



Uncovering Hidden Dynamics of Past Kinship and Exchange Relations on Papua New Guinea's South Coast (650–300 cal BP) Through Scanning Electron Microscopy Automated Mineralogy Analyses of Pottery Sherds

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Abstract

Ethnographic accounts of Melanesian exchange systems, such as the Kula and Hiri, have significantly influenced the development of anthropology. These accounts primarily focus on male agency framed by heroic seafaring ventures, while the agency of women and their cultural practices—key to the interconnectedness of Melanesian societies—has often been overlooked. On Papua New Guinea's south coast details of women's cultural practices are available in ethnography, and the remains of the pottery they made survive well in archaeological contexts. This paper reports the results of Scanning Electron Microscopy based Automated Mineralogy (SEM-AM) analyses of selected pottery sherds from two regions on the Papua New Guinea's south coast located 80 km apart. The sherds are very similar in form and decoration, so we employed precise mineral characterisations to assign the pottery sherds to mineralogical groups and test whether they originated in the same manufacturing location and were traded along the coast. The mineralogical analyses uncovered nuances of past social entanglements, revealing that seafaring alliances and networks were maintained through kinship. We argue that in this instance, pottery-making traditions spread along the coast through the movement of women and intermarriage.

Keywords Pottery · Trade · Scanning electron microscopy · Automated mineralogy

Introduction

Pottery analyses have loomed large in archaeological investigations of how famed Melanesian exchange systems such as the Kula and Hiri emerged and transformed (*e.g.* Allen, 1977c; Bickler, 2006; Egloff, 1978; Frankel & Rhoads, 1994; Irwin et al., 2019). These archaeologists were often inspired from a “Western” perspective by the rich ethnographies produced by early (and predominantly male)

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anthropologists working across the region. The first ethnologist to work in Papua New Guinea was Thomas Huxley, who was appointed Assistant Naturalist on the voyage of HMS *Rattlesnake* (1846–1850) (see, Huxley, 1935). He documented cultural practices diarising his observations and depicting Papuan watercraft, earthenware pottery and other material culture in sketches and watercolours (Lepowsky, 2024:230, 240). Due to his influence in the emergence of anthropology as an academic discipline, Huxley has been described as the founder of Oceanic ethnography (Lepowsky, 2024). Encouraged directly by Huxley, Alfred Cort Haddon soon after commenced extensive ethnographic research in the same region (Seligman, 1940:849; Quiggin, 2011). A shared interest in anthropology introduced Huxley (1935:159–163) to Charles Seligman who later published his influential “Melanesians of British New Guinea” (Seligman, 1910). Bronislaw Malinowski dedicated his famed Kula book “Argonauts of the Western Pacific” (1922) to his mentor Charles Seligman. These early anthropological understandings of Melanesian cultural practices were based on the observations of a highly influential male cohort, albeit parallel to Beatrice Blackwood’s (1935) trailblazing research in New Guinea and the Solomon Islands. The narrative of Kula exchange exhorts chiefly agency, and the Hiri was cast as heroic seafaring ventures orchestrated by men. This is not to say that communities participating in the Hiri or Kula saw the situation the same way (Strathern, 1989; also see Errington & Gewertz, 1987). These male-oriented ethnographies shaped early archaeological investigations in the region, which seldom focussed on women’s cultural practices. Here we seek to bring women’s influence on the development of exchange systems back into view, through a case study of pottery manufacture and the related practice of tattooing in two locations on Papua New Guinea’s south coast. Drawing on ethnographic accounts and the first application of Scanning Electron Microscopy based Automated Mineralogy (SEM-AM) on Pacific pottery, we show that pottery-making traditions spread along the coast through the movement of women and intermarriage.

This paper reports the results of SEM-AM analysis of selected pottery sherds from three ancestral village sites on the Papua New Guinea’s south coast occupied within 650–300 cal BP. These sites are the Western Motu ancestral village of Motu Hanua (referred to below as Motupore) on Motupore Island in Bootless Bay 15 km southeast of Port Moresby and the ancestral villages of Agila and Veirarupu in Hood Bay 80 km further again to the southeast. The pottery used at these three sites show striking parallels in decoration and vessel form. These parallels demonstrate that at times during the past, the three villages were in contact, either directly or through intermediary relations. Motupore is archaeologically well-known for producing pottery for trade (Allen, 2017:302–305). By contrast, there is no ethnographic, oral traditional, or archaeological evidence for past pottery production in Hood Bay (Oram, 1977:85). For this reason, if we were working from pottery forms and decoration alone, it would be reasonable to propose that pots originating from Motupore reached Agila and Veirarupu through trade. Yet little is known about Motu–Hood Bay inter-cultural relationships before 300 cal BP when pots were used at all three sites. To address this gap in knowledge, a selection of pottery sherds from the three sites were subject to SEM-AM analysis. The aim of the analysis is to investigate whether new nuances of past Motu–Hood Bay social entanglements can be found in the mineralogy of the clay and temper used to make the pots. Our paper argues that exchange was in

fact driven and maintained by communities connected through kinship and that such relations can be revealed through analysing the mineralogy of the pots that they used.

The People

During the ethnographic period Motu villages identified as three sub-groups or alliances: Western, Eastern, and Independent. There are seven Western Motu and three Independent Motu villages along c. 65 km of coastline between Redscar Bay and Taurama Head on the western margin of Bootless Bay (Groves, 2011:9). Western Motu oral traditions trace ancestral origins to the village of Motu Hanua on Motupore Island (Golson, 1968:69–70). Settlement there predates oral traditions with Motu Hanua recalled as a place of origin where Western Motu peoples have always lived (Groves, 2011:7). The coastline east of Bootless Bay is the domain of four Eastern Motu villages (Groves, 2011:14). The people with ancestral connections to Agila and Veirarupu in Hood Bay are from five Keapara language speaking villages (referred to below as Keapara) (Fig. 1).

Western and Eastern Motu today speak a single Motu language with little difference (Ray, 1929:66; Wurm, 1964:19). Linguistic research suggests existing minor Western Motu – Eastern linguistic divergence commenced around AD 1700 (Dutton, 1966: Appendix 5.5). The Keapara language is quite different to Motu with linguistic modelling tracing both languages to a single “Proto-Hula [Keapara]-Motu” language dating to AD 1300–1000 (Dutton, 1966: Appendix 5.5). The Keapara dialects spoken in Hood Bay are 58.5% cognate with Motu (Dutton, 1970:912; for comparison, dialects of the same language are at least 70% cognate). These languages were still mutually intelligible; Lawes (1877) observed while visiting Hood Bay that Motu and Keapara speakers understood each other’s languages “pretty well”. Further evidence for past relationships between Motu and Keapara peoples is apparent in their very similar forms of social organisation, which are based on residential, political, and (primarily) patrilineal groups called *iduhu* in Motu and *kwalu* in Keapara (Belshaw, 1957:13; Goddard & Van Heekeren, 2003; Groves, 1963, 2011; Seligman, 1910:49, 750). Among the Motu, all descendants of male lineages belong to their residential *iduhu*. The membership of women is flexible and can change through marriage (Groves, 1963). We return to ethnographic accounts of Motu – Keapara relations in our discussion in light of the results from SEM-AM analysis. In particular, we consider the intergenerational maintenance of women’s cultural practices particularly pottery production as exclusively a woman’s craft.

Tracing Exchange on Papua New Guinea’s South Coast: Methodological Challenges

The site of Motupore is located on Motupore Island, 650 m offshore in Bootless Bay (Figs. 2, 3c, 3d). There is no permanent fresh water on the island and ancestral Motu people managed the environmental limitations of living on a small island by making pottery and shell valuables which they exchanged with coastal villages for mainland resources such as wallaby (*Notamacropus agilis*) (Allen, 1977a, 1977b).

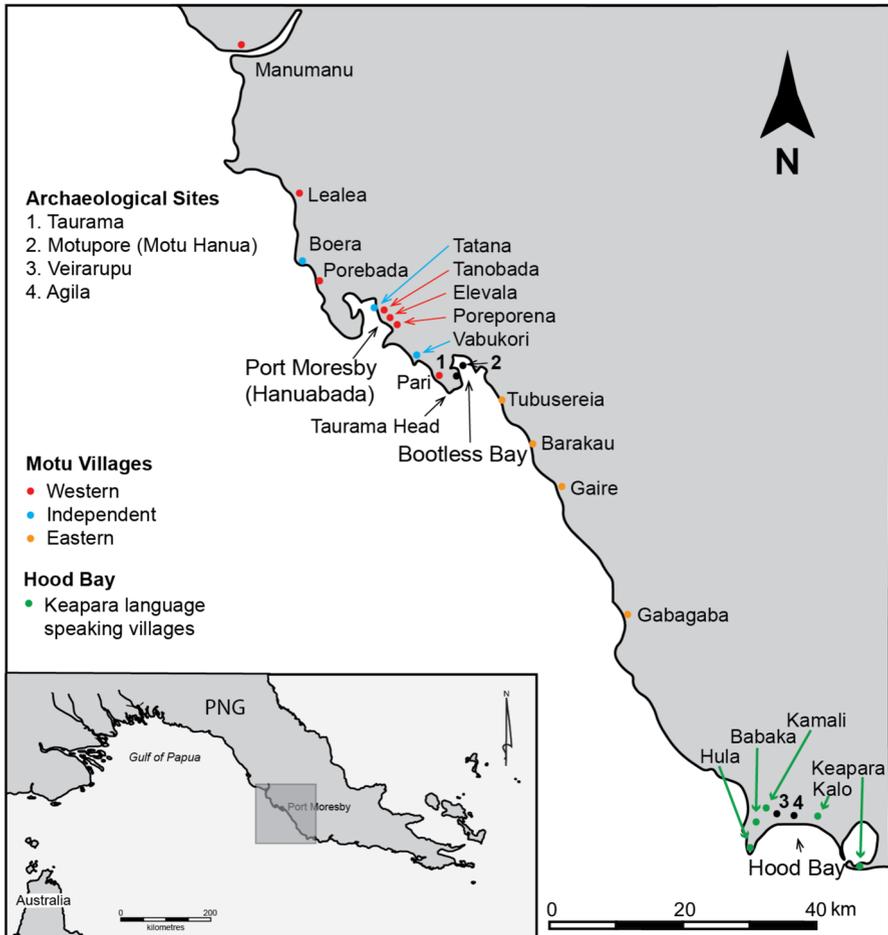


Fig. 1 Motu and Keapara villages in relation to archaeological sites referred to in text

Archaeological surveys in the 1960s and 1970s identified several past settlement sites on the shores of Bootless Bay (PNG National Museum and Art Gallery [NMAG] site codes: ACC, AQP, ADQ, AQM). However, excavations were limited to Taurama (NMAG site codes: AJA, AGN) where potential long-term pottery use relies largely on the single radiocarbon date of 775 ± 85 BP (I- 6887B) (Bulmer, 1978:275). There is ample evidence that trade pots were manufactured at Motupore (Allen, 2017). Whether pots were also made at associated mainland villages such as Taurama remains unknown. It would be understandable if mainland villages avoided making pots because doing so could have compromised relations with Motupore. The rationale for maintaining and supporting specialised industries on islands is illustrated by Mailu pottery production in Amazon Bay. Like Motupore, Mailu became a prolific offshore pottery manufacturing centre (Irwin, 1985). Pottery production was the exclusive domain of Mailu Islanders who provided pots

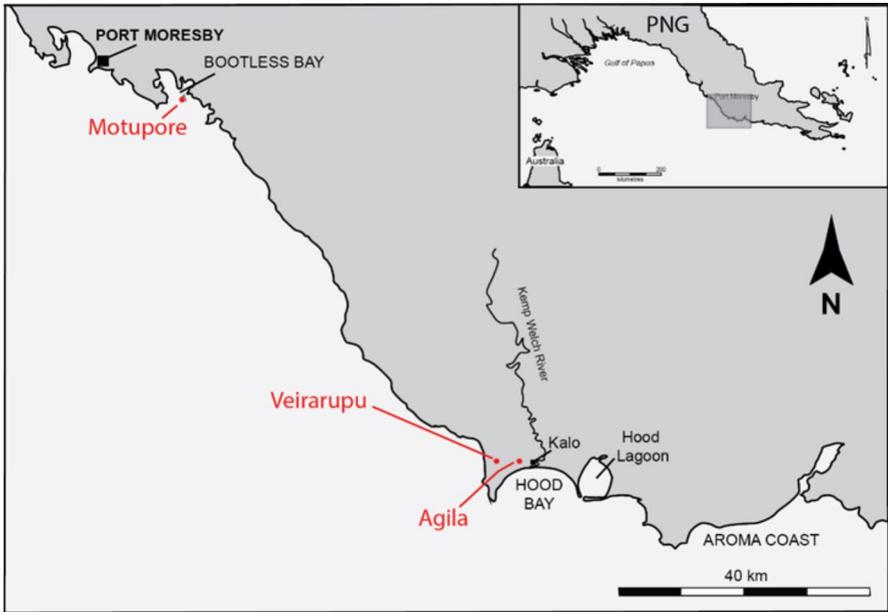


Fig. 2 Archaeological sites where pottery sherds were obtained for analysis

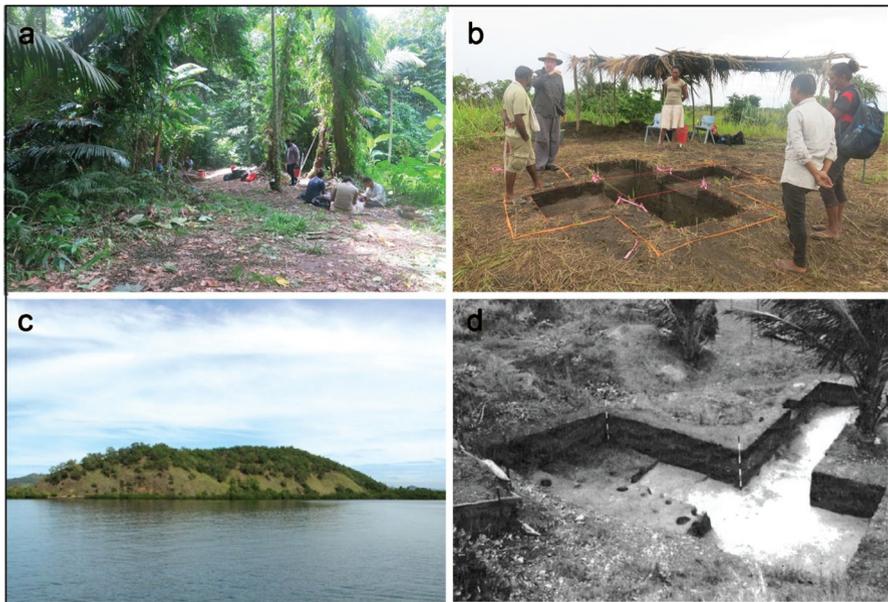


Fig. 3 a Veirarupu, view northeast along dune to the excavation. b Agila excavations completed. c Motupore Island. d Motupore excavations view north, Squares J and K (Allen, 2017:74, Fig. 3.9)

to mainland villages in exchange for horticultural products (Saville, 1926:143). Mainland villagers had the knowledge required to make pots through intermarriage but chose not to because doing so would have compromised social relations with Mailu Islanders.

For many decades, archaeologists have sought to trace exchange networks and cultural interconnections back in time and space by comparing pottery form and decoration from excavated and dated sites (Rice, 2005:245; Summerhayes & Allen, 2007:100). For Papua New Guinea's south coast, these macroscopic analyses of pottery provided a coherent understanding of the region's inter-connected history (Allen, 1977c; Bulmer, 1978; Rhoads, 1994; Swadling, 1980; Vanderwal, 1973). However, interpretations of exchange and interconnection based only on decoration and vessel form are incomplete, as they provide no insight into the first stages of the manufacturing sequence: where the materials were sourced and where the makers were based (for discussion see Rye & Allen, 1980). When variations in decoration and vessel form are cross correlated between archaeological sites, differences and conformities in ceramic attributes can be artefacts of the ways individual researchers described and characterised the pottery sherds. This problem has been addressed with ceramic sourcing studies that have sought to differentiate between source manufacturing and recipient locations so that the social and cultural dynamics of change in trade and exchange relations can be better understood (*e.g.* Bickler, 1997; Rye, 1976; Summerhayes, 1997, 2000a, 2000b; Worthing, 1980, 1982).

Pottery sherds with designs and vessel forms like those excavated in vast numbers at the site of Motupore from 1970 to 1975 have been found distributed widely on PNG's south coast west of Bootless Bay. These include predominantly shell-impressed, drag incised, punctuated, and painted decoration often on carinated bowls or dishes (see Allen, 2017:271–293). Sherds with comparable attributes have been identified at the ancestral village of Popo in Orokelo Bay 300 km to the northwest (Urwin, 2022). Progressively east from Orokelo Bay, similarly decorated sherds have been found at Lui Ova and Keveoki on the Kouri lowlands, Lou'upuru near Kerema, and Urourina on Yule Island (David et al., 2009; Frankel & Rhoads, 1994; Rhoads, 1994; Skelly & David, 2017; Vanderwal, 1973) (Fig. 4). Apart from Geoff Irwin's investigations in Amazon Bay (*e.g.* Irwin, 1974, 1978, 1985), archaeological research on the mainland coast east of Bootless Bay has been limited. During the 1960s, however, Hood Bay drew some archaeological attention when anthropologist Nigel Oram reported "Motupore-type pottery" amongst surface scatters at several ancestral village sites (Johnston, 1971:27). Whether the wide distribution of pottery with comparable attributes is a result of seafaring trade, population movements, exchanges of ideas or a combination of factors has never been confirmed.

Materials: The Hood Bay Excavations

Hood Bay is 80 km southeast from Bootless Bay. The ancestral village of Veirarupu is on a northeast-southwest oriented 2 m high dune near the western margin of the bay (Fig. 3a). The Veirarupu archaeological site is visible as a low-density scatter of pottery sherds and shells exposed by a pedestrian track used for garden access. The thickly

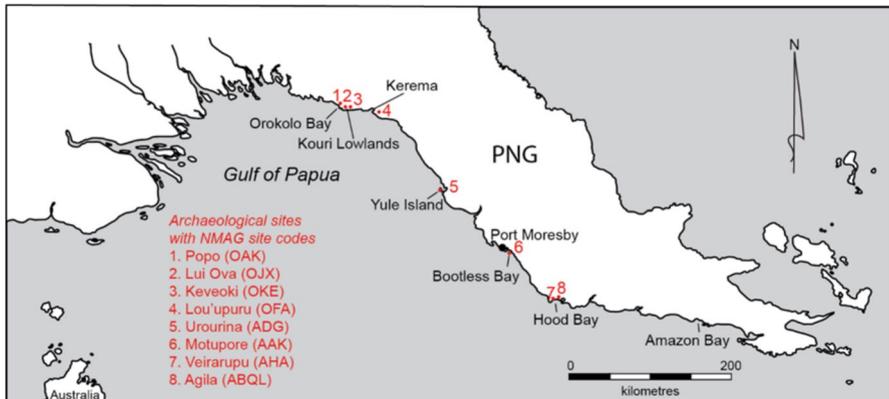


Fig. 4 Archaeological sites where pottery sherds with Motupore-type decorations have been found

vegetated edges of the dune slope down to mixed herbaceous vegetation and mid-height coastal forest. The ancestral village site of Agila is 2.2 km east of Veirarupu. Agila is visible as a low-density scatter of pottery sherds in grasslands interspersed with horticultural gardens, coconut trees, and pandanus palms (Fig. 3b). Fine-grained excavations measuring $1 \times 1 \text{ m}^2$ were conducted at each site (see Skelly et al., 2018, 2023, 2024 for details).

A Chronology of Relations Between Bootless Bay and Hood Bay

The radiocarbon chronology for Motupore is under review following new excavations at the site by the University of Papua New Guinea (UPNG) in 2016–2018. The currently available chronology for Motupore is based on radiocarbon dates from the 1970s excavations with inferential support drawn from the chronological sequencing of “Pottery Analytic Units” (PAUs) (Allen, 2017). Based on Jim Allen’s (2017:151, 620) suggested settlement date for the site, and the probability distribution of the most reliable radiocarbon dates, we infer three chronological phases for the Motupore sequence: c. 750–600 cal BP (PAU 6), c. 600–450 cal BP (PAU 5), and c. 450–300 cal BP (PAU 4–1) (see discussion in Urwin, 2022:180). The earliest evidence of occupation in Hood Bay so far is from Agila, which was occupied after 650 cal BP. The ancestral village of Veirarupu was occupied sometime between 500 and 300 cal BP (Table 1). Veirarupu, Agila, and Motupore were all abandoned c. 300 BP. (Allen, 2017:118; Skelly et al., 2024:23).

The Pottery Sherd Assemblages

The Agila pottery sherd assemblage from upper levels at the site dating to after 520 cal BP have decorative and form attributes like pottery from Mailu Island to the east (Skelly et al., 2018); we did not analyse these sherds using SEM-AM. Pottery sherds from Agila with decorations like those seen at Motupore are limited

Table 1 Radiocarbon determinations for Agila and Veirarupu. All radiocarbon dates are AMS on individual pieces of charcoal or shell collected in situ. Calibrations undertaken using OxCal v4.4 Bronk Ramsey (2023); atmospheric data from Reimer et al. (2020). Shell dates calibrated using a marine reservoir correction (ΔR_{20}) of -127 ± 20 ^{14}C years (Petchey et al., 2008) using the Marine20 calibration curve (Heaton et al., 2020). $\delta^{13}\text{C}$ measured at the University of Waikato using a CO_2 isotope analyser Los Gatos Research model CCIA- 46. *The $\delta^{13}\text{C}$ was measured on prepared graphite and is not shown

Stratigraphic unit (SU)	Wk-laboratory code	Material dated	$\delta^{13}\text{C}$ ‰	^{14}C age BP	Unmodelled calibrated age BP (68.2% probability)	Unmodelled calibrated age BP (95.4% probability)
Agila						
2	42519	<i>Anadara antiquata</i> shell	-0.1 ± 0.1	743 ± 20	420–270	480–180
2	42520	<i>Anadara antiquata</i> shell	1.2 ± 0.1	713 ± 20	400–240	450–140
3	42521	<i>Anadara antiquata</i> shell	1.0 ± 0.1	713 ± 20	400–240	450–140
4	42522	<i>Anadara antiquata</i> shell	1.2 ± 0.1	704 ± 20	400–230	450–140
4	42523	Charcoal	*	379 ± 23	500–340	510–330
4	42524	Charcoal	*	386 ± 23	500–330	500–320
4	54910	Charcoal	-26.4 ± 0.7	387 ± 17	500–330	510–320
6	54911	Charcoal	*	457 ± 17	520–500	530–490
8	54913	Charcoal	-26.5 ± 0.7	617 ± 17	650–550	650–550
Veirarupu						
1B/2	54914	Charcoal	-22.3 ± 0.7	360 ± 18	480–330	500–310
2	54915	Charcoal	-27.0 ± 0.7	349 ± 17	460–320	480–310
4	54916	Charcoal	-24.1 ± 0.7	372 ± 17	490–330	500–320
4/5	54917	Charcoal	-25.6 ± 0.7	365 ± 19	480–330	500–310

to lower levels of the site, which date to before 490 cal BP. The most striking examples are a rim sherd with “vertical herringbone motif” decoration like that from Motupore PAU 5–6 (before 450 cal BP) (Allen, 2017:275–278, figs. 8.4, 8.5 and 8.6a). A second sherd has the supposedly later “sloping incised band motif” decoration as found in Motupore PAU 3–4 (after c. 450 cal BP) (Allen, 2017:283, Fig. 8.11f). We selected these two sherds for SEM-AM analysis to test whether their mineralogical make-up suggests they were made in the Bootless Bay region (Fig. 5j and k).

All excavation levels at Veirarupu contain sherds with decorative and form attributes like those found at Motupore. The Veirarupu assemblage includes 218 rim sherds, 37 with impressed and/or incised decoration on the vessel lip, and 39 sherds with body decoration. Amongst the sherds with body decoration, 17 have bands of shell impressions made using the margin of a bivalve shell (*e.g.* Figure 5 h and i). The most striking parallel with the decorative techniques seen at Motupore is a bowl rim with gouged shell impressions that are visually indistinguishable from the Motupore “slashing” motifs (Allen, 2017:86, 151, 293, figs. 8.18b, c) (Fig. 5 g). Also present at Veirarupu are bivalve impressions on rim interiors (Fig 5f). Slashing motifs and shell-impressed decorations are attributed to Motupore PAU1 (before 300 cal BP). Four Veirarupu sherds with shell-impressed decorations were selected for SEM-AM analysis (Fig. 5f, g, h, i).

A representative selection of five sherds obtained during the UPNG 2016 excavations at Motupore were selected by TB for SEM-AM analysis. The selected sherds are:

- 1) Inverted carinated bowl rim sherd from grey-black humic deposits at 25–30 cm depth (ID code – M1; Fig. 5a).
- 2) Everted indirect pot rim sherd from yellow-brown sandy shell midden deposits at 65–70 cm depth (ID code – M2; Fig. 5b).
- 3) Everted indirect pot rim sherd from grey sandy shell midden deposits at 105–110 cm depth (ID code – M3; Fig. 5c).
- 4) Body sherd with traces of red slip or paint from basal red grit deposits at 145–150 cm depth (ID code – M5; Fig. 5d).

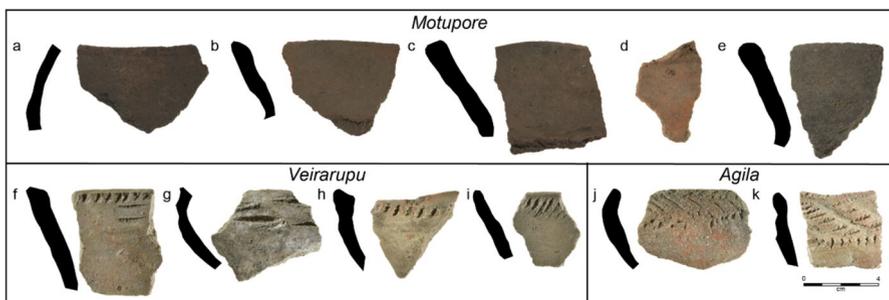


Fig. 5 Pottery sherds selected for comparative analyses (sherd ID codes: Motupore a = M1, b = M2, c = M3, d = M4, e = M5; Veirarupu f = V30, g = V15, h = V27, i = V16; Agila j = AG38, k = AG46)

- 5) Everted indirect pot rim sherd with a band of bivalve margin impressions diagonally oriented on top of a rounded lip. The sherd is from white basal sand deposits at 200–210 cm depth (ID code – M4; Fig. 5e).

Methods

Pottery analyses for the Agila and Veirarupu assemblages involved two phases. To begin, all rim and decorated sherds from Agila ($n = 192$) and Veirarupu ($n = 228$) were individually analysed. The quantitative and qualitative attributes of each sherd were entered in spread sheets for comparative analyses. For inter-site comparisons, we draw on analyses of the Motupore ceramic assemblage by Jim Allen (2017). For the second phase of the analysis, thin Sects. (30 μm) were prepared from pottery sherds from Motupore ($n = 5$), Agila ($n = 2$), and Veirarupu ($n = 4$). The slides were examined under low magnification using plane polarised light (PPL) and cross-polarised light (XPL). Differences in the mineralogy of the sherds were apparent. However, we were not able to quantify the mineral characteristics clearly enough to separate the sherds into distinct groups, representative of different sources for the material used (clay and temper). To address this limitation we used SEM-AM analysis to identify the mineral profile for each sherd and eliminate the mineralogical ambiguity that remained after PPL and XPL analyses (Fig. 6, Table 2). SEM-AM analysis provides comprehensive quantitative mineralogical profiles, including both major and minor mineral phases (Carloni et al., 2022; Schulz et al., 2020). Machines are designed for high throughput and operator-free measurements (*i.e.* 3–8 samples per day). For archaeologists, SEM training is not required; researchers familiar with petrographic analysis will have the knowledge needed to interpret the results (*i.e.* back-scattered electron image and mineral maps).

Several previous ceramic sourcing studies have focussed on sherd assemblages from Motupore. These studies used petrography, proton-induced X-ray emission (PIXE), X-ray fluorescence (XRF) and SEM analyses to characterise sherd mineralogy (Allen & Rye, 1982; Rye, 1976; Rye & Allen, 1980; Rye & Duerden, 1982; Worthing, 1980, 1982, for a detailed review, see Ford et al., 2024). These studies came before the availability of SEM-AM analyses (Wu, 2016; Radclyffe et al., 2021) and relied on comparatively limited mineralogical characterisations of large numbers of sherds and mineral samples. Our study is constrained to a small number of sherds. To mitigate this limitation, large areas of each sherd were measured to provide comprehensive mineralogical characterisations at levels that could not be achieved prior to the availability of large area mapping such as SEM-AM analysis.

SEM-AM utilises standard SEM hardware in combination with image analysis and processing software. By collecting data over an area of several cm^2 , with a pixel resolution of a few micron (typically 2.5 to 10 μm), the mega-pixel data sets generated by SEM-AM significantly reduce sample bias that can be introduced by only measuring selected points. The analysis provides semi-quantitative (mineral estimations) and statistically robust mineralogical compositions of each sample, which is invaluable when studying heterogeneous materials (Carloni et al., 2022; Schulz et al., 2020). In contrast to petrographic point-counting, SEM-AM is much less work

Table 2 Sherd mineralogy by area percent based on SEM-AM data

Sample	Motupore					Veirarupu					Agila	
	M1	M2	M3	M4	M5	V15	V16	V27	V30	AG38	AG46	
Albite	3.33	0.523	0.537	2.36	10.9	0.628	6.12	9.67	12.3	2.73	0.623	
Apatite	0.0019	0.0241	0.0046	0.0017	0.0161	0.0521	0.0099	0.0363	0.0303	0.0045	0.0924	
Barite	0.0001	n.d	n.d	0.0123	0.0007	n.d	n.d	n.d	n.d	0.0377	0.0044	
Calcite	9.8	6.97	4.62	3.99	0.0501	1.27	0.0002	0.0503	0.0002	20.8	16.3	
Calcite-Pyrophyllite	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	3.88	2.06	
Calcite-Quartz	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	0.348	0.314	
Chlorite	0.0079	0.0045	0.0077	0.0121	0.1126	0.0187	0.283	0.463	0.58	0.0223	0.0782	
Cordierite	0.0003	0	0.0001	0.0001	0.0005	0.0007	0.0017	0.0012	0.0002	n.d	n.d	
Diopside	0.0102	0.0083	0.0403	0.322	0.894	0.0086	4.83	4.52	4.08	0.195	0.0253	
Dolomite	0.0003	0.0237	0.0006	0.0002	0.0002	0.0009	n.d	n.d	0.0001	0.0388	0.0024	
Enstatite	0.0068	0.0004	0.0224	0.351	0.0421	0.0054	0.329	0.406	0.422	0.0236	0.0071	
Epidote	0.262	0.137	0.885	0.752	0.841	0.0466	0.26	0.333	0.308	0.0109	0.0105	
Ferrokaersutite	0.0005	0.0009	0.0009	0.0013	0.1109	0.001	0.134	0.120	0.0961	0.0027	0.0005	
Gedrite	0.0291	0.049	0.572	0.0084	0.263	0.419	0.212	0.435	0.828	0.164	0.565	
Gibbsite	n.d	n.d	n.d	0.0001	0.0001	0.0002	0.0001	0.0005	0.0053	n.d	n.d	
Ilmenite	0.0688	0.0126	0.0074	0.0204	0.65	0.0279	1.17	0.998	0.709	0.0391	0.007	
Kaersutite	0.0084	0.0025	0.0055	0.0059	0.0612	0.0032	0.103	0.144	0.152	0.0067	0.0019	
Kaolinite	0.0405	0.0259	0.110	0.0203	0.279	0.848	0.752	1.16	1.16	0.706	0.667	
Magneso-hornblende	0.968	0.158	1.79	5.43	0.725	0.240	2.49	4.64	4.88	0.300	0.229	
Magnetite	0.0075	0.0058	0.0374	0.0025	0.119	0.0241	0.106	0.123	0.0837	0.0173	0.0464	
Montmorillonite	0.639	0.682	0.472	0.247	0.947	1.03	1.14	2.73	3.46	1.33	0.699	
Muscovite	0.0084	0.0053	0.0524	0.0054	0.172	0.0303	0.0902	0.102	0.0584	0.0223	0.0206	
Olivine	0.0365	0.0086	0.147	0.0273	0.0467	0.0482	0.0355	0.0754	0.086	0.0208	0.117	
Orthoclase	1.09	0.469	0.173	0.398	3.32	0.349	1.45	7.80	1.88	0.352	0.187	

Table 2 (continued)

Sample	Motupore					Veirarupu					Agila	
	M1	M2	M3	M4	M5	V15	V16	V27	V30	AG38	AG46	
Paragonite	0.0023	0.002	0.0011	0.0014	0.0101	0.0096	0.0138	0.0031	0.0091	0.0079	0.0217	
Plagioclase	9.91	0.168	0.883	2.16	2.47	0.638	1.51	3.21	4.56	0.635	0.928	
Pyrophyllite	33.7	9.64	43.7	6.49	28.3	41.8	32.9	28.9	34.3	41.1	43.5	
Quartz	33.9	72.2	35	64.8	40.7	38.4	31.2	20.5	21.7	13.9	21.2	
Quartz-Calcite	0.0106	0.0296	0.0309	0.0415	0.0172	0.0166	0.0034	0.0144	0.0159	n.d	n.d	
Rutile	0.0159	0.0146	0.0281	0.0199	0.0484	0.0555	0.058	0.0368	0.0525	0.0215	0.0207	
Sillimanite	0.0005	0.0005	0.0012	0.0006	0.0030	0.0223	0.0287	0.0042	0.0029	0.0019	0.0039	
Spessartine	0.0112	0.0019	0.0791	0.0002	0.1147	0.0093	n.d	0.260	0.0675	0.0036	n.d	
Spinel	0.0005	n.d	n.d	0.0001	0.0017	0.0001	0.0001	0.0002	0.0004	0.0001	0.0002	
Titanite	0.0008	0.0002	0.0005	0.0004	0.0562	0.0003	0.0446	0.0826	0.0851	0.0019	0.0007	
Titanomagnetite	0.0015	0.0038	0.0008	0.0007	0.509	0.0025	0.609	0.440	0.157	0.0053	0.0014	
Zircon	0.0038	0.0001	0.0001	0.0025	0.0030	0.0008	0.0008	0.0010	0.0044	0.0010	0.0002	
Omphacite	0.0609	0.157	0.0673	0.0752	0.105	0.153	0.0419	0.199	0.0799	0.203	0.0902	
Unknown	4.38	2.50	2.97	4.41	4.56	13.1	2.67	5.47	5.19	3.61	3.86	
Pores	1.44	6.04	7.48	7.83	3.32	0.246	11.2	6.92	2.53	9.23	8.11	

Note: n.d. indicates that the phase was not detected. Values listed with three significant numbers for areas $\geq 0.01\%$

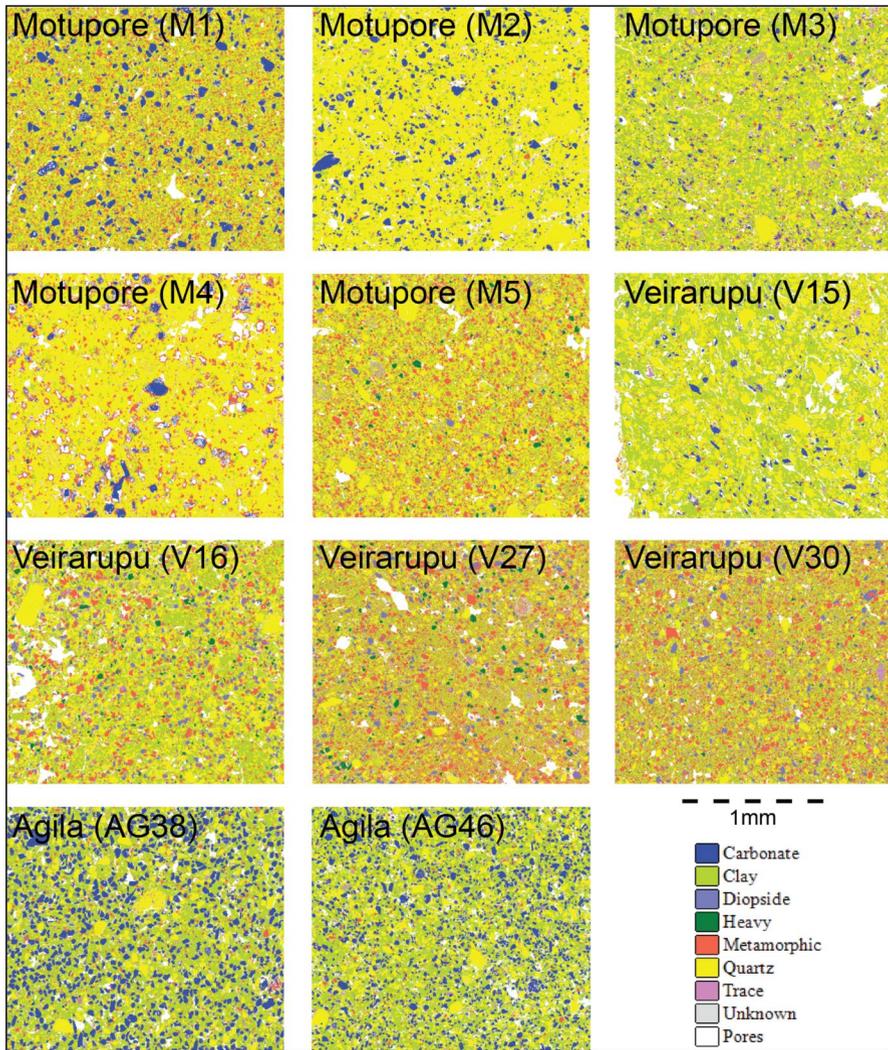


Fig. 6 Mineral distributions in sherds according to SEM-AM data

intensive, minimizes operator bias, and allows very high-resolution sampling, *i.e.* includes minor minerals (*e.g.* heavy minerals from a beach-sand component) that are difficult to capture in a statistically meaningful manner by manual means. The well-known limitations of SEM-AM (*e.g.* Leclerc et al., 2023) include inability to distinguish minerals with the same composition but different crystallographic structure (*e.g.* quartz and tridymite).

SEM-AM is well suited for the current study because of the limited number of available samples from the time period of interest. Compared to portable X-ray fluorescence (pXRF), SEM-AM provides highly accurate mineralogical information for

each available sample, an important requirement for principal component analysis (PCA; Michelaki & Hancock, 2011). pXRF data from unprepared sherds often lacks precision because it is affected by factors like the shape of the sample and its moisture content (Ravansari et al., 2020). Sampling bias is another issue: for example, the Olympus Delta pXRF has a 9 mm spot size, which can be reduced to 3 mm, meaning individual analyses may not accurately represent the overall composition of the sherd or its components (like clay or temper) due to the variability in the sherd's makeup (see Etschmann et al., 2010; Li et al., 2016). To get reliable results, pXRF analysis should involve multiple tests on large sample sets.

SEM-AM data were collected on a Hitachi SU3800 SEM (tungsten filament) at 15 kV with a resolution of 2.48 $\mu\text{m}/\text{pixel}$. Energy dispersive spectra (EDS) spectra were collected with two Bruker Nano GmbH Model XFlash 61 60 detectors running the Bruker Nano GmbH software package “Advanced Mineral Identification and Characterization System (AMICS)”. AMICS acquires back-scattered electron images where different mineral phases are distinguished by variation in grey scale; EDS spectra are measured on each mineral phase. Following data acquisition, the EDS spectra were compared against a library of mineral spectra for mineral identification. From this, the area percent of each mineral was calculated. It is possible to convert the area % to weight % but this requires the mineral density, which is based on an ideal mineral composition. Real-world variations in mineral composition lead to fluctuations in actual mineral density, thus it was preferred to work with area %. PCA was performed using R-studio (version 2023.12.1).

Results

The PCA results of SEM-AM analysis show that the mineralogy of sherds from the three sites separate into discrete clusters. Over 50% of the variance can be explained by two components (Fig. 7: Dim 1 and Dim 2) which is typical for complex heterogeneous samples. The second principal component (Fig. 7: Dim 2) clearly separates the three sites. Over 75% of the Agila and Motupore samples are dominated by quartz, calcite, and pyrophyllite (with the exception of Motupore sherd M5), while the Veirarupu sherds also contain significant amounts of other minerals such as albite and diopside (except for Veirarupu sherd V15). Overall, the main discriminant minerals are carbonates (mainly calcite); quartz; metamorphic minerals (*e.g.* epidote, hornblende); heavy minerals, such as those concentrated in beach placers (*e.g.* magnetite, ilmenite, rutile, titanite); and kaolinite, that define distinct regions in the PCA plots (Fig. 7).

The materials used to make the sherds from the three sites differ to the extent that the vessels from which the sherds originate were clearly made in locations with different local geologies. Although the manufacturing locations cannot be unequivocally determined, the mineralogy of the Motupore sherds suggests manufacture in the Port Moresby – Bootless Bay region which is characterised by the Late-Middle Eocene “Port Moresby Beds” in Bootless Bay, Fairfax Harbour and continue northwest to Boera (siliceous argillite, shale, calcilutite, chert calcarenite). Geology is also influenced by “Bootless Inlet Limestone” deposits (fossiliferous calcarenite, volcanic detritus and minor calcareous tuff) (PNG 1:250 000 geological series

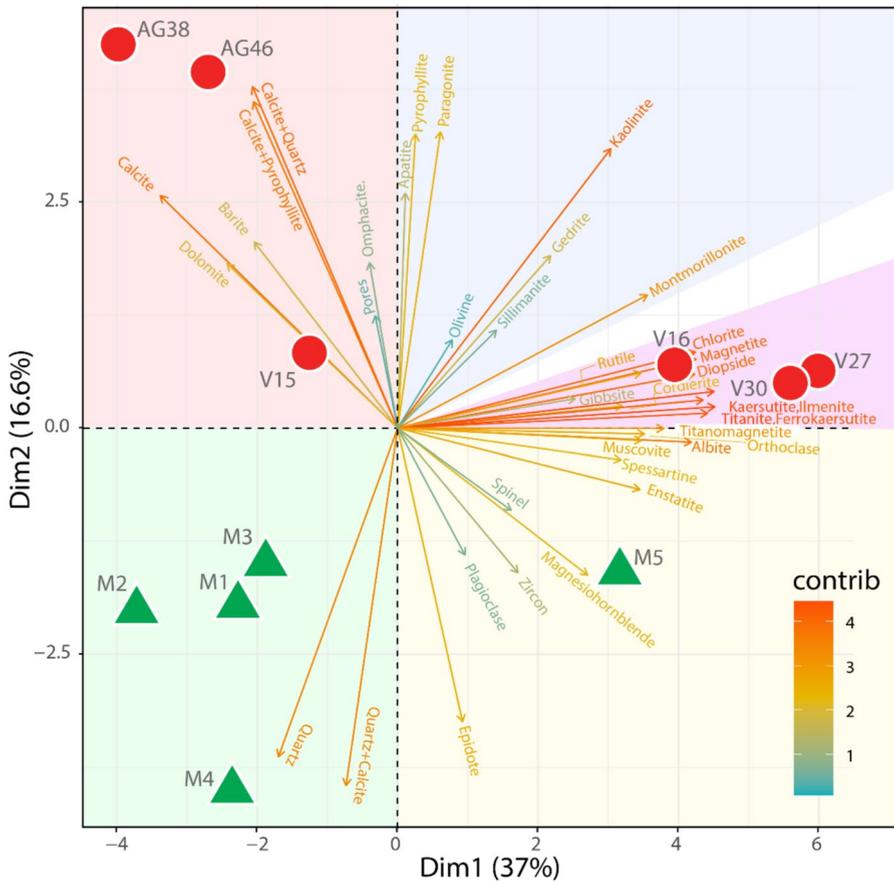


Fig. 7 Principal component analysis of the mineralogical composition of 11 sherds, showing the distribution of samples according to locality (Motupore – M1 -5; Agila – AG38, AG46; Veirarupu – V15, V16, V27, V30) on the first two components. Contributions of individual mineral contents are shown with vectors, each vector is coloured according to the value of the contribution (contrib), with components with a larger value contributing a relatively large portion to the total distance and therefore being most important in separating the different samples. Main discriminants are further highlighted in colour

BMR, 1968: sheets SC 55–7, SC 55–11, SC 55–6). These results agree with those of Worthing (1980, 1982) who sourced a large assemblage of Motupore sherds to the same section of coastline. Worthing further divides the mineralogy of the Motupore sherds into four temper types. We have not attempted to differentiate Motupore temper types as the available assemblage is much too small for that level of analysis. The aim of this paper, however, is not to differentiate temper types in the Motupore assemblage but to determine whether Motupore and Hood Bay assemblages came from the same or different manufacturing locations.

The mineralogy of the sherds from Agila and Veirarupu suggests that they were unlikely to have been made on Motupore Island or the wider Port Moresby

– Bootless Bay region. The Agila and Veirarupu sherds differ from each other in mineralogy. Given that the Agila sherds date to before 520 cal BP and Veirarupu sherds date to 530–290 cal BP, it appears that the materials used for pottery manufacture in the Hood Bay region changed through time. The materials used to make Agila and Veirarupu pots are consistent with the base geology of Hood Bay which is characterised by the Early Cretaceous “Kemp Welch Beds” (argillite, shale, slate, siltstone, minor lithic felspathic sandstone, greywacke, rare conglomerate, limestone, and interbedded volcanics), overlain by deposits of littoral gravel, sand, and silt (PNG 1:250 000 geological series BMR, 1968: sheets SC 55–7, SC 55–11, SC 55–6).

Discussion of the SEM-AM Analyses in Light of Oral Traditions and Ethnography

Results from SEM-AM analysis have shown that the materials used to make the sherds from Motupore was likely derived from a different geological source to the materials used at Veirarupu and Agila. Although our analysis does not confirm their precise geological provenance, the base geology of Bootless Bay and Hood Bay suggest local pottery production, in line with the distinctive mineral associations highlighted by the PCA (Fig. 7). The small sample size is a significant limitation of this study, and it would be desirable to extend this work as further samples become available. Further insights may also be gained from *in situ* isotopic and trace element studies on minerals such as zircon, titanite, and apatite localised using the SEM-AM analysis (Verde et al., 2024).

Confirming geological provenance to identify a “core” pottery manufacturing location was not an aim of this research. We aimed to avoid a processual core – periphery narrative emphasising the agency of manufacturing cores over that of trade/exchange recipients. The fundamental question raised by the results of our analyses is, how can the striking parallels in vessel decoration be explained when the pots derive from different geological locations? What do these results tell us about past ancestral Motu and Keapara exchange relations and how these transformed through time? To address these questions, we draw on colonial-era written ethnographies, oral traditions, genealogies, linguistic research and material culture studies that provide insights into past Western Motu – Eastern Motu – Keapara relations. The individual strands of evidence are far from complete and offer limited temporal depth. However, when the evidence is weaved together and coalesced with the results from SEM-AM analysis, a narrative of shared agency and changing social relations amongst Motu and Keapara peoples is revealed. Each evidential strand is discussed in turn below.

Early colonial ethnographies describing seafaring exchange on the Papua New Guinea’s south coast tend to strongly emphasise the agency of Western Motu cultural practices (*e.g.* in initiating and sustaining exchange). This bias can be traced to November 1873, when W. G. Lawes established the London Missionary Society (LMS) headquarters overlooking the Western Motu village complex of Hanuabada (present-day Port Moresby) (Lennox, 1902:43). In that same decade, Port Moresby

became the port of access for colonial activities on the New Guinea south coast and Western Motu villages took centre stage in ethnographic accounts. LMS missionaries regularly sailed east of Port Moresby searching for suitable locations to expand mission activities. Often, they would finish their first day at sea stopping at the conveniently located villages of Hula or Keapara in Hood Bay and these villages feature in their memoirs (Beswick, 1880; Chalmers, 1887a; Lawes, 1877). To reach Hood Bay, they sailed past Eastern Motu villages, but these villages were rarely visited and were often bypassed entirely.

The emphasis on Western Motu cultural practices was magnified by the scale and performance of the Western Motu Hiri (*e.g.* Barton, 1910; Chalmers, 1887b). The Hiri was an annual exchange involving spectacular fleets of *lagatoi* trading vessels sailing northwest to the Gulf of Papua to exchange cargoes of pots for tons of sago palm (*Metroxylon sagu*) starch and rainforest hardwood canoe hulls (Fig. 8). Seymour Fort (1887:150) observed that “in one of these expeditions ... 20,000 pots were taken, for which they would bring back in exchange 150 tons of sago”.

Archaeological research commenced in the 1960s and was drawn to the Port Moresby and Papuan Gulf regions by research agendas aimed at understanding the antiquity and rationale of Hiri exchange relations (*e.g.* Allen, 1977c; David et al., 2008; Frankel & Vanderwal, 1982; Rhoads, 1982; Skelly, 2014). With archaeological interest tracking the ethnographic narrative, Eastern Motu and Keapara histories received relatively little attention. For example, only one ethnographic account has ever specifically



Fig. 8 “Trial trip of native trading vessels, Port Moresby” photograph by J.W. Lindt 1885. Compliments of State Library, Victoria

focussed on the cultural practices of Keapara speaking peoples (Guise, 1899) and no archaeological investigations have ever taken place on the traditional lands of the Eastern Motu. Archaeologists made only brief visits to Keapara homelands in 1965 and 1971 before our archaeological research commenced in Hood Bay in 2016. It is important to acknowledge the bias in ethnographic and historical sources because the emphasis on Western Motu cultural practices creates an impression that Eastern Motu and Keapara peoples were bit-part actors in a Western Motu narrative. Yet ancestral Eastern Motu and Keapara peoples doubtless participated in long-distance exchange, and we argue they were equally important in shaping community relations on Papua New Guinea's south coast. The period before 300 BP is best understood in terms of Motu – Keapara relations as it is not clear that an East–West divide existed in Motu culture in the way it is described in ethnography. When referring to more recent times, as depicted in ethnographies and historical accounts, the groups are referred to as Western Motu, Eastern Motu, and Keapara as they were clearly differentiated by that time.

An unavoidably one-sided, but detailed, insight into past Eastern Motu – Western Motu relations is available in Western Motu oral traditions. The Western Motu trace their origins to Motupore Island in Bootless Bay (Golson, 1968:69–70). There was a contemporaneous village called Taurama located on the adjacent mainland, established by settlers from Motupore (Oram, 1977:89). According to the oral tradition, the ancestral Eastern Motu were then based at the village of Tubusereia (also known as Tupuselei) on the eastern margin of Bootless Bay. Relations between Taurama and Tubusereia began to sour when a woman from Tubusereia living at Taurama was assaulted by her husband and fled back to her home village (Oram, 1968:426). Tensions rose and people began leaving Taurama for Badihagwa, an elevated defensible location 800 m inland from where Hanuabada was later established (Golson, 1968:69). Escalating conflicts led to the destruction of Taurama and a protracted series of inter-Motu conflicts that continued to the early 1800s (Aire Aire, in Pulsford & Heni, 1968). Applying a 25-year-generation spacing to Western Motu lineages, Nigel Oram estimated that the destruction of Taurama took place around AD 1725–1750 (Aoaë Athanasius “notebook”, cited by Oram, 1968:426–429, 439, 1977:93). Oram (1968:437, n22) also visited Tubusereia to record oral traditions there but was unable to find anyone with knowledge of the Motu conflicts. Yet Oram cautioned that this does not mean that Eastern Motu people did not have knowledge of that period of their history.

Western Motu ancestors fleeing conflicts in Bootless Bay settled less fertile areas to the west near present-day Port Moresby often subject to drought (Oram, 1977:74, 93, Oram, 1989:51). The conditions necessitated changes to subsistence practices which conceivably included initiating seafaring exchange relations which developed into the Hiri (Bulmer, 1979:22–24; Groves, 1960:5–7; Murray, 1912:157; Oram, 1977:85–88; Thomson 1892:76; Williams, 1933:139). During this period of settlement and social change, the Western Motu developed a close alliance with Papuan-language-speaking Koita people who occupied inland grasslands and low hills between Taurama Head and Redscar Bay (Seligman, 1910:41). Though they spoke different languages, by the nineteenth century, Western Motu and Koita people occupied sections of the same villages and were jointly involved in Hiri ventures (Haddon, 1900:278; Stone, 1880:66).

Oral traditions largely of the Western Motu offer an insight into the origins of the Hiri. Nigel Oram (1991:529, Table 1) collated 17 Western Motu oral traditions each naming Edai Siabo as the man responsible for initiating the first Hiri. According to 12 of the 17 traditions, Edai Siabo was from the Motu village of Boera or the ancestral village of Davage. The story of *Taurama E Kiaura* from the Western Motu village of Porebada offers an alternative Hiri origin story that also describes the creation of islands in Bootless Bay (Tau, 1976). Eastern Motu oral traditions are limited to just one account which traces Hiri origins to Tubuseria. By that account, during one of the annual Eastern Motu Hiri ventures, the Western Motu captured four *lagatoi* killing the crews and from there took over the Hiri (Murray, 1912:156). Thereafter, coastal waters west of Bootless Bay were closed to Eastern Motu seafaring (Oram, 1977:86).

Keapara oral traditions provide little information about their relationships with Motu villages. Tubuseria, however, is recalled as *Wapu Ama* which means “huts of the widows” in Keapara language. The reason for this name is not remembered, though the term does allude to past tragedies. Keapara oral traditions focus on origin places to the east and northeast and provide genealogies for chronological context. Applying a 25-year-generation spacing to Keapara genealogies would suggest Agila was settled before AD 1670, and settlement at Veirarupu after AD 1610 (Guise, 1985:43, 46). The most common themes in all Motu and Keapara oral traditions involve cultural schism and the effects of repeated conflicts disrupting seafaring and consequently impacting social and cultural relations amongst Motu and Keapara peoples (e.g. Golson, 1968; Guise, 1985; Kolia, 1977; Oram, 1968; Pulsford & Heni, 1968).

Western Motu marriage partners usually came from the same village and intermarriage with neighbouring villages was rare (Turner, 1878:495). Seligman (1910:44, 81) calculated that 37% of marriages in Western Motu villages involved unions between Western Motu and Koita partners. By contrast, among the Eastern Motu intermarriage with the Koita was rare (Seligman, 1910), and marriages with Keapara villagers was not unknown (Barton, 1910:35; Oram, 1977:86). Intermarriage between (notionally) Western Motu and Eastern Motu villages can be expected to have been more frequent prior to the conflicts in Bootless Bay. The conflicts after all trace to circumstances involving Eastern (Tubuseria) and Western (Taurama) Motu marriage partners (Oram, 1968:426). Eastern and Western intermarriage would have declined when Western Motu ancestors moved west out of Bootless Bay and into closer proximity with the Koita (Oram, 1977:80). Bootless Bay became a barrier to seafaring separating Western Motu from Eastern Motu and Keapara peoples. Eastern Motu – Keapara cultural practices and kinship relations as they were at that time would have been impacted by the social disruptions in Bootless Bay. We suggest that an insight into changing relations between Motu and Keapara peoples can be achieved by looking at women’s cultural practices which have previously gained little archaeological attention compared to the seafaring voyaging and exchange relations of men.

Tracing Past Kinship Relations Through Tattoos and Pottery

Tattooing has long been a significant cultural practice for Motu and Keapara women (and to a far lesser extent for men, see Haddon, 1905:86). Archaeological and ethnographic evidence hints that tattooing designs are interlinked with decorations on

pottery. The origins of diverse Papuan pottery traditions trace to the earliest Oceanic tradition called Lapita which appeared in the Bismarck Archipelago c. 3200 cal BP (Denham et al., 2012; Kirch, 1987). It has been suggested that the needle point dentate-stamped designs on Lapita pots originate from contemporaneous tattoo designs (Green, 1985:220, 1990:38). Kirch (1997:142) posits that the “punctures inflicted by a tattoo needle are virtually identical to the effect produced ... [on] the leather-hard surface of a ceramic vessel”. There are also linguistic traces that link pottery production to tattooing. Describing the tattooing practices on Papua New Guinea’s south coast, Krutak, (2007:109) proposed that the transformative properties of heat (or fire) are fundamental “to the overall logic of Papuan ... tattoo customs”. For example, the Motu term for a woman without tattoos is *kasiri vavor*, which translates as “raw” or “uncooked”. Fire separates food between the raw and the cooked and in the same way the “heat” imbued in tattooing practices separates “the girl from the woman” (Krutak, 2007:111). It is also worth noting that pottery production was exclusively a women’s cultural practice in the early colonial era, and tattooing was an essential part of personhood for women.

Past Motu – Keapara relations are evident in women’s use of body tattooing and the manufacture and/or use of pots. Life stages amongst Motu and Keapara women were socially signalled by the addition of body tattoos commencing around six years of age and continuing through to marriage (Fig. 9). Early colonial observers of the designs used by Western Motu, Eastern Motu, and Keapara women related to eligibility for marriage considered these identical (Barton, 1918; Finsch, 1885:20–22; Haddon, 1894:175; Lawes, 1879:370). The eligibility design has two lines commencing from the shoulder meeting on the chest. The Motu called the design *gado* and the Keapara called it *aigo iavu* (Barton, 1918:50; Haddon, 1894:175). After women were married, the *gado* or *aigo iavu* were infilled with geometric designs, which were also indistinguishable among the Motu and Keapara women (Turner, 1878:481). Barton (1918:36) suggests the origins of *gado* or *aigo iavu* trace to the frigate bird, called *mukou* by the Western Motu and *kokobe* by the Eastern Motu and Keapara peoples. This is a rare but significant linguistic connection between the tattoo designs.

Although observers routinely describe tattoos as “identical”, Barton (1918:35) considered Eastern Motu and Keapara tattoos to be finer in detail compared to the same designs used by the Western Motu. Barton (1918:35) also suggested that Eastern Motu and Keapara women placed a greater importance on tattooing than the Western Motu, which he thought reflected the high incidence of Western Motu – Koita intermarriage. For Keapara women, tattooing and marriage were intrinsically connected. During the annual *kapa* festival in Hood Bay, Keapara women of marriageable age were freshly adorned with tattoos that were displayed during cultural performances. Women who were not freshly tattooed were not considered eligible for marriage and would not marry that year (Guise, 1899:214–215).

Pottery production was the exclusive domain of Eastern and Western Motu women. Although the Eastern Motu were not involved in Hiri pottery production before the twentieth century, Seligman (1910:114) noted that “the women of the villages of Tupeselei, Gaile and Kapakapa are all potters”. Keapara women used pots, but there are no ethnographic or oral traditional records of pottery being made in Hood Bay. Successful pottery production requires precise and exacting skills. The process



Fig. 9 Young girl being tattooed in Gaile (Kaile) village (east of Port Moresby). Photograph by Francis R. Barton, Papua New Guinea c.1899–1907. Courtesy of the Royal Anthropological Institute (RAI no. 20286)

commences with obtaining suitable clay which could be sourced locally or several kilometres away (Groves, 1960:11). The clay must be carefully cleaned, and an appropriate temper added depending on the working characteristics of the clay and knowledge of how the mixture will react to firing (Groves, 1960:11–13; Rye, 1976:118–119). Great care must be taken to ensure pots are evenly formed and symmetrical. Inconsistencies in wall-thickness or firing temperature would cause pots to fail when fired (Ari-fin 1990:56–60; Groves, 1960:16). Becoming a proficient pottery maker was a long learning process for Motu women who acquired the knowledge and skills needed from their senior kin (Fig. 10). It is doubtful that the knowledge required for successful pottery production could be obtained through occasional social contact.

Several strands of evidence discussed above suggest that relations between Motu and Keapara groups reached an inflection when the settlements of Motupore, Agila, and Veirarupu were abandoned c. 300 cal. BP. These changes are evident in oral traditions, Western Motu – Eastern Motu linguistic divergence, changing settlement locations, changing marriage alliances and the establishment of new exchange relations antecedent to the Hiri. Potential reasons for the breakdown in Motu relations can be teased out through Bateson's (1935) thesis of "schismogenesis". According to Bateson's (1935:181) modelling, the Western Motu – Eastern Motu breakdown was a process of "symmetrical differentiation" caused by a decline in the "reciprocal" exchange that had provided stability. Intermarriage as exchange and ancillary



Fig. 10 Motu pottery manufacture, Hanuabada. Archive image description: “clay dug from nearby hillside, made, sundried and burnt; “glaze” from pulp of mangrove applied when hot” (photograph by Frank Hurley, 1921. Courtesy Australian Museum Archives – AMS320/V4422)

exchange “cycles” (see Lévi-Strauss, 1971:63–64), were likely important to maintaining Motu alliances. Thus, changing marriage practices between Motu groups may have been a factor in relationship breakdown. Around the time when marriage alliances were changing, increasing Motu – Keapara reciprocity is archaeologically apparent in pottery design and ethnographically apparent in tattoo designs.

The parallels in pottery assemblages derived from Bootless Bay and Hood Bay suggest Motu – Keapara kinship associations allowed the intergenerational sharing of knowledge. The nature and directions of those kinship relations is not clear, however, the presence of almost identical tattooing traditions related to marriage in the early colonial era raises the prospect that Motu – Keapara kinship associations included intermarriage. These kinship associations declined when conflicts amongst coastal groups disrupted seafaring relations and the Bootless Bay – Hood Bay ceramic tradition sustained by knowledge shared through kinship ties came to an end.

Conclusion

Our paper demonstrates that SEM-AM analysis is a novel and highly precise method of geochemical characterisation that builds upon non-automated SEM-EDS and is of high research value to Pacific archaeologists. When combined with qualitative vessel

form and decorative analysis, SEM-AM analysis has the potential to help understand the social and cultural agency of peoples who shaped cultural trajectories of pottery using groups. Our analysis shows that, despite remarkable similarities of pottery forms and decorations, at least some of the pottery with “Motupore-type” decoration found in Hood Bay was made locally. This is important because similar sherds have been found spread across 350 km of Papua New Guinea’s south coast, and there is now no reason to assume these all came from Bootless Bay. When revisiting assumptions based on macro analyses of pottery alone, we need to keep an open mind to how alliances and networks that enchaind this region were formed and maintained. Future SEM-AM analyses of sherds with “Motupore-type” decorations from coastal sites to the northwest have the potential to add nuance to understandings of the emergence and social dynamics of seafaring on the Papuan south coast.

It is not possible to say whether Motu or Keapara women made the pots used in Hood Bay. In fact, in many ways, it is difficult to visually distinguish between the pots that they used. The tattoo traditions maintained by Motu and Keapara women also cannot be distinguished. Like pottery production, tattoo traditions have a heritage which pre-dates social memory. These social and cultural parallels run counter to an ethnographic narrative of men’s seafaring heroics that emphasises Western Motu agency. The agency of all Motu and Keapara peoples appears to have been equally influential in guiding ancestral social and cultural practices. Several generations after Agila and Veirarupu were abandoned, Keapara women no longer made pots and there was no memory of pots being made in Hood Bay. We cannot be sure when pottery manufacture ended and further archaeological investigations may show that pottery manufacturing persisted after Agila and Veirarupu were abandoned.

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Author Contributions RS wrote the introduction, background sections, discussion and prepared Figs. 1,2,3,4,5,6. BE oversaw analysis, wrote the methods and results sections, and contributed to drafting Fig. 7. JB oversaw analysis, the drafting of methods and results sections and drafted Fig. 7. CU contributed to the intellectual development of the paper, writing and editing. FP completed radiocarbon analyses, wrote the dating section and edited chronological referencing throughout. TB obtained the Motupore sherds, provided sherd context and descriptions and text edits.

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Data Availability No datasets were generated or analysed during the current study.

Declarations

Competing Interests The authors declare no competing interests.

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