	Rock art: Boats, anthropomorphs, fish and geometric patterns; Surface materials: pottery and ceramics including Chinese tradeware; Deposit characteristics: rocky floor with coral
	2	Nusiata	Raitawuni 1	R	Rock art: Anthropomorphs, faded images
	3	Nusiata	Raitawuni 2	R; C	Rock art: Boats, anthropomorphs, sun symbols; Surface materials: ceramics and marine shellfish; Deposit characteristics:: minimal sediment
	4	Nusiata	Raitawuni 3	S	Deposit characteristics; minimal sediment, owl roost deposit
	5	Nusiata	Leitupun	S	Deposit characteristics: some sediment towards dripline, disturbed by *sopi* still. Surface materials: earthenware pottery, marine shell and recent materials such as bamboo, coconut shells and large Chinese or Thai jars still in use.
	6	Nusiata	?Negeri Lama - Nusiata	N	Possible remains of stone structure from negeri lama
	7	Nusiata	Dari 1	R	Rock art: Zoomorphs - chicken and dog or goat; Deposit characteristics: minimal or no sediment
	8	Nusiata	Dari 3	R	Rock art: faded images
	9	Nusiata	Dari 4	R	Rock art: faded images
	10	Rumahlewang Kecil	Gua Letiara	C	Deposit characteristics: minimal sediment, disturbed by roots; Surface materials: earthenware pottery.
	11	Rumahlewang Kecil	Nederupun 1	C	Deposit characteristics: rock floor, no surface deposit
	12	Rumahlewang Kecil	Nederupun 2	S	Deposit characteristics: rock floor, no sediment, modern rubbish on surface
	13	Rumahlewang Kecil	Nederupun 3	S	Deposit characteristics: no surface deposit, rocky floor
	14	Rumahlewang Kecil	Nederupun 4	S	Deposit characteristics: once extensive, now minimal; Surface materials; earthenware pottery, marine shell, stone artefacts.
	15	Upuhupun	Gua Pamali	C	Deposit characteristics: minimal sediment, sloping floor; Surface materials: stone believed to represent tiger's head by local villagers.
	16	Nyboyta	Nyboyta Road 1	S	Deposit characteristics: minimal sediment, disturbed by *sopi* still
	17	Nyboyta	Nyboyta Road 2	S	Deposit characteristics: minimal sediment, disturbed by modern roots
	18	Pota Besar	Nyboyta Road 3	R	Deposit characteristics: destroyed by construction of road; Rock art: faded images

Island	No	Desa/Village	Name	Type	Findings
	19	Pota Besar	Gua Rainoni	C	Deposit characteristics: extensive sedimentary deposit, dark cave with two chambers, disturbed by pig wallows; Surface materials: marine shell, hearth
	20	Pota Besar	Lelarma 1	C	Large cave only about 3 m asl; Deposit characteristics: some sedimentary deposit but extensive pig wallow damage; Surface materials: marine shell.
	21	Pota Besar	Gua Roipikka	C	Large cave 5 m width across mouth; Deposit characteristics: decent sedimentary deposit but extensive pig wallow damage
	22	Pota Besar	Yertan 1	C	Cave 54 m asl; Deposit characteristics: some sedimentary deposit but extensive pig wallow damage
	23	Pota Besar	Yertan 2	S	Cave by beach. Deposit characteristics: some sediment but disturbed by pigs.
	24	Pota Besar	Lelarma 2	S	Deposit characteristics: some sediment but extensive pig wallow damage. Surface materials: marine shell.
	25	Pota Besar	Lelarma 3	S	Deposit characteristics: minimal sediment, rocky floor.
Babar Barat	26	Manuwuy	Palyora Cave	C; B	Surface deposit: no sediment, human skeletal remains, disturbed by ocean
	27	Manuwuy	Hutmiey Negeri Lama	N	Stone wall remains indicating presence of former fortified negeri lama
	28	Manuwuy	Liang Palyora	S	Deposit characteristics: minimal sediment, Surface material: grindstones, goat bones
	29	Manuwuy	Liang Palyora 5	S; B	Deposit characteristics: some sediment, Surface material: earthenware pottery, marine shell, grindstones and pestle pounding stones. Human remains with earthenware pottery and bone beads on shelf above floor.
	30	Manuwuy	Palyora South 1	S	Surface deposit: minimal sediment, earthenware pottery, marine shell, turtle bones
	31	Manuwuy	Palyora South 2	S	Deposit characteristics: Stone floor, no surface deposit
	32	Watrupun	Yeramnyawi Rockshelter 1	S	Deposit characteristics: some sediment, earthenware pottery, grindstones
	33	Watrupun	Yeramnyawi Rockshelter 3+4	S	Deposit characteristics: potentially deep sedimentary deposit but disturbed by pig wallows. Surface material: earthenware pottery, marine shell.
	34	Watrupun	Yeramnyawi Rockshelter 5	S	Deposit characteristics: some sediment, marine shell
	35	Watrupun	Yeramnyawi Rockshelter 6	S	Deposit characteristics: some sediment, disturbed by roots; Surface materials: grindstones.
	36	Watrupun	Jeriri Cave	C	Deposit characteristics: minimal sediment. Steeply sloping rocky floor.
	37	Watrupun	Lyelunmna 1	C	Deposit characteristics: minimal sediment. Disturbed by roots.
	38	Watrupun	Lyelunmna 2	C	Deposit characteristics: minimal sediment. Disturbed by roots.
	39	Letsiara	Liang Melmela	C	Deposit characteristics: some sediment, dog skeleton. Dark cave with 2 chambers
	40	Letsiara	Looraa Shelter	C	Deposit characteristics: minimal sediment, pottery, human, goat & dog skeletal material
	41	Letsiara	Retnona Cave	C	No surface deposit
	42	Tela	Ninakak Cave	C	Deposit characteristics: some sediment, marine shell. Disturbed by pigs.
	43	Tela	Wonawafne Rockshelter	S	Deposit characteristics: some sediment, marine shell, bone. Possible excavation potential
Babar Timur	44	Nokanoka	Nokanoka Rockshelter	S	Deposit characteristics: some sediment, possible grindstone. Very rocky
	45	Koroing	Werla 1	S	Deposit characteristics: minimal sediment
	46	Koroing	Werla 2	S	No surface deposit
	47	Letwurung	Uwety Rockshelter	S	Deposit characteristics: minimal sediment, disturbed by roots
	48	Kokwari	Wulua Negeri Lama	N	Stone wall and gateway remains of former negeri lama. Deposit characteristics: has sediment and would be suitable for open site excavation.
	49	Kokwari	Wakap Burial	B	Disturbed (looted) burial area - skulls, minimal postcranial elements, ceramics, etc. including Chinese trade ware. All material now relocated in secondary location under rock ledge.
	50	Kokwari	Totiylillol Cave	S	Deposit characteristics: minimal sediment, disturbed by river.
	51	Kokwari	Ilkeoi Negeri Lama	N	Stone wall and gateway remains of negeri lama. Deposit characteristics: has sediment and would be suitable for open site excavation.

Island	No	Desa/Village	Name	Type	Findings
	52	Ahanari	Lewiri 1	S	Deposit characteristics: no surface deposit, rocky floor.
	53	Ahanari	Lewiri 2	S	Deposit characteristics: some sediment, marine shell. Possible excavation potential
	54	Analutur	Blukor 1	C	Deposit characteristics: minimal sediment, earthenware pottery, grindstone. Small cave.
	55	Analutur	Blulor 2	C	Deposit characteristics: minimal sediment. Large cave, but rapidly eroding ceiling and walls makes habitation unlikely.
	56	Analutur	Lisopol Rockshelter	S	Deposit characteristics: minimal sediment, shell artefacts. Oirata (Kisar Island language group) Ancestral Area
	57	Analutur	Alpeli Cave	C	Deposit characteristics: Oirata area, cave once held timber statue of king - sold.
	58	Manuwui	Wulyeni Negeri Lama	N	Stone wall remains of negeri lama. Significant surface deposit of pottery & grindstones. Possible excavation potential.
	59	Tutuwawan	Elway 1	S	Deposit characteristics: minimal sediment, marine shell, grindstones, Ming Dynasty ceramics
	60	Tutuwawan	Elway 2	S	Deposit characteristics: minimal sediment, grind stones
	61	Tutuwawan	Kukeweble Negeri Lama	N	Large, extensive wall remains of former negeri lama. Largest negeri lama identified, stone altar under Banyan tree shows signs of recent use.
	62	Tutuwawan	Kukeweble Rockshelter	S	Deposit characteristics: some sediment, marine shell disturbed by sopi still.

Source: Authors, 2017

Figure 2. Northern Limestone formation of Wetang showing uplifted terraces, eastern side of the island (Source: Authors, 2017)

RESULT AND DISCUSSION

The Survey of Pulau Wetang

Pulau Wetang (hereafter Wetang) was surveyed from a base at the islands northern tip; Nusiata Village. The most significant archaeological discoveries were made among the limestone terraces of Wetang's northern uplift platform (Figure 2).

Caves and Rockshelters

Nine caves and ten rockshelters were identified during the survey of Wetang. The cave/rockshelter sites with the greatest archaeological potential were located in Wetang's larger, southern limestone uplift formation. Here the terraces are slightly wider providing greater opportunity for sediment accumulation in the sites. Unfortunately, all of the sites we identified on Wetang had either been disturbed to some degree, lacked sufficient deposit for excavation, or were too close to the coast to preserve long-term records (or combinations of all three).

Figure 3. Gua Rainoni (#19: Table 1) – left chamber with small second entrance on distant left and flowstone pedestal just left of centre. The uneven surface of the floor deposit is caused by extensive pig activities
(Source: Authors, 2017)

Figure 4. Rockshelters on Wetang with Sopi stills. A) Leitupun (#5: Table 1); B) Nyboyta Road 1 (#16: Table 1) (Source: Authors, 2017)

In particular, the rockshelter of Nederupun 4 (#14: Table 1) suggests a once significant cultural deposit containing marine shell, pottery and stone artefacts. Unfortunately, however, this deposit is now almost entirely spread over the hillside below for the purpose of growing corn. The cave of Rainoni (#19: Table 1) preserved one of the most extensive soil deposits seen on the survey, however the low light of the cave in addition to extensive disturbance by pigs makes it a less than promising site for archaeological excavation (Figure 3).

The production of *sopi* (the locally made distilled alcohol) is quite common in the region and it appears to be standard practice on both Wetang and Babar Besar to set up the still in rockshelters, usually those rockshelters which have a decent overhang and sediment floor – features also sought by archaeologists. Thus, the few sites that were luckily free of pigs, roots or agriculture were found to have a *sopi* still dug into their centre (Figure 4).

Rock Art

Several significant rock art sites were discovered in the limestone terraces of north Wetang (Figure 2) near the village of Nusiata, and a single possible rock art site

Figure 5. Tawuwun cave and rock art (#1: Table 1). A) Cave overview showing rocky floor, uneaven roof surface and smooth flowstone on sides. B) Tawuwun boat with large sail structure. C) One of many panels of motifs at Tawuwun (Source: Authors, 2017)

Figure 6. Dari 1 rockart site (#7: Table 1). Chicken motif directly above scale (Source: Authors, 2017)

was located on the road between Nyboyta and Pota Besar. The site with the most extensive rock art was the cave of Tawuwun (#1: Table 1) in the wall of the first (lowest to sea level) terrace on Wetang's north coast. Tawuwun is a medium size cave (Figure 5: A), approximately 4 m wide at the entrance and 2.5 m at the highest point. While some sediment is preserved and Chinese ceramics were found on the floor of the cave, the surface of the floor was exceptionally rocky indicating that excavation would not be feasible. The rock art of Tawuwun is extensive but notably constrained to the lower walls on the sides of the cave where flowstone has produced a smooth surface suitable for preserving rock art. Predominant motifs include boats (some large and highly detailed, see Figure 5: B), anthropomorphs, tree-of-life symbols, fish, concentric squares and other geometric patterns (Figure 5: C).

In addition to Tawuwun, one other cave with rock art was identified in the same locality but higher up; in the wall of the third terrace (above sea level). This site, Raitawuni 2 (#3: Table 1) preserved a variety of motifs, also in red pigment, both on the external walls of the cave, as well as inside. The rest of the rock art sites identified on Wetang were in small rockshelters or depressions in the terrace wall where weathering and flowstone had produced smooth surfaces. Of these sites, Dari 1 (#7: Table 1; Figure 6) preserved the most interesting assemblage of animal motifs including a distinctive chicken and a number of quadrupeds; possibly goats or dogs.

Kampung Lama/Negeri Lama

One possible kampung/negeri lama (fortified village) locality was identified atop the north plateau on Wetang based on stone arrangements and location. Many more negeri lamas are probably to be found in Wetang and Babar if time is allocated to exploring the higher parts of the island. Our survey was largely focused on locating caves and rockshelters, thus survey for forts was not 'purposive' but rather incidental if such were located while surveying for caves and rockshelters.

The Survey of Pulau Babar Besar

The survey of Pulau Babar Besar (hereafter referred to as Babar) was conducted in two portions, separated by the subdistrict divisions of the island into Babar Barat (West Babar) and Babar Timur (East Babar). Each subdistrict survey was based out of the corresponding Kecamatan (subdistrict capital); Tepa in Babar Barat and Letwurung in Babar Timor.

Caves and Rockshelters

A total of 11 caves and 20 rockshelters were identified on Babar. The majority of these were in Babar Barat. One of the richest regions, archaeologically, in Babar Barat was in the vicinity of the village of Manuwuy. Along the Palyora ridgeline (#28 and 29: Table 1) we located a number of connected rockshelters that contained marine shell, stone artefacts (grindstones) and domestic animal bones on the surface (Figure 7). While the surface deposit might have some depth, disturbance by roots, an abundance of surface limestone rubble and their low elevation/proximity to the coast means archaeological excavation for prehistoric human occupation would likely not be fruitful.

Another locality not far from Manuwuy known as Yeramnyawi also contained a series of caves and rockshelters along a ridgeline. The surface deposit at the Yeramnyawi sites is undisturbed by roots or rocks and appears to have sufficient depth for excavation.

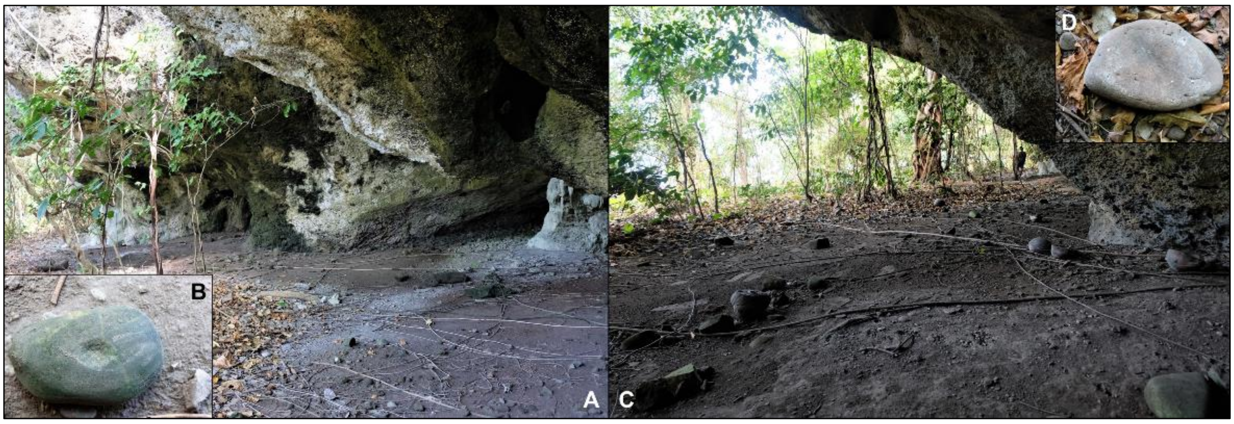

Figure 7. Liang Palyora rockshelters (#28: Table 1). A) Connecting rockshelters of Liang Palyora, B) Grindstone recovered from surface showing pitting. C) Middle placed rockshelter in Liang Palyora complex. D) Grindstone showing use wear (Source: Authors, 2017)

Figure 8. Sites from Babar Barat showing deposit disturbed by pigs. A) Ninakak cave (#42: Table 1) with domestic pig on left-hand side of the cave. B) Yaramnyawi Rockshelters 3+4 (#33: Table 1) showing pig wallow disturbance to an otherwise promising deposit, right-hand side (Source: Authors, 2017)

Unfortunately, as with some of the sites on Wetang, numerous sites on Babar including the Yaramnyawi deposits were heavily disturbed by pig wallows (Figure 8).

Burial Sites

Three sites containing human remains were identified during the survey of Babar. Two of the sites were found in the Palyora area (discussed above). Palyora Cave (#26: Table 1) is a small beach cave with human postcranial elements on the surface suggesting the remains of at least a few individuals. The sites low elevation and proximity to the ocean however suggests the site lacks antiquity. The second Palyora site with human remains is Liang Palyora 5 (#29: Table 1) where human cranial and postcranial bones are preserved on a small rock shelf above the main floor of the rockshelter (Figure 8: A). Large earthenware pottery fragments (some with red ochre staining) along with bone beads, other grave goods and marine shells lie in association with the human remains (Figure 9: B & C).

A disturbed burial site known as Wakap (#49: Table 1) was identified near the village of Kokwari (Figure 9). This site is assumed to have been previously recorded as ‘Kokwari cave’ by Sudarmika (2000) who visited the locality as part of an archaeological survey team from Balai Arkeologi Ambon, led by Mr M. Nedissa. Our examination of this site raised some concerns about the original description and account of the site as a primary burial location. While there are discrepancies between the report and our 2017 survey findings, no other site in the Kokwari area was known by local villagers to contain human remains or matches the description of Sudarmika (2000). If this is indeed the same site reported by Sudarmika, our survey provides some important clarification on site description and interpretation. The original interpretation by Sudarmika (2000) that the site was a primary burial ground lacks any supporting

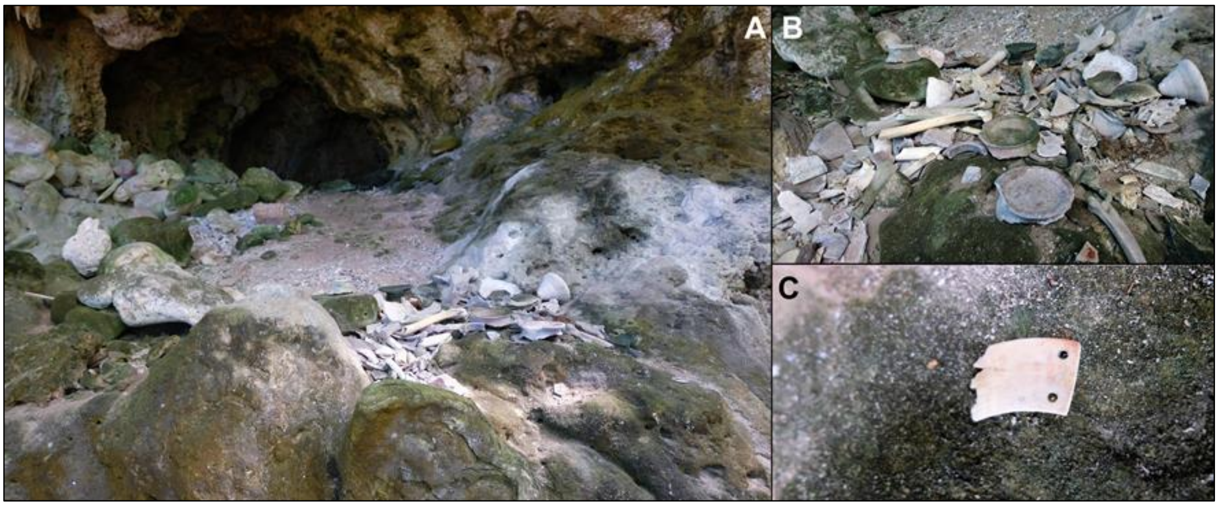

Figure 9. Liang Palyora 5 ledge burial (#29: Table 1). A) Site overview. B) Human bones in association with pottery and marine shells. C) Bone bead associated with human remains.
(Source: Authors, 2017)

Figure 10. Wakap Burial Ground (#49: Table 1). A) Original burial ground in foreground, ledge with human remains beyond local guide. B) Skulls and jaws arranged on ledge. C) Earthenware pottery and ceramic remains retrieved from secondary ledge placement. D) Bracelets found in association with other remaining grave goods
(Source: Authors, 2017)

evidence. The small overhangs and ledges at Wakap have a predominance of cranial cases with an almost complete absence of post cranial bones (Figure 10: A & B), in addition to the arranged formation of the skulls and large sherds of Chinese tradeware, European porcelain, earthenware and other grave goods, which suggests secondary placement. Discussion with the local villagers from Kokwari made it clear that the burial ground had originally been in the open clearing that the overhangs surround (Figure 10: A). It had been looted a number of years ago and the value items of metal and ceramics taken. The disturbed human bones, broken ceramics and other grave goods (Figure 10: B, C, & D), which were discarded by the looters, were later placed by the local villagers under the overhangs, hence the 'arranged' appearance of the skulls and the comparatively small number of post cranial bones.

Kampung Lama/Negeri Lama

A number of significant kampung/negeri lama (old fortified village) sites were identified, all in Babar Timur with a single exception near the village of Manuwuy in Babar Barat. The forts had thick stone walls sometimes up to 1.5 m wide and reaching 2 m high (Figure 11: A & C) with entrance and exit 'gateways' (Figure 11: A). The walls of the forts are of varying height; those close to modern settlements and garden areas have often had stone from the walls recycled to make modern garden

Figure 11. Kukeweble Negeri Lama (#61: Table 1). A) Southern wall with local guide as scale. B) Stone altar (Left) under scared Banyan tree – located in the centre of the Kukeweble fortification. C) Atop the west wall showing average wall thickness, local guide for scale
(Source: Authors, 2017)

walls or for other construction. The site in Babar Barat is the clearest example of this and thus the most poorly preserved of the negeri lamas visited in the course of the survey.

The formation of the fort walls is roughly semicircular with a steep escarpment or drop off on the unwalled section of the construction providing natural defence. Oral history from local villagers is unanimous in recording these as village settlements occupied by individual clan groups which were fortified with high walls for protection against raiding by other clan groups living in similar fortified settlements. Pacification and movement to the current village locations seems to have occurred in with the arrival of the Dutch or missionaries. Oral history for multiple villages/clans in Babar Timur begins with the occupation of a few ancestral villages high in the mountains. War and population expansion over time resulted in the downward movement and sometimes separation of entire villages that then constructed 'new' fortifications on the next terrace down (closer to the coast). Repetition of this process over time eventually resulted in the modern distribution of coastal villages present today, leaving a series of abandoned fortified villages stepping up into the hills. No fortified settlements in Babar have been excavated, however, radiocarbon dates from excavated fortified settlements in nearby Timor-Leste indicate that they are common throughout the Wallacean Archipelago and may have been initiated as early as AD 1300 (Lape & Chao, 2008). It appears that they continued to be constructed and occupied for centuries, becoming widespread by between about AD 1550 and AD 1800 (Lape, 2006; Lape & Chao, 2008; O'Connor et al., 2002).

The largest, most complete negeri lama observed on Babar was the Kukeweble Negeri Lama (#61: Table 1; Figure 11), covering an approximate area of over one hectare near the village of Tutuwawan. Located close to the coast on the lowest terrace, Kukeweble represents the final traditional stone walled settlement of the Tutuwawan ancestors in their move from the mountains to the coast.

The three other negeri lamas visited in Babar Timur were all farther inland and higher up than Kukeweble. Wulua Negeri Lama (#48: Table 1) is particularly significant for its position directly on the edge of the first major terrace up from the coast. The narrow stone lined gateway to this ancestral village, located atop a 50 m steep cliff (Figure 12: A) and surrounding stone walls on all other sides would have made this negeri lama particularly secure against enemy forces. Wulyeni Negeri Lama (#58: Table 1; Figure 12: B) is also located on the first terrace up from the coast and while the

Figure 12. Negeri lamas atop the first terrance, Babar Timur. A) Wulua (#48: Table 1) – showing entrance atop cliff. B) South wall of Wulyeni (#58: Table 1)
(Source: Authors, 2017)

smallest of the negeri lamas in the area, has an abundance of earthenware pottery and stone artefacts on the surface suggesting a good potential for archaeological excavation.

The most inland negeri lama visited was Ilkeoi (#51: Table 1) and is the second-most inland fort of its series according to the local Kokwari villagers. The oldest, more inland negeri lamas were not visited on this survey due to their remote forest locations, time constraints and the focus of the survey being more concerned with cave and rockshelter deposits preserving human occupation records beyond the negeri lama period (pre-AD 1300).

CONCLUSION

The 2017 archaeological survey of the Babar IG employed a number of survey techniques, notably geology, topography and satellite images to identify key focus areas for pedestrian survey. Having located prospective areas for survey using these means the assistance of local villagers with specific knowledge of the area was sought to accompany the survey team. The results of the pedestrian survey of Babar and Wetang indicate that while numerous caves and rockshelters are found with evidence for past human habitation, the fabric and matrix structure of the limestone parent material of the caves, and the topography of the islands, are not conducive to the formation and preservation of deep sedimentary deposits with excavation potential. Due to the coralline sandy matrix of most of the caves and rockshelters, homogeneous smooth surfaces suitable for the execution of rock art are also sparse. Notably, the caves and rockshelters in which rock art was located had more homogenous wall surfaces than those without rock art. Carbonate flows had covered the coarse-textured surface of the cave walls making an ideal backdrop for the paintings. Some caves and rockshelters located on broader lower terraces of the islands do have sedimentary deposits suitable for excavation, however these have been significantly impacted by both feral and domestic impounded pigs digging into the floors, and by human use for activities such as *sopi* production.

Perhaps the most significant find was the location of seven new rock art sites containing numerous motifs predominantly painted in red pigment. No rock art sites have previously been recorded on any of the islands of the Babar IG, MBD (Ririmasse, 2013; Sudarmika, 2000). Based on the motifs which include a variety of boats (some including sails), small human figures and domestic animals such as cockerels and quadrupeds (dogs or goats?) the art is likely to date within the last 3,000 years (O'Connor et al. 2017).

The fortified settlements (negeri lama) are mostly well preserved, some still have high intact walls and gateways as well as internal features. As opposed to the cave sites the forts have high excavation potential. Oral history relating to the use and abandonment of fortified settlements would make it possible to reconstruct the history of population movement during the historic period. Oral accounts of settlement history indicate that the earliest fortified settlements (negeri lamas) were the most inland and that populations relocated closer to the coast over time, as each settlement was abandoned and a new one built, with the final move made to the current coastal locations.

Our findings suggest the human burial sites are likely to be of mixed age. The two in the Palyora area are difficult to date. Palyora Cave has no grave goods at all, while Liang Palyora 5 contains sherds of locally made earthenware which could date to any time in the last 3,500 years. The exposed nature of these sites coupled with the fresh appearance of the bones suggests that both sites are considerably more recent. Based on the oral accounts of local villagers the Wakap site had previously contained gold and bronze items which were looted. The site contains broken sherds of Chinese tradeware, European porcelain of Dutch origin and low fired earthenware. The Chinese and Dutch porcelain suggests use of the burial location from at least AD 1700 until AD 1900, and it may have been used earlier than this.

The survey of Babar and Wetang has added significantly to the database of known archaeological sites in the Babar IG, MBD and demonstrated the success of a survey methodology based on ground-truthing predictions from geological maps and satellite imagery. Our findings show that satellite images are particularly good for successful identification of terraces that contain rockshelters and are also excellent for detecting negeri lama fortifications in areas of light or cleared vegetation. Geological maps are particularly helpful in site location as well, however significant improvements in the resolution and comparability of geological data across the region is required to enable accurate predictions between islands, based on geology. The slope of terraces is also shown to have a significant impact on the preservation of archaeological sediments, for while steep terraces are more likely to form significant overhangs for rockshelters, the width of the lower terrace impacts the degree of sediment retention within the rockshelter. For now, for archaeological surveys in MBD, geological maps remain a good starting point followed by refinements based on topography and satellite images, and finally, pedestrian surveys to identify individual sites.

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