What do you do with a dugout canoe: An investigation into how the introduction of dugout canoes transformed the social and economic landscape of Indigenous Australia.

By

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CONTENTS

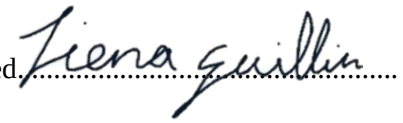
ABSTRACT

This thesis aims to explore how the introduction of dugout canoes influenced the social and economic landscape of Indigenous Australians. The methodological approach focuses on the analysis of characteristics of Indigenous watercraft in rock art, and spatial distribution of dated middens throughout the Northern Territory exploring whether there is a connection between canoe depictions and changes within midden assemblages. This thesis supports the theory that the introduction of the dugout canoe changed the distribution and sustenance patterns of Aboriginal and the growing argument of an earlier date of first contact with the Macassans. Additionally, I propose that social differences and minimal value in interaction as the reason for the stunted proliferation of the dugout canoe through Australia. Overall, the dugout canoe provided Indigenous communities with a means to travel further with ease and facilitated more successful hunting of high value foods which altered the social and economic landscape of Indigenous Australians.

Australia is home to one of the longest continuously surviving cultures in the world, spanning at least 65,000 years, which was involved in international communication, trade, and relationships with the outside world well before the first European settlement in 1788. This includes centuries of annual visits from Makassar, Indonesia to the northern Australian Indigenous communities seeking out trepang, an edible type of holothurian, a sea cucumber used in Chinese medicine, but also known to collect pearls, pearl shells and turtles. Trips were made annually with fleets of wooden patorani-type praus and their timing was determined by the monsoonal winds. With them, the Macassan fishermen brought the techniques and tools required to create dugout canoes. As these voyages continued for centuries there grew a number of temporary villages and camps revisited if providing suitable anchorages (and some of the Tamarind trees planted by Macassans still survive in Arnhem land providing a great shade, Marcus Lacey, Senior Ranger, pers. comm.).

DECLARATION

I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

Signed.  .....

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I wish to acknowledge the Traditional Owners of the land on which I have written this thesis from, the Wurundjeri Woi-wurrung the Traditional Custodians of Naarm/Melbourne and those who are the protectors and Traditional Custodians of the lands of which I have studied. I pay my respects to their Elders, past and present, and emerging.

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CHAPTER ONE INTRODUCTION

Australia is home to one of the longest surviving groups of people in the world, it is then unsurprising that there was international communication, trade, and relationships prior to the well-known European settlement in 1788. One of these is the centuries of annual visits from Makassar, Indonesia to the northern Australian Indigenous communities. Operating under the *Vereenigde Oostindische Compagnie* (Dutch East India Company, referred to as VOC from herein) these international arrivals were seeking out trepang (*teripang* in Indonesian) an edible type of *holothurian,* sea cucumber used in Chinese medicine, but were known to also collect pearls, pearl shells and turtles (Clark and May 2013:1; Warner 1932:480). Trips were made annually with fleets of wooden *patorani*-type praus, an older type of praus from southern Sulawesi characterised by a high curved stem and stern post, and were determined by the monsoonal winds (Blair and Hall 2013:213; Hawkins 1982:49,131). Arriving between December and January, the fishing season would last a number of months until the visitors would leave Australia as early as April and as late as June (Mitchell 1996:181). As these voyages continued for centuries, there grew a number of temporary villages and camps that were revisited where there were suitable anchorages and materials to live comfortably and dry out the trepang before sailing home (Blair and Hall 2013:212). The communities involved in this contact lived along the coast of the Northern Territory and Western Australia, the groups studied previously, and in this research, comprise of the Yolgnu in north eastern Arnhem Land, the Warnindilyakwa people of the Groote Eylandt Archipelago, Iwaidja in the Garig Gunak Barlu National Park, Amarak and Kundjey'mi from along East Alligator River and Maung from South Goulburn Island and surrounds (Horton 1996). With them, the Macassan fishermen brought the techniques, tools and knowledge required to create dugout canoes. A more difficult to construct watercraft, but one that is larger, more robust and capable of seafaring travel when compared to the bark canoe that was previously utilised (Mitchell 1996:183-184).

Despite the long period of contact this canoe technology did not disperse around Australia and is confined to the coastal areas with direct contact with the Macassans. Earlier researchers believed this was evidence that the Aboriginal groups did not make their own dugout canoes and only utilised those traded or left behind by the Macassans, stating that they were not capable of producing the canoes themselves (Halls 1961:208; Meggitt 1964:32; Thomas 1905:72). However, this has been disproven as there is additional evidence of canoe construction within Australia through artefactual remains of tool use and the more modern reproduction of canoe building techniques (Mitchell 1959:195-196; 1996:183; Payne 2016). Due to this lack of dispersal, this research will focus on the area of Arnhem Land in the Northern Territory, Australia, and its surrounding islands as there are

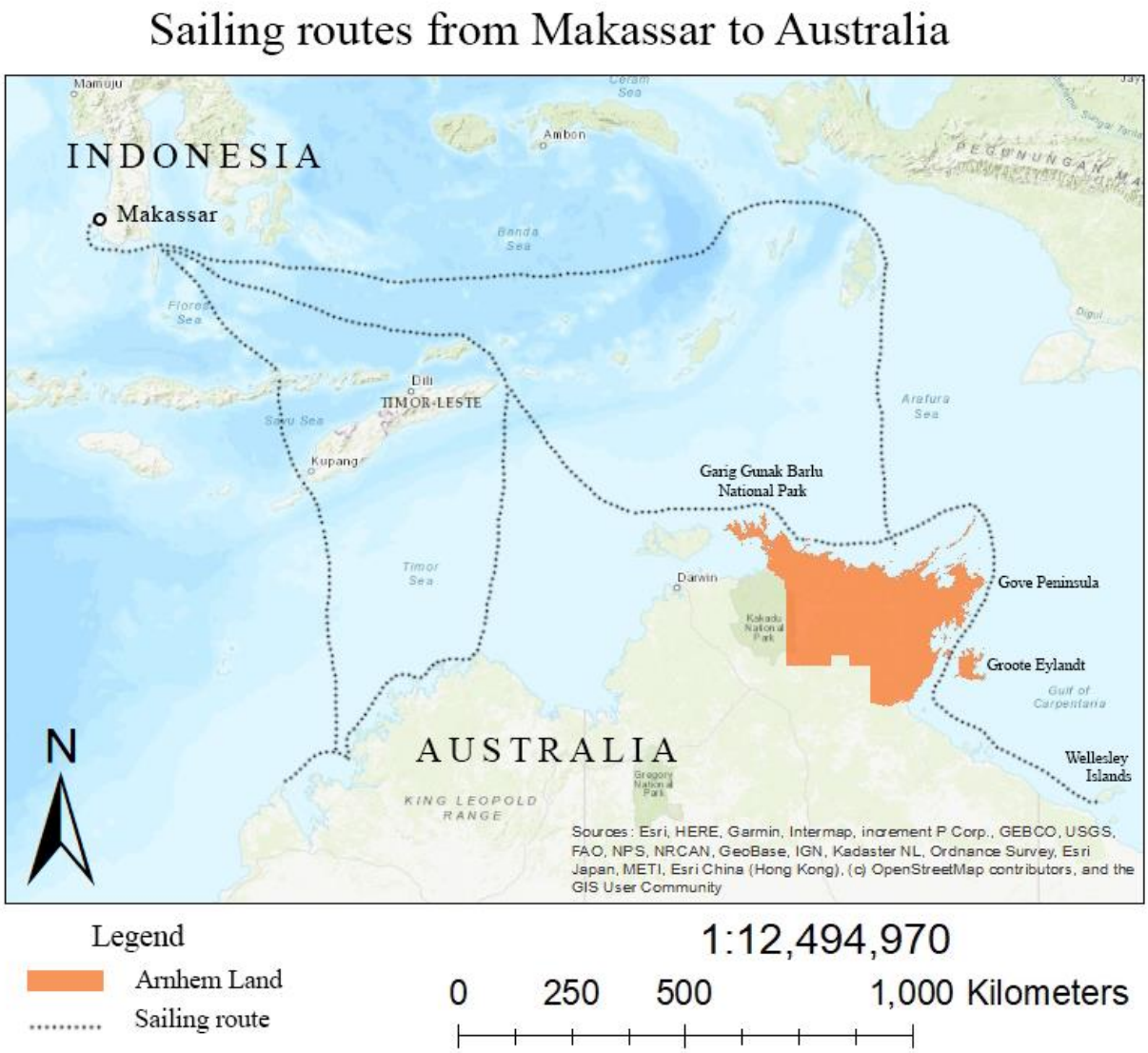

Figure 1-1. Map of the Macassan sailing routes taken to Australia with the study area of this research, Arnhem Land, highlighted in orange (Based on Ormond-Parker 2020:4).

known long periods of contact within these regions and ample study material (Figure 1-1). However, additional information and consideration will be given to other areas of direct contact such as within the Kimberly Ranges in Western Australia and further south-east into Queensland including Wellesley Islands, where contact did occur (Ormond-Parker 2020:4).

For this research, the term 'Macassan' will be used to discuss traders who travelled to Australian waters from Makassar to fish for trepang under the VOC. This term encompasses a number of different ethnic and linguistic ground from the Malay Archipelago and predominantly includes Makassarese, Bugis and Bajau (Blair and Hall 2013:208-209). This terminology has been accepted into academic literature since its use by the pioneering researcher Macknight (1976). However, it is important to note that this is not a term the sailors themselves would have used and they are not always a homogenous group. Additionally, there is an ongoing discussion on the specific timing of

Macassan contact with the earliest reported dates in recent literature indicating a minimum date of contact of 1664 AD (Taçon *et al.* 2010b:6). However, the widely accepted 'golden age' of contact was during the mid-1700s until the early 1800s when the number of ships, fishermen and trepang was increasing rapidly (Wesley *et al.* 2016:173). During the 1733-1734 season, only 42 praus made the journey and imported 111 piculs of trepang (the picul is an old Asian unit of weight and is equal to 60.5 kg) (Macknight 1986:70). Comparatively in the 1786-1787 season 60 praus left Makassar and returned with 2,140 piculs of trepang, just shy of the average import for the decade of 2,762 piculs (Knaap and Sutherland 2004:99-101; Macknight 1986:70). This period is characterised by cooperation between the Macassans and the Indigenous Australians who would often live and work with the fishermen while they were visiting (Wesley *et al.* 2016:173). The decline of this relationship started during the 1820s when there was an increase in British visitors and non-cooperative practices between the groups (Wesley *et al.* 2016:173). Just before this overall deteriorating in relationship Matthew Flinders noted the Macassans would describe the Indigenous Australians as 'cannibals' or 'Ourang Outang' equating them to the great ape, however it should be noted that *orang* is the Malay word for people (Macknight 1976:83). Later in 1874, a cattle station owner in the Cobourg Peninsula wrote of the Indigenous population murdering Macassans when the opportunity presented itself (Mitchell 1994:100-101). This strained relationship continued for almost another century facing an increase in legislation outlawing the practice, until, in 1907, the last prau left Australian waters, being deemed illegal by the Australian government (Blair and Hall 2013:213-214; Clark 2013:179-180; Hawkins 1982:48). A small number of illegal praus have been seized in Australian waters following this ruling, but this too has been steadily decreasing (Clark 2013:180; Clark and May 2013:8-9).

The consequences of the interaction between the Macassan trepang fishermen and the Aboriginal Australians of the north coast has been previously researched. This relationship can be seen in tangible archaeological evidence and intangible threads in communication. An element of this tangible evidence is seen in surviving rock art and bark art throughout the northern region and surrounding islands (May *et al.* 2009; Taçon and May 2013; Taçon *et al.* 2010b), the remains of other goods that were traded and/or brought into Australia by the foreign visitors (Ormond-Parker 2020; Wesley *et al.* 2014a) and fishing techniques including the use of metal fishing hooks and spears (Meggitt 1964; Mitchell 1996). Comparatively the intangible evidence presents itself through international influences in language and loanwords (Evans 1992; Walker and Zorc 1981) and cultural and religious traditions (Ganter 2013; Palmer 2007). One aspect of this relationship that is always mentioned is the introduction of dugout canoes into Australia. This trade in technology is often highlighted as significant to the Aboriginal groups. Blair and Hall (2013) note this new technology as a defining feature of this relationship and its benefit when compared to other Indigenous groups. They say:

> ‘Yolngu obtained dugout canoes from Macassans and, with the benefits of iron tools, began to manufacture them for themselves… [this] provided Yolngu with a valuable commodity for trade with inland groups’ (Blair and Hall 2013:214).

However, despite these authors noting the significance of this relationship, few have directly linked this technological advancement to changes in the Indigenous society and the economic landscape of the region. This research will seek to explore this connection through the question of how did the introduction of dugout canoes influence the social and economic landscape of Indigenous Australians?

To do this the project aims to:

- Use new technology to analyse rock art imagery of dugout canoes.
- Analyse and compare shell midden research from northern Australia with that of elsewhere in Australia to determine the likelihood of dugout canoes influencing the spatial distribution.
- Assess the nature of information transfer in regard to dugout canoes being introduced to Australia and the impact of this on further dispersal within Australia.
- Test previous assumptions made about the extent of the social and economic impact of dugout canoes.

This project will make a significant contribution to the discipline through the exploration of the dispersal of dugout canoes, and the reassessment of previous notions and archaeological works that have not been studied with dugout canoes at the forefront of research. The accepted importance of this replication of a new canoe building technique has led to it being overlooked as a standalone topic of research. Additionally, the scarcity of Indigenous watercraft in rock art, and with no surviving canoes from the height of the period of contact, has caused it to often be overlooked in favour of larger more robust collections. Within the wider national community knowing the implication of this technology will give opportunities for further discussion on the reasons why this advancement was not used throughout Australia. Additionally, this can then lead to comparisons of patterns of distribution and cultural changes due to dugout canoes when contrasted to that of wider Australia. The focus on the effect of the introduction of dugout canoes, and not Macassan arrival, is a new research subject and opens more opportunities for further study exploring the reason why Aboriginal people did not adapt and utilise the technology of the praus.

Thesis structure

Following from the introduction, chapter two introduces the cultural landscape and previous research of the Macassan contact along northern Australia. Chapter three contains a description of the methodology for new technology associated with rock art interpretation and further explores how shell midden analysis and comparison of midden data will be undertaken. Further, in chapter four the results of the analysis and the new data from this research will be presented. In chapter five the results are further analysed, and their interpretation is discussed within the local sphere of research and a wider context, including further research areas. Finally, in chapter six the conclusions of this research will be put forward.

CHAPTER TWO LITERATURE REVIEW

Prior to European settlement in 1788, Australia was frequently travelled to by a number of other international visitors for hundreds of years from the port of Makassar, Indonesia in search of Australian trepang to export to China (Figure 1-1). With them, the Macassan sailors brought new language, metals, diseases, and the dugout canoe. The adoption of this canoe into Indigenous society within northern Australia greatly altered the social and economic landscape. However, this maritime history can be difficult to trace due to the harsh Australian environment not preserving the wooden vessels, but threads of intangible history remain and some tangible objects in the form of shell middens and rock art can be found today. Most existing research is focused on the duality of this relationship and presents a correlation between the Macassan arrival and some changes in Indigenous society and minimal tangible evidence from archaeological excavations. This research will endeavour to expand this analysis to directly link to the introduced technological advancement of dugout canoes and theorise why their use within Australia was geographically limited.

Indigenous Australians often used natural features in the landscape, such as mountains or rivers to denote boundary lines for different family groups and clanships, however, these demarcations should not be perceived as an impassable barrier, for there have been watercraft in Australia for as long as there have been people. But this area of study is often ignored due to the lack of surviving evidence and gaps in oral traditions and stories due to European colonisation. The difference in passing along tradition for indigenous groups, oral stories as opposed to European writing, has led to a misconception of difficulty with water travel that has lasted many decades (Black 1941:351-352). In the earlier studies, much of Australia was thought to have been uninhabited due to this water barrier stopping Indigenous people. But modern studies have shown this is the opposite of what was happening and bark canoes were widely used for inland water travels (Bradley 1991:86-87). This lack of surviving evidence was for a long time interpreted as Indigenous Australians being ‘trapped’ by waterways and oceans (Black 1941:352). But it is now known that this is not the case and a number of watercraft were used all over Australia. Most widespread is the bark canoe which is best suited for protected waterways like rivers and lakes (Bradley 1991:86-87). This introduced the question of why the seafaring dugout canoes were not introduced all over Australia. Was this a result of a distrust of the foreign arrivals? Or was there a similar situation to the ‘de-evolution’ experienced by the once seafaring Māori of New Zealand, who upon their arrival to Aotearoa, with their dugout canoes and outrigger technology, decided it was not worth it to keep making such extensive vessels and continued to produced more simple vessels (Irwin 2008:18-19)? Where once the Māori did not need to travel across the sea, they did not waste time and resources on seafaring vessels. The Indigenous people were able to and did, survive in Australia for tens of thousands of years and so once this technology

was available for their use was it worth it to change? Did they need to keep making such large vessels or was there no need to go to all that effort when they had everything they needed to survive at their fingertips? The introduction of dugout canoes opened new avenues of exploitable resources including a higher number of successful dugong and turtle hunts, but this was more than enough of a reward for the work needed to produce a dugout canoe in Australia. It's possible that the dugout canoe can be summarised as, a long-lasting and favourable ocean-going vessel, despite it not always being needed.

Being a coastal community the ocean provided a vast area full of exploitable resources for tools, clothing and food that were utilised by coastal Aboriginal groups. These resources included a large range of fish species, molluscs, crabs and other smaller marine animals and larger marine animals such as turtles and dugongs. In Garig Gunak Barlu National Park, north west Arnhem Land, alone over 320 species of mollusc have been identified (Mitchell 1994:19). The edible species of shell taxa that have been identified in Indigenous midden sites in northern Australia are presented in Table 2-1. The two most common larger marine species that were caught and will be a focus of this research and include dugongs and turtles. Dugongs (*Dugong dugon*) are a marine mammal that consume seagrass and other vegetation in coastal and intertidal habitats. The dugong is extremely restricted by its diet and cannot be found in the open ocean or away from these seagrass meadows. Despite being a predominantly docile animal dugongs can grow up the 3m in length as an adult (Tol *et al.* 2016). Marine turtles make up the other large marine species of significance. These include five different species each with their own distribution, behaviour and value to the Indigenous community. There are two deep water turtle species the pacific ridley (*Lepidochelys olivacea*) and the loggerhead (*Caretta caretta*), one reef species the hawksbill (*Eretmochelys imbricata*) and the final two species are inshore species, the flatback (*Natator depressus*) and green (*Chelonia mydas*). These turtles' range in size from a maximum length of approximately 1m in hawksbill turtles to the 1.5 m pacific ridley and loggerhead turtles. The green turtle was the most abundant and also the heaviest weighing an average of 130 kg. Hence, the coastal environment was more than able to provide marine meats for Indigenous communities to eat.

Table 2-1. List of marine taxa found in midden sites on the North Australian coast and a description of the family (Collated from Bradley 1997; Clarke 1994; Faulkner 2006; Mitchell 1993; 1994; Mowat 1995; Tynan 2017; WoRMS 2022).

Family	Description
Arcidae	Ark clam, small to large saltwater marine bivalve.
Cardiidae	Cockle, small sandy bivalve mollusc.
Carditidae	Marine bivalve clams.

Family	Description
Chamidae	Jewel box clams, saltwater clams.
Chitonidae	Chitons, marine mollusc with a shell of articulating plates.
Cyrenidae	Family of clam.
Donacidae	Bean clams.
Ellobiidae	Hollow-shelled snails, terrestrial gastropod.
Haliotidae	Abalone, small to very large herbivorous sea snails.
Isognomonidae	Pearl oysters, medium to large saltwater clams.
Littorinidae	Periwinkles, sea snails.
Mactridae	Trough shells, saltwater clams.
Melongenidae	Crown conch, large marine gastropods.
Mesodesmatidae	Family of clam.
Muricidae	Murex snails.
Mytilidae	Mussels, mollusc that lives in brackish water.
Nassariidae	Dog whelks, sea snail.
Neritidae	Nerites, sea snail.
Ostreidae	True oysters.
Pectinidae	Scallops, bivalve molluscs.
Pinnidae	Pen shells, large saltwater clams.
Placunidae	Windowpane oysters, saltwater clams.
Portunidae	Swimming crabs.
Potamididae	Potamidids, snails that live in brackish water and mud flats.
Psammobiidae	Sunset clams.
Pteriidae	Feather oysters, saltwater clams and source of saltwater pearls.
Spondylidae	Thorny and spiny oysters.
Strombidae	True conch, very large sea snails.
Tegulidae	Family of sea snails.
Tellinidae	Family of bivalve molluscs.
Trochidae	Top snail, sea snail.
Turbinellidae	Predatory sea snails.
Turbinidae	Turban snails.
Veneridae	Venus clams.
Volutidae	Predatory sea snails.

There is a stark difference between the earlier, and sometimes considered more basic, bark canoe and the dugout canoe of the later period in their surviving evidence. Bark canoe construction leaves behind scar trees, eucalypts that are unable to fully heal over the removed bark portion but are not dead upon bark removal. However, often the dugout canoe leaves no trace of its source tree due to its more destructive construction. Which involves felling the tree, shaping the outside and removing the inner wood with the assistance of fire to make a concave boat (Emtage 1967:23-25). This is a more laborious process of creation and requires specific tools such as the axe and adze. Hence, literature often devalues the Indigenous people's hand in dugout canoe creation due to this limited surviving physical evidence. When researching this narrative, all available evidence must be considered no matter how minimal this seems, and trust must placed in the Traditional Owners to tell their own stories. Due to an existing mis-trust with non-Aboriginals, what evidence is surviving is highly protected and sought after. This tangible evidence is often seen through the study of rock art and bark art throughout northern Australia, shell middens and their changes of materials and location throughout time, and the abundance of the lithics used to create dugout canoes, in addition to the adaption to introduced metals. Additionally, there are several traded goods found in Macassan sites, indigenous sites and mentioned in oral traditions that can be traced to show this relationship. The intangible evidence is often limited to oral traditions that include Macassans and dugout canoes, including funerary practices and the use of Macassan language for introduced items by Aboriginal Australians. Finally, the surviving evidence that can be found all over Australia in different museums and institutes is model dugout canoes, often described as children's toys, but not always so, these were often created on mission sites to generate revenue and used for religious and funerary practices.

Rock art

There is minimal written evidence of Aboriginal Australians from their perspective, but one surviving product is in the form of rock and bark art. This general avoidance of written history indicated the importance of what is preserved both to modern archaeologists and the artists who were leaving their mark on the landscape. Along the northern coast of Australia, there are numerous records of both Indigenous dugout canoes and Indonesian praus ships drawn on stone. These are important in two aspects. They showcase the significance of the relationship between the Indigenous groups and their northern neighbours, and the importance of the very few preserved depictions of indigenous watercraft. Several researchers have noted that wooden artefacts are rarely recoverable in Australia due to a number of environmental factors including high soil acidity, scavenging animals, climatic oscillations and termites, and social factors including Aboriginal funeral ceremonies that involved the destruction of belongings, so these artworks are of the utmost importance (Allen and Brockwell 2020:148; Gunn *et al.* 2017:184; Nugent 2015:79).

In Arnhem land and northern Australia, there was an increase in watercraft in rock art during the 18th century when the depiction of *praus* was a common motif (Burningham 1994:139; May *et al.* 2021:133-135; Taçon and May 2013:130; Taçon *et al.* 2010b:5). Additional Macassan iconography includes knives, beads, sorcery paintings, buildings associated with trepang sites and Indonesian animals (Chaloupka 1999:89,191-194; Gunn *et al.* 2017:165; Taçon and May 2013:131-134; Wesley and Litster 2015:11-12). This assortment of rock art has undergone a number of studies including Taçon *et al.* (2010b) who dated beeswax figures, an especially significant practice when there are multiple layers of art. This research confirms previous archaeological studies that a form of Macassan contact had started prior to the 1700s, which contrasted with historical evidence and was previously dismissed (Taçon *et al.* 2010b:8). The dating at Djulirri confirmed this, as the oldest yellow prau was created before AD1664 (Taçon *et al.* 2010b:8). Furthermore, the style of rock art can be used to assist in organising a chronology of individual sites, such as at Wulk Lagoon (Wesley *et al.* 2015:27-28). Overall, many sites have hundreds of individual depictions in rock art, such as the Malarrak complex, Djurray sites and Djulirri complex, and with over 200 contact rock art sites in the Wellington Ranges alone there is an abundance of contact rock art in northern Australia (Gunn *et al.* 2017:167; Taçon and May 2013:129; Taçon *et al.* 2010b:1). This is in contrast to the minimal depictions of indigenous watercraft (Chaloupka 1999:18-19). In the comprehensive Australian rock art book by Chaloupka (1999) there are 277 images of Aboriginal contact rock art, but only one of Indigenous watercraft, depicting a dugong hunt in a dugout canoe (Chaloupka 1999:18-19). However, on Groote Eylandt, there are additional bark paintings depicting Macassan contact imagery including six praus collected in a 1948 expedition to the region (May *et al.* 2009:369). As a result of this study May concludes that the depiction of Macassan praus years after the foreign visitors stopped coming shows the significance of the longstanding relationship (May *et al.* 2009:381). Additionally, the oral traditions around the Macassans are highlighted as many of these artists would have been young children during the time of the last Macassan visitors and some of the scenes painted place these icons into creation settings (May *et al.* 2009:381-382). Furthermore, the art depicts the praus in such detail, especially in x-ray style, that it can be concluded that the Aboriginal people would have sailed on the praus and knew intimately how they worked both below deck and above, even sailing back to Makassar (Burningham 1994:140; May *et al.* 2009:383). Linking back to the distribution of dugout canoes in Australia and areas of Macassan contact, there are no Macassan vessels depicted in rock art in the Kimberley Ranges in Western Australia despite the Macassan travel to these locations being known (Burningham 1994:143; Ormond-Parker 2020:4). Two contrasting thoughts can be deduced from these previous studies of rock art. One, is that the Macassan visitors were seen as significant to the Aboriginal Australians, this can be deduced from the high number of depictions of this relationship,

and that the lack of dugout canoe depictions shows the adoption of this technology into everyday life where it is no longer worthy of depiction in rock art as it is no longer considered 'special'.

Dugong and Marine Turtle in Shell middens

Shell middens are a useful resource in generating a timeline of a site. They can give insight into changes over time and by proxy, the causes of the changes can be hypothesised. Prior research on shell middens has been focused on environmental changes that can impact a species abundance in the archaeological record (see Bourke *et al.* 2007; Brockwell *et al.* 2020; Faulkner 2011; Luebbers 1978; Mowat 1995; Tynan 2017; Woodroffe *et al.* 1988). There is a lack of attention given to technological advances in causing these changes in distribution. A key marker that will indicate the importance of dugout canoes is an increase in larger marine animals such as sea turtles and dugongs appearing and a small reduction in other meats where it is known dugout canoes were used when compared to a similar timeline from other locations within Australia (Faulkner 2006:5-6; Mitchell 1996:188-189). It is important that this change only occurs where dugout canoes are found to prove the connection, otherwise a number of climatic factors are the likely possibility (Tynan 2017:217-219). This increase would be expected during the 1700s but especially after the 1750s when the waters around Australia were increasingly exploited by the VOC (Knaap and Sutherland 2004:99; Macknight 2013:20-21). But, as mentioned previously, new evidence is showing an increasingly early period of first contact so earlier increases are possible (Taçon *et al.* 2010b:8).

Along with dugout canoes, the Macassans brought over metal tools such as iron which was used for harpoons and fishhooks that further increased the capabilities of Aboriginal Australians to catch larger marine animals with ease. Prior to Macassan contact ethnographic histories list multiple methods for capturing turtles and dugongs including the use of nets, capturing nesting turtles and spearing with wooden spears from bark canoes (Bradley 1991:94; Mitchell 1996:183). But once iron and other metals were introduced to the area it was quickly adopted as a superior hunting tool, the metal was hafted onto the wooden spear and would pierce a turtle shell, leading to more successful catches with less skill required (Mitchell 1996:184). A number of excavations throughout Garig Gunak Barlu National Park undertaken by Mitchell (1996) support this claim, in which the data from 43 shell middens was divided into pre-contact and post-contact remains around the date of 1720 and compared for turtle and dugong remains. Of the 28 pre-contact midden deposits only one accounting for 3.6% contained turtle or dugong, compared to 9 accounting for 52.9% of post-contact midden deposits containing turtle or dugong remains (Mitchell 1996:185-187). A further investigation of the Barlambidj midden which is located at a major trepang processing site and had pre- and post-contact dating revealed that turtle bones accounted for 85.9% of the weight of the post-contact midden. Compared to 22.3% of the weight of the pre-contact remains (Mitchell 1996:186-188). Mitchell's

research was presented as being opposing to the ethnographic history of the region and concludes that archaeological investigation and analysis should be used in tandem with ethnohistory to ensure accuracy of information.

The evidence of the increase in dugong and turtle hunting can be seen in more than just the rise in remains in midden site throughout the region. One such research of this additional evidence is Mitchell (1994) who analyses ethnohistorical records from the 1800s and initially demonstrates the adoption of iron for harpoons as specialised tools against these larger mammals (Mitchell 1994:135). Additionally, Mitchell (1994) highlights instances when hunting was unsuccessful when iron tools were unavailable (Mitchell 1994:136). Despite the increase in success offered when iron was utilised hunting of dugong was still difficult due to their sensitivity and the danger presented by the adult animals. Furthermore, the value of the turtle and dugong meat when compared to mollusc was presented by Mitchell, and the conclusion was that the dugong and turtle meat were the most desirable in terms of nutritional value (Miller *et al.* 1993; Mitchell 1994:373-374). Miller *et al.* (1993) compared the nutritional value of different elements of turtle and dugong to an array of other marine resources available in the Cobourg Peninsular, including mud crab, fish, oysters, snails, mussels and worms (Miller *et al.* 1993). Turtle fat was determined to have more than twice the energy content when compared to the other marine animal in the study. Additionally, turtle flesh and dugong flesh provided more protein than any of the other marine animals that were studied. Millers' conclusions have been supported in additional studies (Bradley 1997:311-313). This research gives insight into the importance of the dugout canoe and iron tools in creating a more advantageous scenario to facilitate the capture of these larger more valuable marine mammals.

Local construction capabilities

There is an additional theory around the introduction of dugout canoes that there was no local construction by Indigenous Australians (Halls 1961:208; Meggitt 1964:32; Thomas 1905:72). With this theory, it is expected that there would be a spike in large mammals through the 1800s when the export records show a climax in exports from Australian waters (Adhuri 2013:184-185). However, these theories are often associated with theories of inferiority of Aboriginal people that were held at the time of their writing. Thomas (1905) describes the Indigenous population as a 'savage tribe' and that:

> 'the dug-out came via Torres Straits, preceding the outrigger, which has undoubtedly reached the continent by this route' (Thomas 1905:72).

A chronology of observations about canoes, recorded by Mitchell (1994:123), describe the transition from bark canoes in 1818, to dugout canoes made by the Macassans from 1827 until 1844. After

which the dugout canoe superseded the bark canoe and smaller versions were observed being made by Aboriginal people, with the final observation cited being in 1932 when Sunter (1937) observed and made a detailed record of the Aboriginal construction of dugout canoes (Mitchell 1994:123-124; Sunter 1937:67-68).

More recent research has shown the capabilities of the Aboriginal groups to construct their own dugout canoes and develop an 'Australian' variation that is not just a copy of the Macassan vessel (Macknight 1972:304-305). Furthermore, dugout canoes allowed for further travel and larger catches in one go. This change is expected to be present in the archaeological record with an increase in large mammalian bones such as dugongs and turtles (Faulkner 2006:5-6). These may have additionally been able to be exploited outside of the traditional hunting seasons or been able to be cultivated in much higher numbers than in previously utilised bark canoes. There are additional widespread changes to the social structure of Indigenous groups during and after the Macassan contact period. This is evidenced in Clarke (1994:465) in which Aboriginal groups moved to new locations and had a wider range of food in their diet. Items that are considered more exotic and requiring a more specialised tool to harvest. This movement is likely to have been associated with the introduction and use of dugout canoes by the Aboriginal groups on Groote Eylandt. This is not a connection that was presented by Clarke but will be explored in this research.

The tools required for the production of dugout canoes vary slightly throughout the world (Johnstone 1988:46). This toolkit primarily consists of an axe and a scraper for removing the internal wood, most often a lithic adze, but can also be made of shells or metals (Hornell 1948:46-48; Meide 1995:14-24). These can be used as markers to show that Indigenous Australians had the toolkit required to produce a dugout canoe themselves and it was not just imported through the Macassans. Additionally, the presence of artefacts, such as the adze indicates woodworking when wooden artefacts have not been preserved (Maloney and Dilkes-Hall 2020:264). Adze use has previously been associated with both soft and hardwood species in Australia through the recovery of wood shavings at multiple sites throughout the Kimberly region (Maloney and Dilkes-Hall 2020:278).

The use of ground-edge axes within Arnhem land has been a continued practice for at least 65,000 years, indicating the availability of tools required for dugout canoe manufacture (Wesley *et al.* 2018:111). Furthermore, out of 12,729 lithic tools recovered by Wesley *et al.* (2018), only eight were ground-edge axes or axes indicative of community cooperation when other resources were scarce (Wesley *et al.* 2018:115-120). An interesting point of discussion raised by Wesley is the lack of point technology in retouched flakes at Maliwawa in western Arnhem Land. There is an archaeological consensus around the sharing of point technologies that it is a good indicator of inter-cultural connections in sharing information to benefit the wider community (Wesley *et al.* 2018:122).

However, there are records of extensive trade networks within the north of Australia at the time of contact. This noted lack of technology sharing may be linked to the limited spread of dugout canoes within Australia. The expectation is the use of stone axes in the creation of canoes all over Australia, these axes have been located *in situ* all over the country and have matched axe marks in canoe trees (Mitchell 1959:192). However, if the Macassans introduced iron tools, then the production of dugout canoes would not be limited by the earlier stone tools that were widely available (Mitchell 1996:183). The Indigenous use of iron was very sudden and maximised in Arnhem Land with iron being hafted for spears, used as axes and adze for canoe construction and containers (Wesley 2014:65). These iron adzes have been located at multiple caves associated with post-contact rock art including the Awunbarna complex in western Arnhem Land (Roberts and Parker 2003:23). Previous studies have shown that the Aboriginal Australians had knowledge of and capabilities to produce the tools required to create their own dugout canoes, and the lack of physical remains of this production has likely caused the misconception that they were not built within Australia.

The comforts of home and other tangible evidence

With them, the Macassan traders brought a number of comforts from home to Australia and introduced them to the Indigenous population. It is believed these were traded with the local Aboriginal people in a 'trial and error' fashion until some key desired commodities were identified such as tobacco and arrack, a type of alcohol from distilled palm (Brady 2013:142-143, 145). Furthermore, research suggests that the initial trading was due to the Macassans wanting to make room for excess trepang and other opportunistic exports of pearls, pearl shells and turtle, it wasn't until the later period that their items were brought with the intention of trading (Brady 2013:141-142; Clark and May 2013:1; Warner 1932:480). The betel nut was also brought to Australia by the trepangers but it was not taken up by the Aboriginal people (Brady 2013:144-145). Furthermore, a number of beads have been recovered in Arnhem Land from the Macassan contact period and the later European trade in the 20th Century (Wesley and Litster 2015:8). However, these beads are predominantly located at Macassan processing sites and not often in Indigenous camping grounds. But they were traded to neighbouring groups and islands, depicted in rock art and described using the Macassan word for beads *manik-manik* and *manimani*. This demonstrates the importance of this import to the Indigenous population (Wesley and Litster 2015:11-12). In addition to beads, pottery has been located from Macassan sites and current investigations indicate that all the pottery located is of south Sulawesi in origin (Wesley *et al.* 2014a:22). There was some variably with the potsherds recovered from Anuru Bay and throughout Arnhem Land but this was determined to be due to the variability with source materials and manufacturing techniques (Wesley *et al.* 2014a:23). Other known physical goods and traded goods in Australia include opium/tobacco pipes, coins, tamarind

plants and Macassan stone arrangements (Brady 2013:146-147; Ormond-Parker 2020:5-7). Studies of burials with Arnhem land have also confirmed that there are Macassan bodies that were buried on Australian soil alongside Indigenous remains (Theden-Ringl *et al.* 2011:47). However, they were faced with a very small sample size for the study and additional research would be required to produce a more robust story of Macassan burials in Australia. The study of trade goods that were adopted into Indigenous society can give insight into the priorities of the people and their relationships with the wider community.

Sharing of language and other intangible evidence

There are several intangible surviving remnants of the Macassan contact with Indigenous groups in Australia. One of these studied by Ganter (2013) is the prevalence of Muslim influences in Aboriginal traditions. Ganter notes important religious ceremonies being performed in Macassan, a mix of the languages of the traders including Malay, Bugis and Makassarese, in a similar fashion to Catholic ceremonies being performed in Latin (Ganter 2013:58). However it is emphasised that Islam was never adopted as a faith, rather individual elements that fit within the already established Indigenous stories were adapted where it was determined to be a good fit (Ganter 2013:60). An important note within this research is that the initial catholic missionaries were outlawing these practices and the 'Muslim allusions in Yolngu mythology were downplayed and often went unexplained' (Ganter 2013:58). With any trade relationship, there needs to be communication and so a number of words were shared between the people. While there is no definitive list of translated words there are a few hundred words known to have been used across the cultures (Evans 1992:46-48). These words were predominantly practical in nature as a large number of these words have no Australian morphology (Evans 1992:65). This ability to communicate with the Macassans was originally thought to have been widespread however further research by Thomas (2013) indicated that there were a small number of 'translators' who were key to the trade process (Thomas 2013:71). The presence of these translators is also seen in historical recounts of interactions including translating Malay for Flinders (Thomas 2013:73-74). Known Indigenous religion and oral tradition is linked closely to the canoe throughout Arnhem Land for the beginning and end of life. There are stories that have been passed down of the Djanggawul Sisters arriving in Arnhem Land on a canoe from Bralgu (a northern mythical land) and brining life with them (Berndt 1974:39). Furthermore, the significance of ones ties to their canoe is seen in the funerary rites within the Tiwi culture (an Indigenous society on the Tiwi Islands 80km north of Darwin), where the canoe of the deceased must undergo ritual treatment to prevent the deceased spirit from soiling the sea and warning the sea creatures to avoid the area (Berndt 1974:27). This importance of the canoes in society as seen repeatedly along the peninsula and is exemplified through the influence from Makassar.

As with most modern ‘first contact experiences’ the Macassan arrival in Australia was not without negative repercussions. This introduces research and ideas of previous infectious disease introduction through the Macassan trade route (Macknight 1986:72-74). Through a study of population counts and historical observations Macknight (1986) documented multiple smallpox outbreaks within the Aboriginal population, the first of which was in 1789, followed by an outbreak in 1829 and a decade from 1860 (Macknight 1986:72). Additionally, a study of ringworm found in Indigenous communities in Arnhem Land was directly linked to South Sulawesi, reinforcing the theory of Macassan disease introduction (Green and Kaminski 1973:114-117). However, comprehensive study of Indigenous remains with the intention of disease research is often met with fierce resistance from the community that must be respected. Studies of intangible evidence requires cooperation and trust from the Traditional Owners and can be more difficult to ‘prove’ to a wider audience. But these difficulties must not detract from the importance of oral traditions and languages, especially when there is little tangible evidence.

A modern context of contact

Today there are no surviving dugout canoes from the heyday of Macassan trading in the 1700s-1800s, however, in many museums around Australia you can find model canoes. A reason for this overrepresentation can be attributed to the mobility of models, the lesser space they take up compared to larger canoes and the cheaper cost associated with storage and conservation of these items. Furthermore, during the 1900s anthropologists sourcing material in the Pacific were instructed to collect models of items such as houses, canoes, traps and other large apparatus that were infeasible to collect in their full size (Davies 2012:143; McCarthy 1946:19-20). Comparatively, the display of models can be perceived as more authentic than replicas, indigenous made or not. This is supported by Daina Fletcher (senior curator, Australian National Maritime Museum) who advocates for the use of commissioned Indigenous made replicas over items made by people outside of the Indigenous communities (Gapps and Smith 2015:99). Additionally, the use of replicas can offer some security to the communities in keeping original artefacts safe from harm and allowing non-commissioned works to stay on their family land. This was of a large concern in the early 1900s when explorers documented Indigenous groups hiding canoes upon noticing the Europeans (Akerman 2015:99). Despite a large number of these being described as children’s toys, it is unlikely to be at the high number displayed in museums. In response to this demand, while some models were used as children’s toys, due to the market some were made with the intention of sale, especially on the mission sites. Evidence of this practice first appears early in the record in the 1880s with ‘models’ being a distinct category of export under curiosities (Davies 2012:143-144). Comparatively some canoes are relics of religion and funerary practices. In northern Australia, the Maung people of the Goulburn Islands and the

Gunwinggu people east of Darwin their funerary oral traditions tell of the deceased spirit passing a number of tests set by different guardian beings before paddling a canoe to the land of ancestors (Berndt 1974:26). The possession of Aboriginal artefacts within Australia and around the globe is an increasingly contentious topic with the increase in agency given to Aboriginal communities.

Conclusion

In conclusion, a number of aspects relating to the relationship between the Macassan trepangers and the Aboriginal Australians have previously been investigated. There are several facets of these interactions that leave remnant tangible archaeology and a smaller but important number that represent the intangible history of this relationship. A large number of contact rock art can be tied to the importance of absence of Indigenous watercraft depictions. The changes in remains and location of middens have been preliminarily linked to the technological advances however not on a wide scale, or in comparison to other areas of Australia. Furthermore, the evidence of the lithic technology required to produce dugout canoes within Australia, not just import them from Makassar. Additionally, a number of smaller traded goods are found in Australia including imported pottery, beads that were further traded between indigenous groups, coins and pipes. Including evidence of at least one Macassan man being buried on Australian land. On the other hand, the intangible evidence of this relationship is more difficult to follow but includes the adaption of religious practices, 'loanwords' and translators between the Aboriginal groups and Macassan traders. Finally, the evidence presented in a modern context of museums all over Australia value model canoes and attribute these predominantly to children's toys, however, there are recounts of these being used to make a profit on the missionary sites and for funerary and religious practices. Overall, the relationship between the Macassans and the Aboriginal groups of northern Australia has been explored through several different facets, but only a small number of these have been investigated directly regarding the dugout canoe. This technological advancement will be used to link these different studies together and show the wider social and economic impact of new technology on Aboriginal Australians.

CHAPTER THREE METHODOLOGY

Rock art

The intention when recording rock art is to accurately depict the feature as it is presented now but in such a way that the original intention of the piece can be determined. Due to the limits of photography, this has previously been done through tracing and reproduction. However, as technology is ever-changing and improving, and its uses within research become broader as time passes, more accurate ways to depict rock art become available for wider use. Since the discovery of Indigenous watercraft in rock art in Arnhem Land the technology available for analysis has improved ten-fold. The reanalysis of rock art as technology improves can show previously unknown details and features. These can give further insight into the meaning of these pieces and show how techniques differed by artist and time. In Arnhem Land, the small number of Indigenous rock art was primarily photographed and investigated in the 1970s since this time the technology of working with rock art has improved immensely (Chaloupka 1999:18-19). The introduction of 3D scanning in relation to rock art can tell a more detailed story of the context of pieces and give them a clearer position on the rock face (Domingo *et al.* 2013:1880-1881). This can show more insight into the physical attributes of the artist and their reach within the environment, provide an analysis of different viewpoints and can produce higher resolution images than many conventional digital cameras (Fernández-Lozano *et al.* 2017:161-162; Horn *et al.* 2022:192). This technology can be combined with image enhancement to further exemplify details unable to be seen by the naked eye.

One such program specifically created to better interpret rock art is DStretch, a plug-in for ImageJ, a photograph processing and analysis program. DStretch will analyse the red, green and blue colour bands embedded in an image and enhance them, this can show previously unseen details (Evans and Mourad 2018:79). Additionally, this program has the convenience of use immediately out in the field through the mobile application or can be applied to post-processing of photos after the fieldwork is completed. Red and orange pigments have been specifically targeted in DStretch software and can show the biggest change between before the image processing and afterwards (Hollmann 2018:159). This technology has been successfully utilised on every continent with established ancient human occupation. McDonald *et al.* (2016) used DStretch to catalogue a large number of native rock art in the Great Basin, USA and contextualise a number of smaller pieces against a larger ‘hidden’ artistic landscape (McDonald *et al.* 2016:928-929). Hollmann (2018) was able to see a collection of small dots, flowers and bees depicted in rock art in South Africa (Hollmann 2018:163-165). Staying in Africa, Evans and Mourad (2018) utilised DStretch to enhance a range of coloured pigments, including a blueish-green arsenic colour in Egyptian tombs (Evans and Mourad

2018:80-83). Bayarri *et al.* (2021) were able to develop a chronology for rock art in Spain and Fernández-Lozano *et al.* (2017) were able to document unseen motifs and new interpretation of previously recorded iconography in the Spanish Neolithic rock art (Bayarri *et al.* 2021:14-16; Fernández-Lozano *et al.* 2017:165). However, this technology is still emerging in Australia, and even less so when considering the geographical borders of the northern coastline. Gunn *et al.* (2017) used the program to analyse contact rock art motifs in central southern Arnhem Land. This study showed the usefulness of the program when associated with indigenous x-ray depictions of praus, as the yellow and red details of the vessel were lost to the white colouring of the sails and boat (Gunn *et al.* 2017:168-169). Jalandoni and May (2020) combined the DStretch analysis with 3D models of rock art from Kakadu National Park. It was determined that the 3D model provided a significant level of detail for rock art identification that the DStretch images were barely consulted (Jalandoni and May 2020:143). Gunn *et al.* (2017) utilised DStretch to show the details of poorly preserved European-style vessels at the Djurray shelter in the southern Arnhem Land plateau (Gunn *et al.* 2017:168-169) and May *et al.* (2017) used the analysis to clearly show characteristics of red scorcey figures at blended in with the rockface (May *et al.* 2017:55). Overall, the DStretch program is a new and powerful tool that can show further insight and lead to a deeper understanding of rock art allowing for a more accurate interpretation despite weathering and other environmental degradation. It is additionally extremely user-friendly, can be applied to a wide range of scenarios and is not limited to in-person analysis. The images with their DStretch enhancement were transferred to a Samsung Galaxy Tab S6 and traced using the Sketchbook application (Figure 3-1; the series of analysis of each rock art is depicted in Appendix 1).

Once the interpretation is complete the rock art images will be categorised according to their characteristics. These will include but not be limited to figures, animals, fishing tools/activities, artistic style, presence of any surrounding or overlapping icons and boat features. The use of DStretch software before categorisation and analysis will reduce the likelihood of misinterpretation of the images and distortion due to deterioration or image quality (Horn *et al.* 2022:198-199). Finally, this data and their relationships will be presented in ArcGIS (a powerful mapping and spatial analysis tool) to best determine these relationships. Any identified correlations will be compared to the distribution of Macassan contact and dugout canoes' presence in the northern Australia region.

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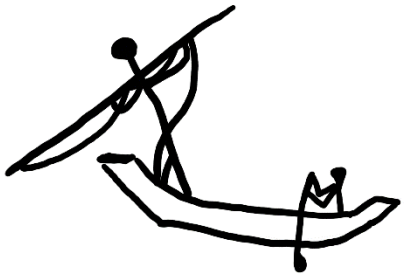
a)

b)

Figure removed due to copyright restriction.



c)

d)

Figure 3-1. Stages of analysis of rock art. a) original photograph by Daryl Wesley, b) DStretch enhancement with YWE matrix, c) DStretch enhanced image with canoe scene traced in Sketchbook application, d) final isolated drawing.

Middens and lithics

Analysis of midden deposits will be conducted on previous data collected. For data to be comparable it must undergo the same or similar analysis and any differences that may arise must be highlighted and any resulting discrepancies explained. Where possible any shell deposits will be analysed using the minimum number of individuals (MNI), weight in grams, and the number of identifiable specimens (NISP) this will give a more accurate representation of the data and allow cover for any differences in analysis (Faulkner 2006:105; Mowat 1995:81-82). Additionality, it allows for comparison with other remains such as other marine faunal remains, terrestrial species remains charcoal, vegetation and any contact materials. It has been established that the sampling strategy used during the excavation will have a significant impact on the structure of the assemblage (Woo *et al.* 2016:736). This is especially significant with regards to the taxonomic richness and will have to be considered when discussing the analysis. Where known the shell or faunal remains will be listed to species level, if unknown the genus will be grouped. Radiocarbon dating will be the preferred methodology for dating excavations, if any other method is used it will be noted. Additionally, the

date range for determining pre-contact and post-contact labels of sites will be centred around AD 1720 but also include contextual indicators, such as metal, glass and pottery (Mitchell 1996:185). With prior dates being pre-contact and following dates being characterised as post-contact.

The lithic analysis will be compared to the standard set out in Holdaway and Stern (2004) *A Record in Stone* and will be determined to be a flaked artefact if one or more of the following characteristics can be identified:

- A distinct bulb of percussion is identifiable;
- A ring crack is located;
- A platform with defined eraillure scar present beneath it; and
- Definitive flake scars or remnants of flake scars;

Additionally, these will be classified as per Hiscock (1984) which includes four definitions; flake, core, retouched flake and flaked piece. Due to retouch being unspecified in many circumstances if this terminology is inconsistently utilised these artefacts will be grouped as a flake. If terminology such as angular fragment or waste flake is used these will be grouped as a flaked piece. If another source, terminology or definition was used this will be noted and any further changes listed. The classification of lithic materials will not be limited to just stone sources as in a post-contact context glass and other introduced materials were also flaked for their tool use (Mitchell 1994:217). Due to the complexities associated with reassessing previously collected data a concerted effort will be made to detail and justify the use of any data with discrepancies.

The shell middens with be categorised based on their location, age, artefact contacts and faunal remains. Additionally, ArcGIS will be used to produce heat maps of the dispersal of post-contact middens with an increase in dugong and turtle remains compared to the dispersal of direct Macassan contact. The Department of Environment, Parks and Water Security (DEPWS) (Northern Territory Government) published spatial datasets on the land systems of the Northern Part of the NT. This includes Arnhem Land, the section of which was published as a shapefile in 2019 and updated in mid-2021. This has been uploaded to ArcGIS and will provide further information on the land system, landform and soil description of each location (DEPWS 2021). Furthermore, information about the geographical setting and context of the shell middens will be recorded, this data will undergo statistical analysis through a linear regression model in Microsoft Excel to investigate patterns of distributions and frequency of features. A regression analysis was performed on the distance from pre-contact and post-contact sites to the closest Aboriginal and Macassan trepang site and a series of maps were created that depict the heat map distribution of pre-contact and post-contact middens overlaid with the location of Aboriginal and Macassan trepang sites. It would be expected to see a

significant relationship between the post-contact midden sites and Macassan trepang sites if the arrival of the Macassans and the introduction of dugout canoes changes the distribution of Aboriginal people. Adding to this relationship the location of known indigenous watercraft in rock art will be spatially compared.

Limitations

There were several limitations associated with this research. The first is that there is a small sample of Aboriginal rock art that has been recorded that depicts Aboriginal canoes. This means any statistical analysis completed will not be statistically significant. However, with less than 100 known canoe depictions in Australia, this study will look at approximately 10% of these. So to have a more robust statistical analysis contextual information will be used to supplement the rock art itself. This will include the wider context of the rock art environment and the comparison to the distribution of shell middens that depict evidence of changing socio-economic climate around the time of Macassan contact. Whilst this will not change the raw statistical significance it will create a more robust argument for correlation and discussion.

The second limitation comes with the source of research material. Due to the coronavirus pandemic and state restrictions still being enforced in 2022 travel around Australia has been very difficult. As a result, the photographs of rock art had been taken by Daryl Wesley and Paul Taçon and provided by Daryl Wesley for this thesis. These have been taken over multiple years of visiting rock art galleries. There are some inconsistencies with the photographs, lighting changes, the angle of the picture, no colour scale is present, and the scale is not consistent, many photos are missing a scale bar so some pieces can only be given a relative size rather than definitive. Additionally, no direct consultation was undertaken for this thesis. Previous communications from Daryl Wesley and interviews of published research was utilised.

CHAPTER FOUR RESULTS

Rock art

This study analysed nine depictions of canoes at four different locations. Five canoe depictions are located at Djulirri in the Wellington Range, two at East Alligator River, one at Marligur and one at Red Lily Lagoon (Figure 3-1). This analysis will first cover a subject analysis, looking at the individual rock art pieces and then a structural analysis, looking at the spatial distribution of these sites and the wider context of their depictions (Morwood and Hobbs 2002:148-205). Finally, the distribution of the rock art sites within the land systems of Arnhem Land will be explored. Analysis will be in order of most to least depictions starting at Djulirri (Figure 4-2 and Figure 4-3), and the series of analysis of each rock art is depicted in Appendix 1.

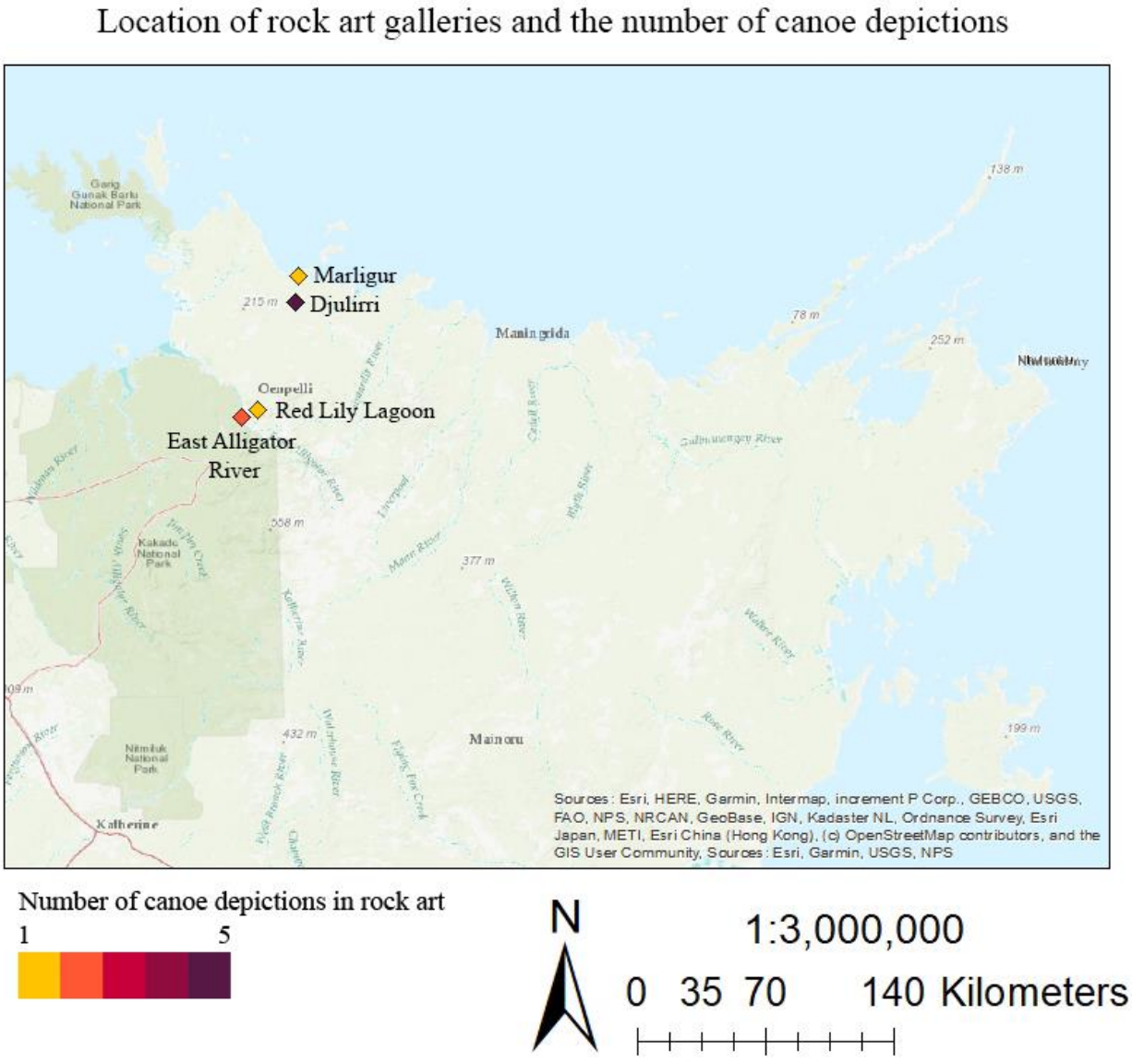


Figure 4-1. Map of the researched rock art galleries and the number of canoe depictions (Adapted from Taçon *et al.* 2010a:417; Wesley *et al.* 2014b:1).

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Figure 4-2. Gallery one at Djulirri, red arrows point to the numbered canoe scenes of this research (Photograph: Daryl Wesley).

Figure removed due to copyright restriction.

Figure 4-3. Gallery two at Djulirri, red arrows point to the numbered canoe scenes of this research (Photograph: Paul Taçon).

At Djulirri there are five different depictions of dugout canoes in rock art in proximity with gallery one on the left and gallery two to the right and set back further into the rock shelter (Figure 4-2 and Figure 4-3). The depictions here are all painted in the same or similar white ochre and are all illustrations of hunting. All high-quality photos from Daryl Wesley were enhanced with the DStretch YWE matrix, the depictions of canoe four and five are lower quality and were enhanced with the DStretch LAB matrix. Djulirri is situated on the Buldiva land system and is characterised by open forests on sandy soils with rocky outcrops and rugged sandstone (DEPWS 2021; Fletcher and Ryan 2021).

Gallery one contains two canoe scenes. Canoe one, on the left depicts, three figures sitting on top of a canoe that has six vertical lines across its body (Figure 4-2). The figure to the leftmost and in the middle are both seated with knees bent above the canoe walls. Differing from these companions, the figure on the right is holding a paddle or spear with no discernible catch at the other end. Directly to the right of the leading figure's head is a small hand with only four fingers. This hand and canoe scene stands out as the background is dominated by red, orange, and black depictions. Just to the right of canoe one is canoe two, a much smaller depiction nestled between and underneath a number of white contact-themed figures. Canoe two depicts a turtle hunt with one figure sitting in a canoe that has no distinctive features or marks. The figure is actively paddling the canoe while a line at the front of the canoe is attached to what is likely a turtle. Overlapping this line is another figure spearing a stingray not in a canoe creating a cohesive hunting scene. The canoe is painted on top of the head of an orange kangaroo/wallaby. Gallery one contains a large number of art pieces overlaid on each other over a long period. The top of the gallery still has the head of a large x-ray style crocodile visible while its body has been smudged and overlaid with many layers of art. This includes a large orange anthropomorphous, a large red-masted ship and a smokehouse in black. Other red animals in x-ray style are highlighted with the DStretch YWE matrix enhancement, including two crocodiles.

Gallery two contains three canoe scenes (Figure 4-3). Canoe three on the left depicts two figures in a canoe fishing. The figure at the front is standing, holding a spear in a dynamic pose ready to strike. The spear has a line attached to it which falls into the canoe. At the back of the boat, a figure is seated with only the upper body shown, they are holding a paddle that is in the water beside the canoe. The figures are hunting a turtle seen to the left of the canoe swimming away. Behind this depiction is two large yellow ochre art pieces that are undefined. Above the canoe, there are multiple figures in the same white ochre as the canoe. To the right of canoe one is another smaller depiction of the same scene but flipped. Canoe four has a figure in the back of the boat on the left seated holding a paddle in the water. At the front of the boat on the right is another figure standing holding a spear with a rope attached to it leading into the boat. To the right approximately a metre away is a turtle

depicted swimming away (Daryl Wesley, pers. Comm. 2022). The canoe is directly above the tail of a large red ochre depiction of a crocodile and overlaid over the same yellow ochre art piece as canoe three. Again to the left, above the turtle canoe four is hunting, is canoe five. Canoe five contains five figures and depicts a whale hunt (Daryl Wesley, pers. Comm. 2022). The canoe is depicted in the water with extensions of lines at the front and back of the canoe to depict the movement and water level, and a short horizontal line across the body of the canoe. The three leftmost figures are all seen seated in the canoe with paddles extending below the waterline. To the right is a figure standing on the canoe holding an up to their face possibly a spear-thrower similar to those studied in McNiven and Brady (2012:79). On the rightmost bow is another standing figure holding a line of rope that is coiled in the canoe. This rope extends out to a whale depiction. The canoe is in white ochre on top of the same large red ochre crocodile depictions as canoe four. Overall, gallery two has hundreds of distinguishable rock art pieces. There are a few large animal depictions in red and yellow ochre, but it primarily contains white ochre figures engaging in traditional and contact activities. The canoe depictions are on the bottom edge of the rock face just above an overhang and of average size compared to the rest of the gallery. Multiple depictions show hunting activities, including a hunting party with spears, striking a crocodile with a boomerang and an individual spearing a turtle underwater. One piece of contact art includes a white ochre silhouette of a man with a hat and a smoking pipe.

At East Alligator River the rock art includes two almost identical canoe depictions. The two depictions are similar in size however canoe seven on the right is in better condition and has a clearer depiction than canoe six on the left (Figure 4-4). Both canoes are filled in and have a large figure wearing a cloak with a long stick for steering the canoe. The figure on the right is depicted smoking, this may have also been happening with the figure on the left however it is unable to be discerned despite this depiction being enhanced with the DStretch LAB matrix. Both canoes have a cargo of eggs, probably of the magpie goose a local source of nutrition and presence in Dreamtime stories, canoe six has eight eggs while canoe seven has been more successful and has nine eggs (Nye *et al.* 2007:30). To the left of the boats is a fishing rod on its own. Behind the figures is a smear of red ochre, and two large ghostly white figures hunting with spears, one behind each canoe depiction. Above canoe seven to the right of the ghostly figure is an animal of some sort, likely a macropod, preserved in better condition than the hunting figures. Behind canoe six and the ghostly figure is possibly another very faded canoe scene, there is at least one figure possibly two in a canoe. This may be connected to the fishing rod depiction to the left; however, it is unclear. East Alligator River is situated on the Cyperus land system and is characterised by seasonally flooded coastal plains with a high number of grasses and sedges (DEPWS 2021).

Figure removed due to copyright restriction.

Figure 4-4. Canoe depictions at East Alligator River, canoe six on the left and canoe seven on the right (Photograph: Daryl Wesley).

At Marligur the rock art depicts two figures, one kneeling and one seated paddling the canoe, canoe eight (Figure 4-5). The canoe has vertical lines at the front and back of the canoe and a possible rope or fishing rod resting on the base. It is depicted in x-ray style and there is an animal depiction just in front of the canoe, possibly a turtle. Red ochre was used to create this art and with DStretch enhancement, with LRE matrix it can be seen overlaying a yellow indistinguishable art piece with a botanical feature in the same yellow above and to the right of the boat scene. Marligur is situated on the Littoral land system, a tidal mudflat and coastal floodplain with channels and estuaries (DEPWS 2021).

Finally, at Red Lily Lagoon canoe nine is a depiction also in x-ray style. The depiction is in yellow ochre, difficult to discern with no enhancement and shows two figures in a canoe (Figure 4-6). The canoe has vertical lines at the front and back, one figure is holding a paddle and the other a fishing rod or spear. This depiction was enhanced with DStretch LDS matrix to show that behind the boat the gallery includes a white figure, red ochre, black discolouration, and yellow and red botanical depictions. This portion of the gallery has been heavily utilised previously, with many undiscernible drawings. Overlaid on the left figure is part of a large red ochre crocodile depiction, with a section portion of a red ochre animal in the same style to the bottom right of the canoe. Red Lily Lagoon is situated on the Buldiva land system characterised by open forests on sandy soils with rocky outcrops and rugged sandstone (DEPWS 2021; Fletcher and Ryan 2021).

Figure removed due to copyright restriction.

Figure 4-5. Canoe eight at Marligur (Photograph: Daryl Wesley).

Figure removed due to copyright restriction.

Figure 4-6. Rock art gallery at Red Lily Lagoon, in the centre canoe nine (Photograph: Daryl Wesley).

A summary of this analysis is presented in Table 4-1, and a full breakdown of the photo enhancement and digitisation as per the methodology of Chapter 3 and Figure 3-1 is presented in Appendix 1.

Table 4-1. Summary of the canoe depictions in rock art in Arnhem Land.

Canoe depiction ID	Location	No. of figures	Activity description	Animals present	Ochre colour and style
1	Djulirri	3	Hunting	·	White
2	Djulirri	1	Turtle hunting	Turtle	White
3	Djulirri	2	Turtle hunting	Turtle	White
4	Djulirri	2	Turtle hunting	Turtle	White
5	Djulirri	5	Whale hunt	Whale?	White
6	East Alligator River	1	Egg collecting	Magpie goose eggs	White
7	East Alligator River	1	Egg collecting	Magpie goose eggs	White
8	Marligur	2	Travel	·	Red · X-ray
9	Red Lily Lagoon	2	Fishing	·	Yellow · X-ray

Shell middens

There are a large number of references to the Macassan arrival changing sustenance and occupation patterns of the Aboriginal Australians throughout Arnhem Land and northern Australia, however, few go into detail about these changes other than a referencing an area (Figure 4-7) (Bradley 1997; Faulkner 2006; Luebbers 1978; Mowat 1995; Schrire 1972). I have presented here a map of these places, however, to maintain integrity will be studying in detail those of the Cobourg Peninsula from Mitchell (1994) (Figure 4-8) and Groote Eylandt Archipelago from Clarke (1994) (Figure 4-9). These two studies have a detailed breakdown of the methodology and contents of each excavated midden and stratigraphy to allow for further analysis.

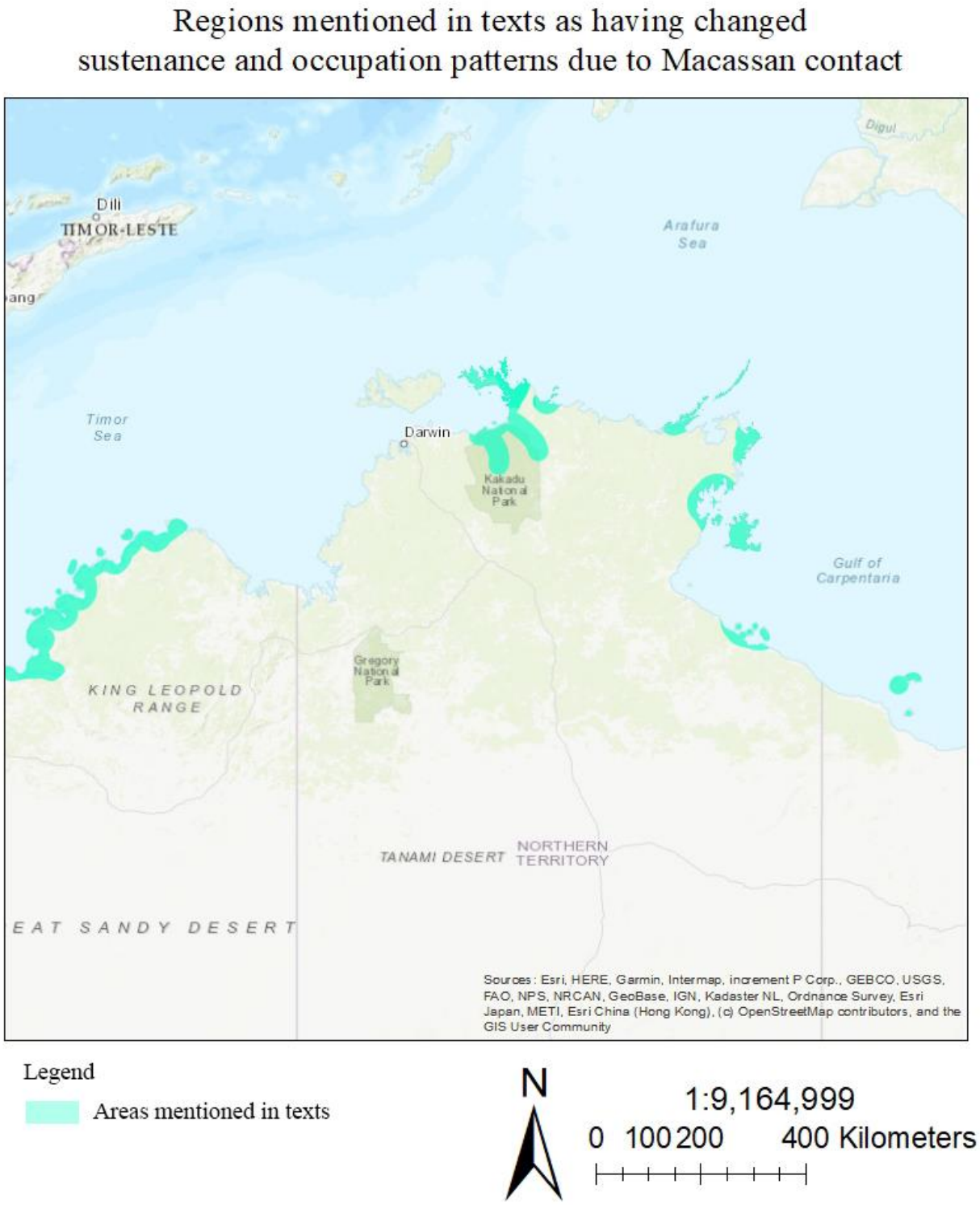


Figure 4-7. Areas of Arnhem Land and the Northern Territory that have been mentioned in previous research as having a change in sustenance and occupation patterns of the Aboriginal Australians after Macassans arrival (Bradley 1997; Faulkner 2006; Luebbers 1978; Mowat 1995; Schrire 1972).

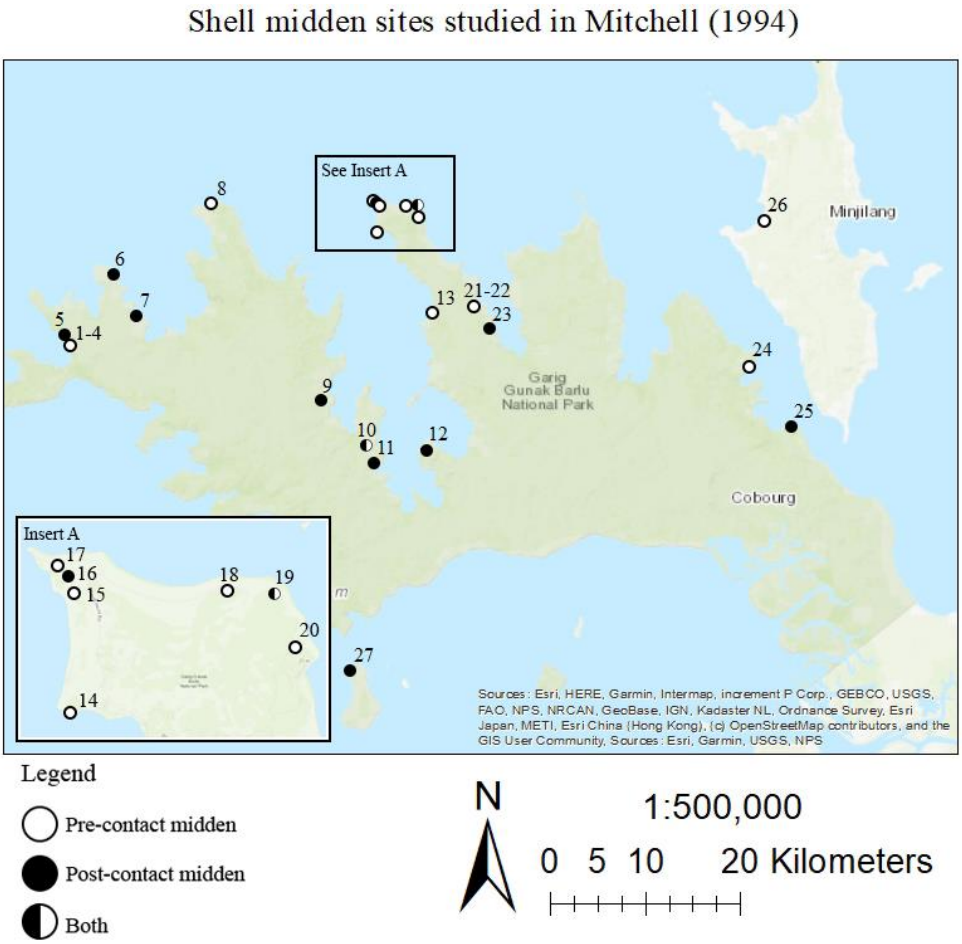


Figure 4-8. Location of shell middens studied in Mitchell (1994) that will be reassessed in this research.

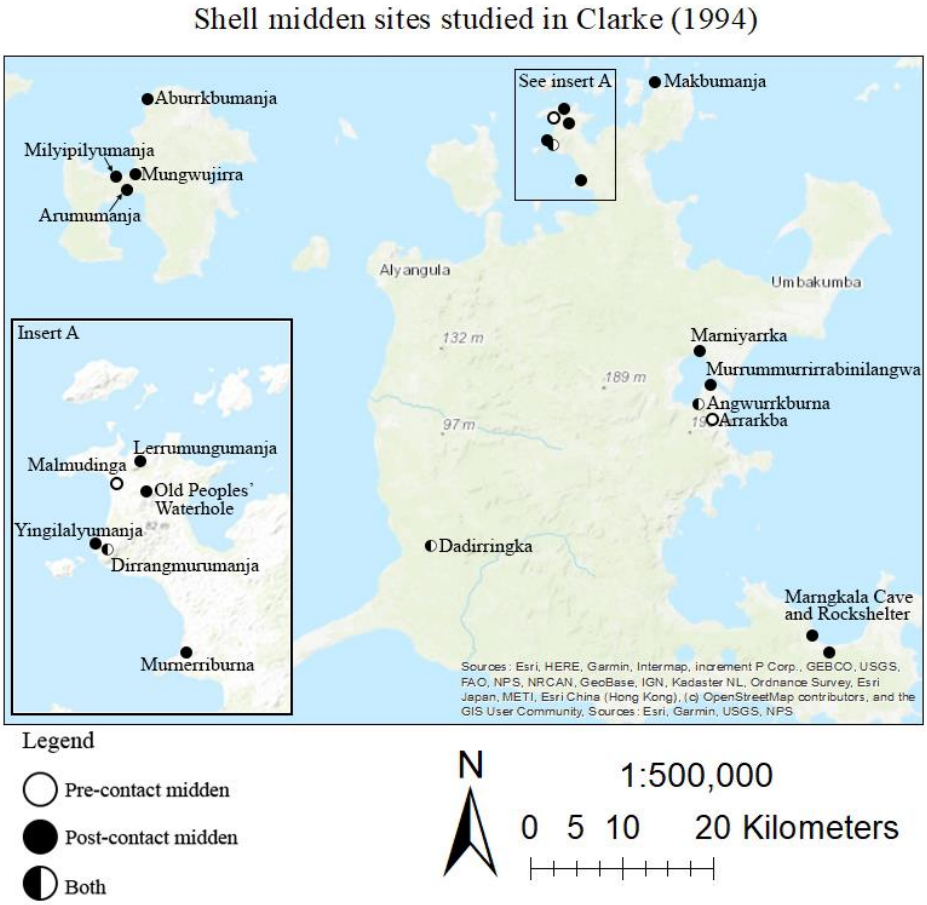


Figure 4-9. Location of shell middens studied in Clarke (1994) that will be reassessed in this research.

Analysis of Mitchell (1994)

Mitchell (1994) presents the results of firsthand excavation with consideration and revisiting of sites used in previous research of shell middens in the Cobourg Peninsula (Figure 4-8). Connected to mainland Australia but a thin "neck" Cobourg Peninsula is the north-western extremity of Arnhem Land and consists of a number of large inlets. The Cobourg Peninsula has since been renamed to Garig Gunak Barlu National Park and will be referred to as such from herein. Mitchell's study included 27 excavated shell middens documenting the context and contents of each midden. These were split by pre-Macassan contact (pre-contact) and post-Macassan contact (post-contact) via chronologically diagnostic artefacts, middens containing coins, glass and Macassan pottery etc. as post-contact and those with no indicator as pre-contact. Additionally, where charcoal was present the middens were radiocarbon dated and calibrated using a method modelled after Stuiver and Reimer (1986). A summary of the middens has been presented in Table 4-2.

Table 4-2. Summary of midden sites, their location, age and contents with post-contact sites shaded grey (adapted from Mitchell 1994:173-235).

ID	Location	Period	Artefacts	Faunal remains
1	Popham Bay	Pre-contact	·	·
2	Popham Bay	Pre-contact	·	·
3	Popham Bay	Pre-contact	·	·
4	Popham Bay	Pre-contact	·	·
5	Popham Bay	Post-contact	Ceramics · Glass · Quartzite flake	Turtle · Pig
6	Trepang Bay	Post-contact	Iron · Glass · Pottery · Flaked glass · Silcrete flake	Dugong
7	Trepang Bay	Post-contact	Porcelain · Grindstone · Flaked glass	·
8	Port Essington	Pre-contact	·	·
9	Knocker Bay	Post-contact	Glass · Grindstone · Metal drum	Turtle
10	Minto Head	Pre-contact	Ochre	Crab
10	Minto Head	Post-contact	Flaked glass · Ochre · Metal · Pottery · Shell artefacts · Slate flakes · Quartzite flakes	·
11	Minto Head	Post-contact	Nails · Pottery · Tobacco pipe · Glass · Flaked glass	Dugong · Fish · Buffalo · Lizard · Bandicoot · Macropod
12	Middle Head	Post-contact	·	·
13	Berkeley Bay	Pre-contact	Manuports	·

ID	Location	Period	Artefacts	Faunal remains
14	Black Point	Pre-contact	Stone circles	Human
15	Black Point	Pre-contact	Stone circles	·
16	Smith Point	Post-contact	Manuport · Slate points · Flakes Glass · Tobacco pipe	Turtle · Macropod
17	Smith Point	Pre-contact	Coral circles	Crab · Human
18	Smith Point	Pre-contact	·	·
19	Port Bremer	Pre-contact	·	Fish
19	Port Bremer	Post-contact	Pottery	Turtle
20	Port Bremer	Pre-contact	Stone core · Manuports	Crab
21	Lizard Bay	Pre-contact	Manuports	·
22	Lizard Bay	Pre-contact	Manuports	·
23	Lizard Bay	Post-contact	Glass · Metal	·
24	Bowen Straits	Pre-contact	Pestle	Fish
25	Bowen straits	Post-contact	Metal · Porcelain · Flaked glass · Glass · Stone axe fragments · Quartz/quartzite flakes	Dugong
26	Palm Bay	Pre-contact	Manuports · Dolerite axe	·
27	Bluff Point	Post-contact	Metal · Glass · Manuport · Stone axes	Dugong

Of these studied sites 16 were classified as pre-contact sites, nine were deemed post-contact sites and two had lower stratigraphic layers of pre-context deposits and higher stratigraphic layers of post-contact material. Four middens contained dugong remains including multiple dugong ribs and another four contained turtle remains including turtle vertebra and carapace. No turtle species were identified by Mitchell (1994). These dugong and turtle remains were all dated to post-contact middens and were present in 67% of the post-contact middens (33% each). No turtle or dugong remains were identified in the pre-contact middens (Figure 4-10). Additionally, terrestrial fauna was located in three of the post-contact middens accounting for 25% and including animals such as buffalo, macropods, pig and bandicoot (Table 4-2). No terrestrial fauna remains were located in pre-contact middens, but one pre-contact midden contained human remains (Mitchell 1994:184).

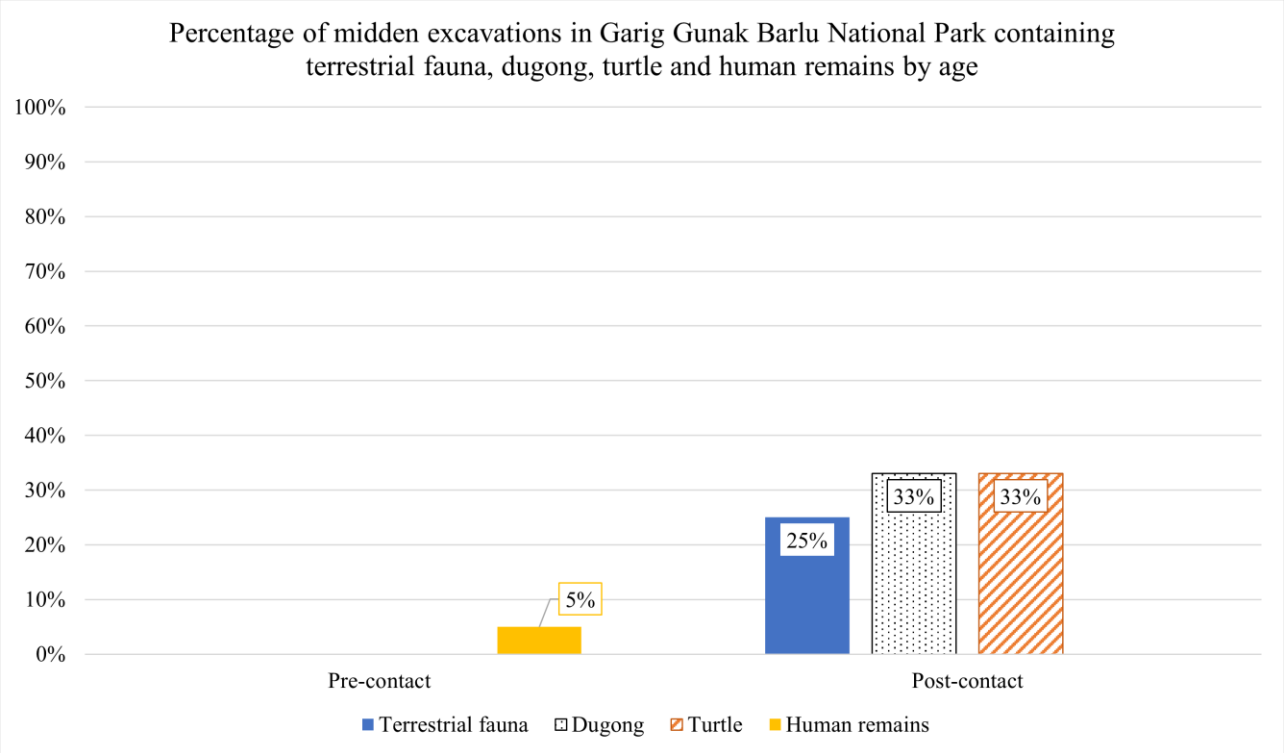


Figure 4-10. Graphical depiction of the percentage of midden excavations in Garig Gunak Barlu National Park containing terrestrial fauna, dugong, turtle and human remains separated by age of the deposit (adapted from Mitchell 1994:173-235).

Another research point in Mitchell (1994) is the presence of lithic artefacts within the middens and the origin point of the material. Within the Garig Gunak Barlu National Park, the local material consists of quartz pebbles, sandstone, siltstone and quartzite, any other raw material located during excavation would have to be imported from elsewhere (Mitchell 1994:232). An initial look at the presence of lithics within the midden shows an increase from pre-contact to post-contact middens, where only 53% (n=9) pre-contact middens contain lithic artefacts, primarily manuports (a piece of stone moved by humans but with no further modification), compared to 75% (n=9) of post-contact middens, primarily flakes (Figure 4-11) (Mitchell 1994:232-233). Of the pre-contact middens only two contained imported material consisting of ochre and a dolerite axe, accounting for 12% (n=2) of the middens, with 41% containing local materials (Figure 4-10). Comparatively, of the post-contact middens, 58% (n=7) contained imported material with only 17% (n=2) containing local material lithics (Figure 4-12). These imported material lithics include a dolerite axe fragment, silcrete flakes, quartzite grinding stones, slate points and quartz flakes. Furthermore, five of the post-contact midden sites contained flaked glass. At midden 25 located at Irgul Point, half of the glass bottle bases had been flaked and the Aboriginal people had a preference for flaking dark green glass compared to the brown, clear or light green glass also found within the midden (Mitchell 1994:128-219).

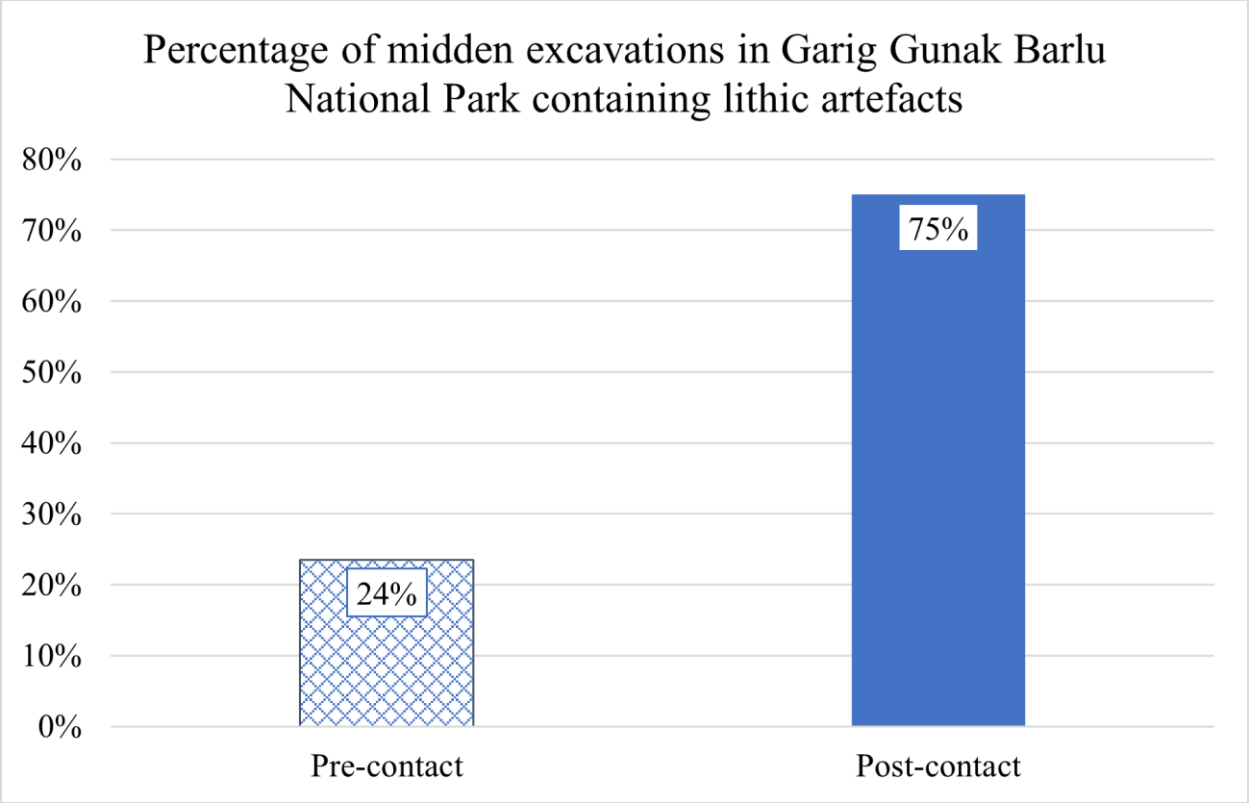


Figure 4-11. Percentage of midden excavation in Garig Gunak Barlu National Park containing lithic artefacts by time.

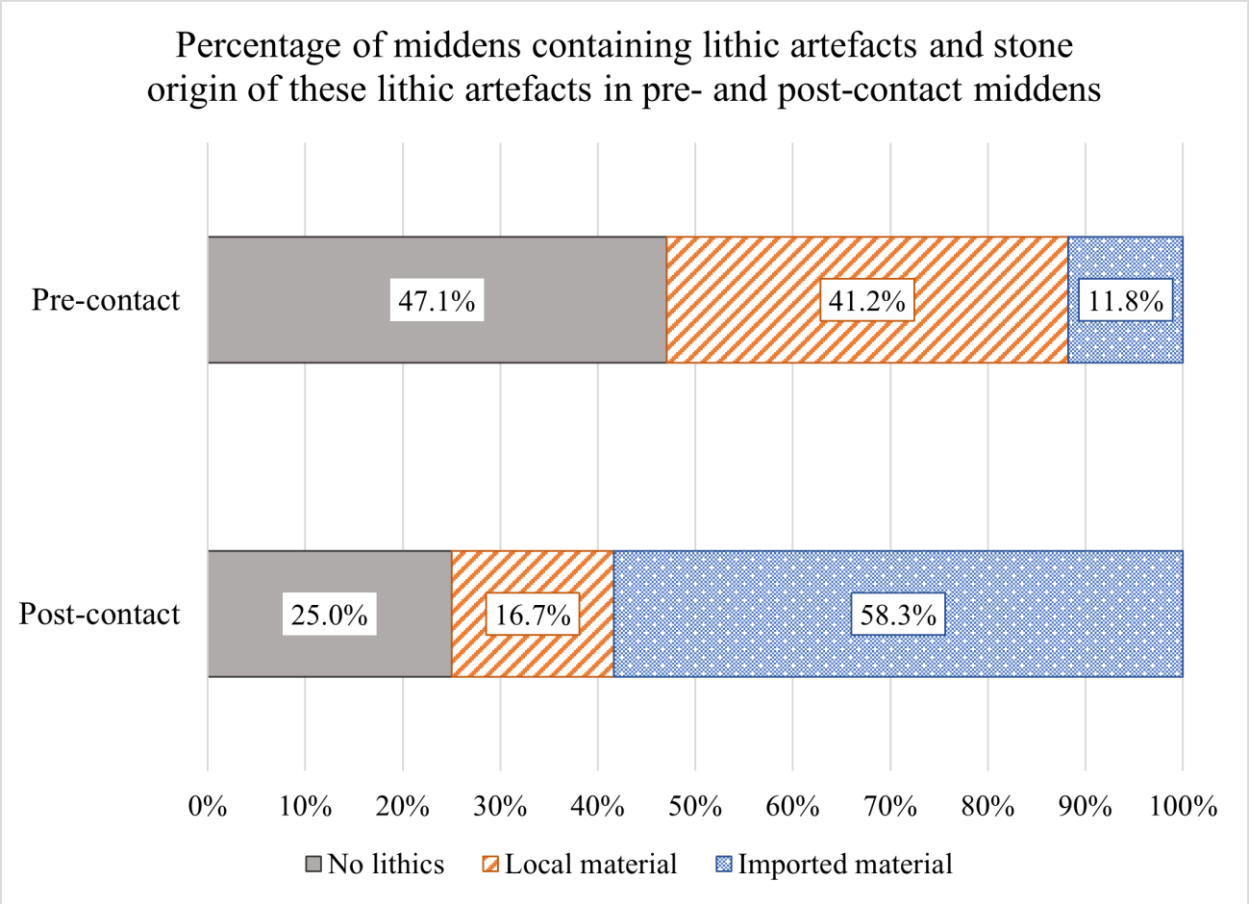


Figure 4-12. Percentage of midden excavation in Garig Gunak Barlu National Park containing lithic artefacts and stone origin of these lithic artefacts in pre-contact and post-contact middens.

The shell middens of Garig Gunak Barlu National Park cover six land systems; Blue Mud, Caiman, Dune, Kennedy, Littoral and Mountnorris (Figure 4-13) (DEPWS 2021). Of these, Kennedy has the most middens, four each of pre-contact and post-contact middens, accounting for 30% of the total middens, 27% of pre-contact middens and 40% of post-contact middens. Kennedy land system is characterised by gently undulating to flat plains adjacent to the coast. The Littoral and Caiman land systems follow next with six middens each. In the Littoral land system 33% of the pre-contact middens are located (n=5), accounting for the highest number of pre-contact sites in a land system, and 40% of post-contact middens (n=1). The Littoral land system is characterised as a tidal mudflat and coastal floodplain with channels and estuaries. With the same number of total middens studied, the Caiman land system contains 7% of the pre-contact middens (n=1), 40% of the post-contact middens (n=4) and 50% of the middens with both pre-and post-contact sites (n=1). The Caiman land system has undulating plains and rises through Cretaceous sediment (DEPWS 2021). Close behind the Dune land system contains five middens, 27% of the pre-contact middens (n=4) and 50% of the middens with both pre-and post-contact sites (n=1). As expected, the dune land system contains dunes, beach ridges and coastal sandplains. Finally, the Blue Mud land system contains one pre-contact midden, accounting for 7% of the pre-contact middens, and the Mountnorris land system contains one post-contact midden accounting for 4% of the post-contact middens. The Blue Mud land system is characterised by beach ridge pains and chenier plains and is only found on Croker Island within Garig Gunak Barlu National Park. Comparatively, the Mountnorris land system is on mainland Australia near Mountnorris Bay and contains flat to gently undulating lowland plains (DEPWS 2021).

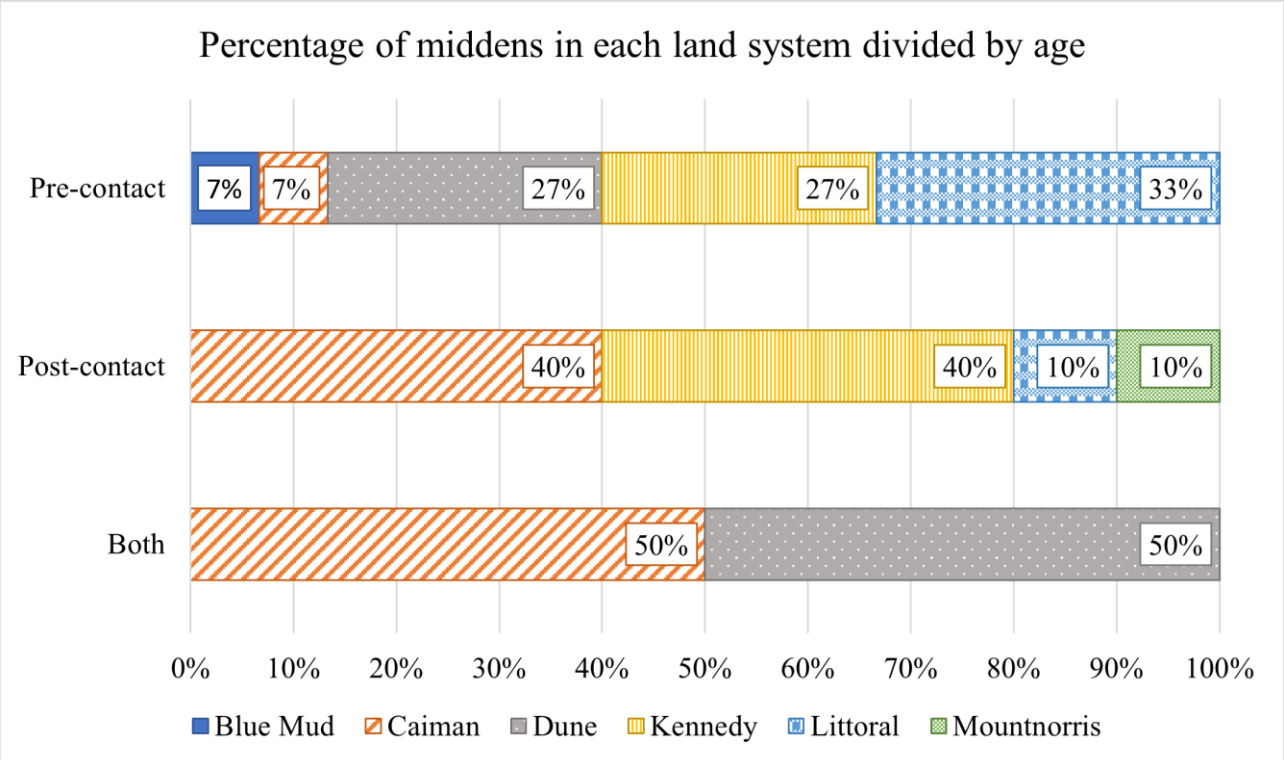


Figure 4-13. Percentage of middens on each land system divided by age.

Further to this Mitchell (1994) lists the location of excavated trepang sites in Garig Gunak Barlu National Park which can be compared to the distribution of pre-contact and post-contact Aboriginal sites. These trepang sites included Macassan sites and Aboriginal trepang sites. The results of the regression analysis of the distance from pre-contact and post-contact sites to the closest Aboriginal and Macassan trepang site is presented in Figure 4-14 and a series of maps that depict the heat map distribution of pre-contact and post-contact middens overlaid with the location of Aboriginal and Macassan trepang sites are presented in Figure 4-15 to Figure 4-18. In the analysis midden 27 was considered an outlier due to being located on Greenhill Island and is isolated from known Aboriginal and Macassan trepang sites. The regression analysis for pre-contact sites produced a determination coefficient of 0.447 and a p-value of 0.003. Thus, there is a weak positive correlation between the distance to Aboriginal and Macassan trepang sites that determine the location of the pre-contact middens, almost equidistant from the graph data (Figure 4-14). However, the post-contact sites have a determination coefficient of 0.040 and a p-value of 0.555. These values and the graphical depiction point to no correlation between the post-contact sites and distance to Aboriginal or Macassan sites. But show a general trend of being closer to Macassan trepang sites regardless of distance to Aboriginal trepang sites.

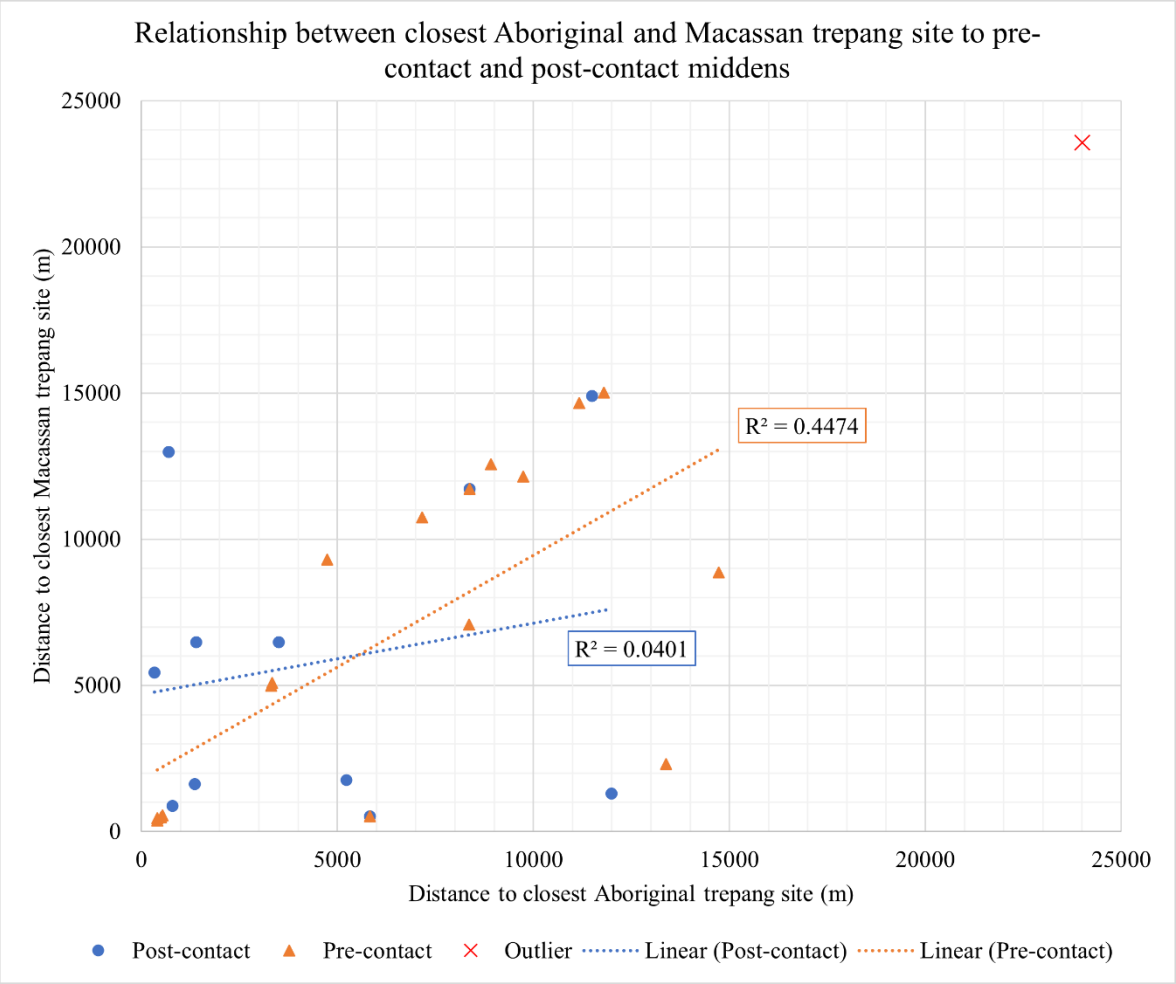


Figure 4-14. Relationship between closest Aboriginal trepang site and Macassan trepang site to pre-contact and post-contact middens with linear line of best fit.

The pre-contact midden sites are located along the mainland National Park and Croker Island and align closely with the distribution of Aboriginal trepang sites located within the National Park particularly around the western and northern clusters (Figure 4-15). This is especially prevalent when compared to the pre-contact midden sites and the distribution of Macassan trepang sites which are not clustered together (Figure 4-16). Comparatively the post-contact middens show minimal correlation to the distribution of Aboriginal trepang sites, with the exception of a cluster on the western coast, with the majority of the sites around the centre of the National Park where only one Aboriginal trepang site is located (Figure 4-17). However, the Macassan trepang sites do align with the distribution of the post-contact shell middens containing two clusters on the western peninsular and at the centre of the National Park (Figure 4-18).

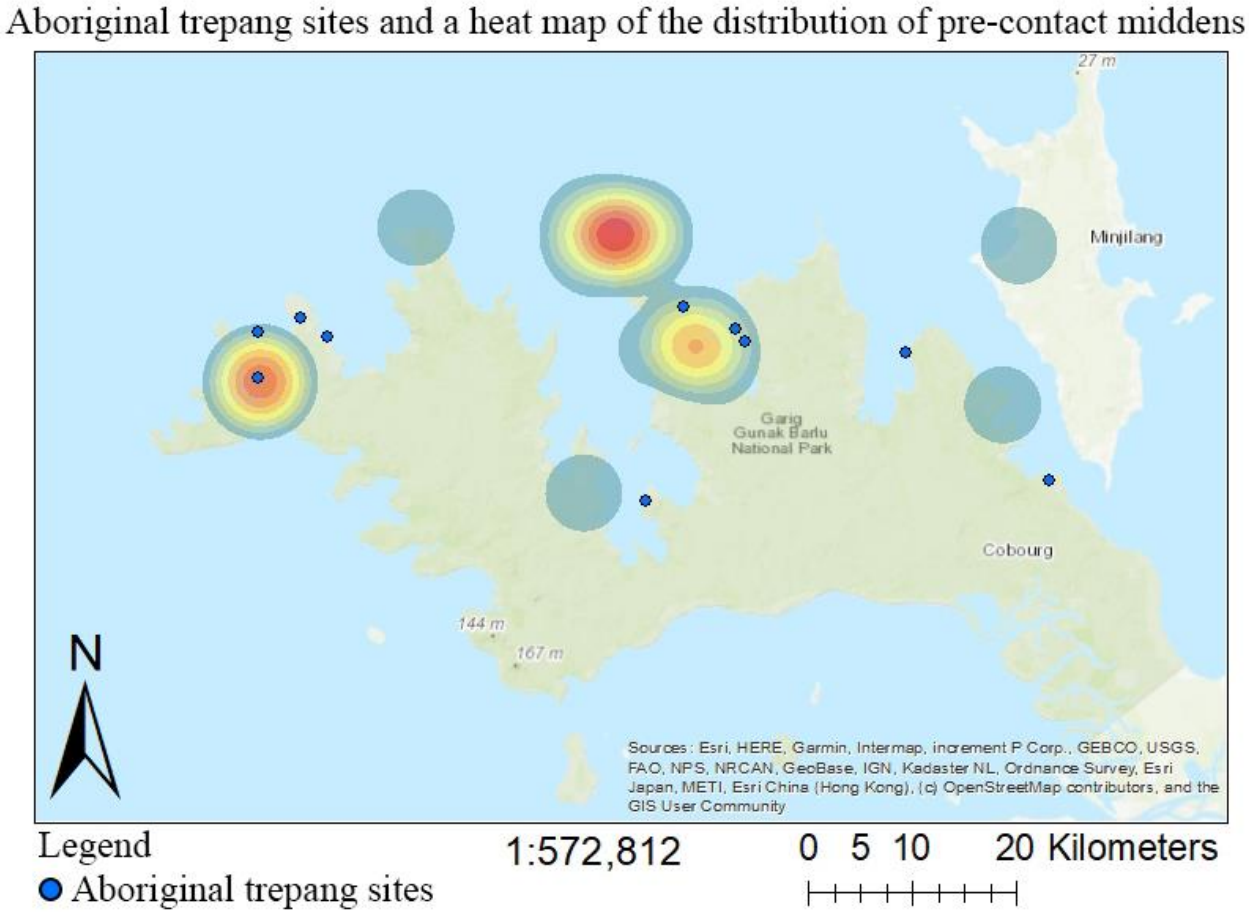


Figure 4-15. Aboriginal trepang sites and the heat map distribution of pre-contact middens.

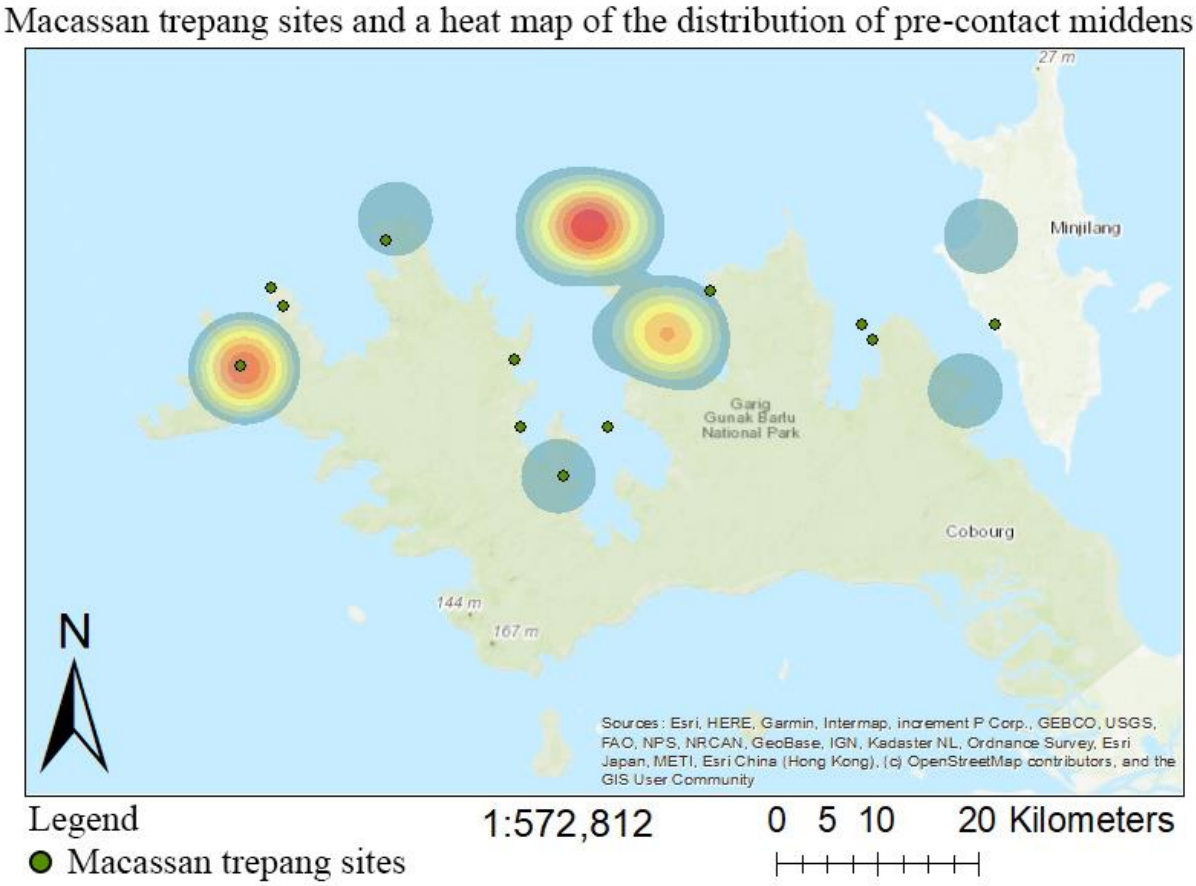


Figure 4-16. Macassan trepang sites and the heat map distribution of pre-contact middens.

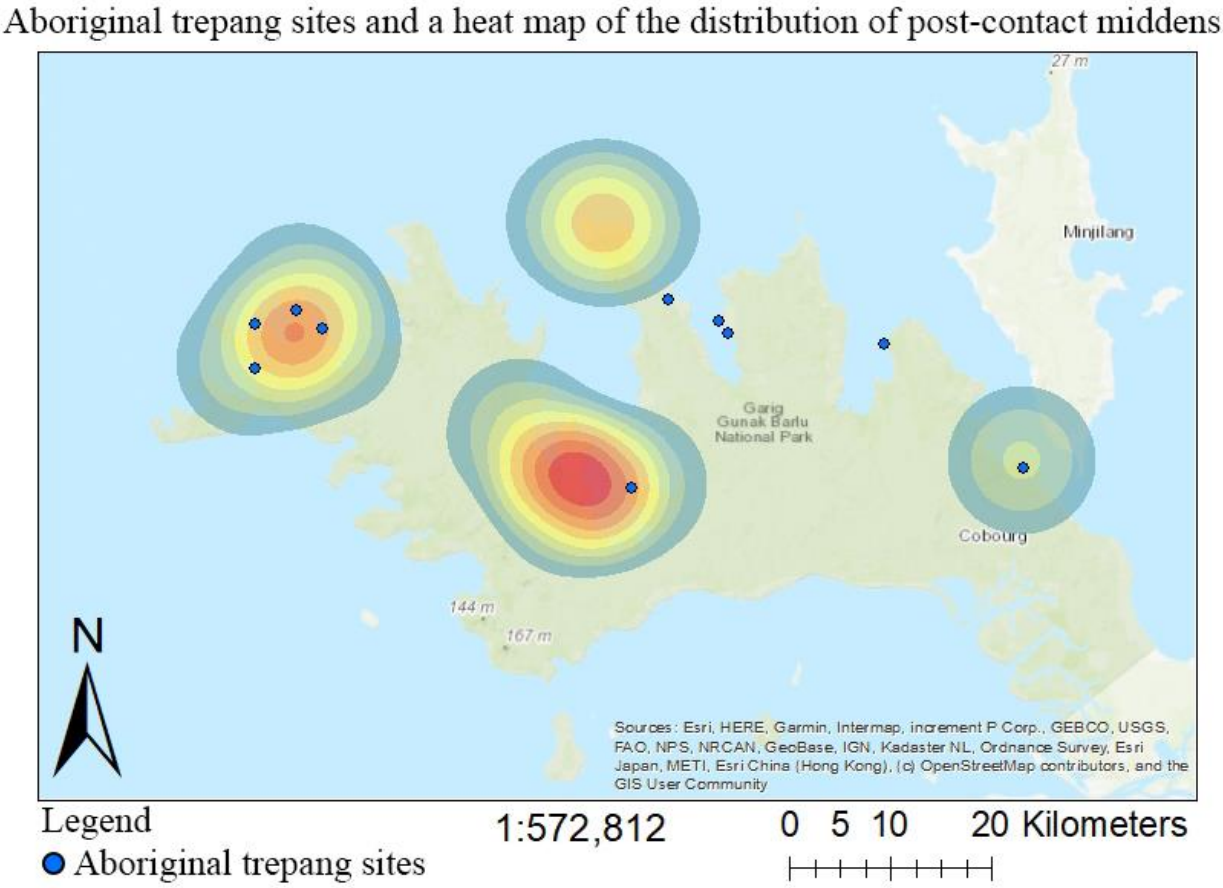


Figure 4-17. Aboriginal trepang sites and the heatmap distribution of post-contact middens.

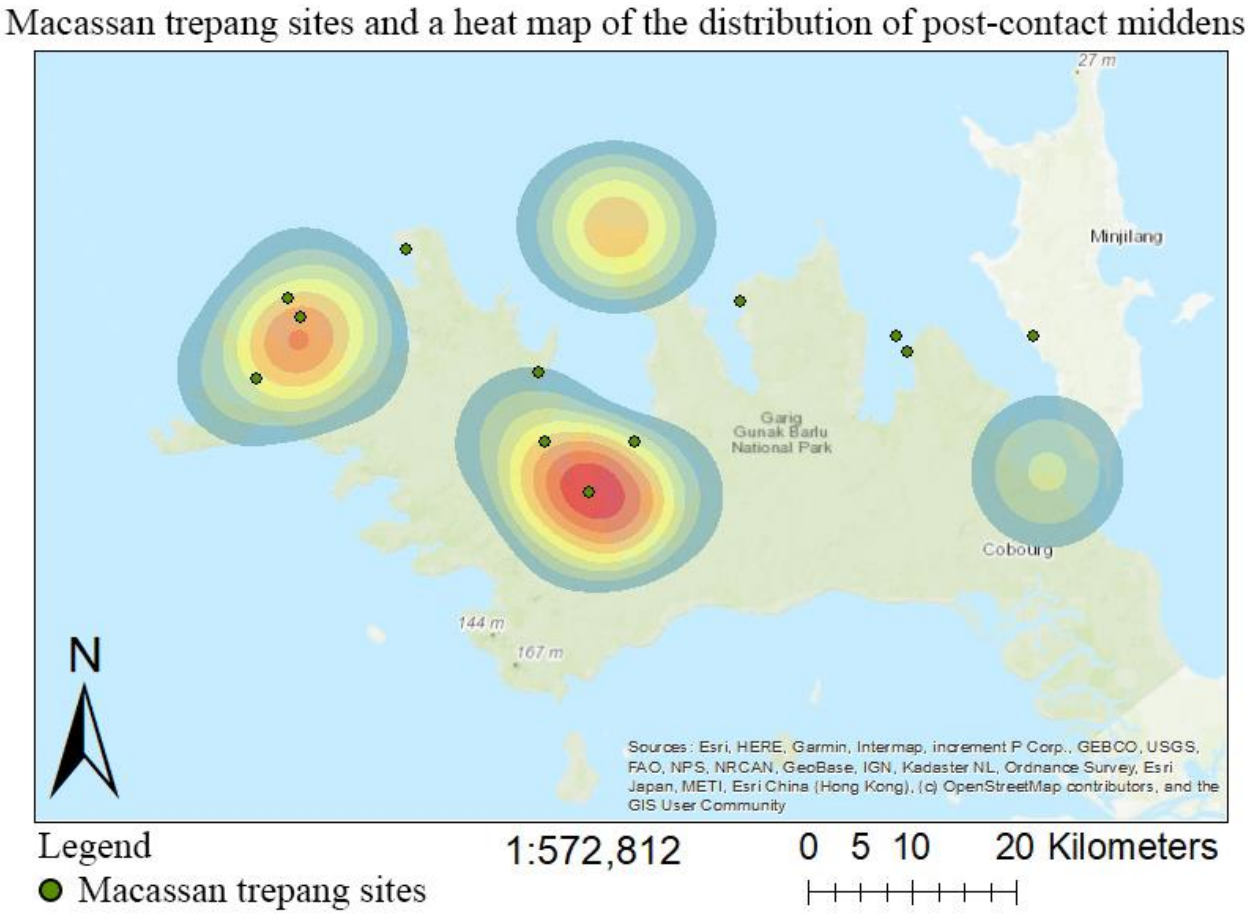


Figure 4-18. Macassan trepang sites and the heat map distribution of post-contact middens.

Analysis of Clarke (1994)

Clarke (1994) presents the results of firsthand excavation in the Groote Eylandt Archipelago (Figure 4-9). The archipelago is within the western waters of the Gulf of Carpentaria and consists of hundreds of islands and was home to 14 different clan groups and two moieties with strong connections between them. Groote Eylandt is the largest of these, having an area of just over 2,300 m^2, just 13km to the west is Bickerton island a gateway between the mainland Australia and Groote Eylandt where the majority of people were bilingual (Clarke 1994:22-32). Clarke's study included 19 excavated shell middens documenting the context and contents of each midden. The middens were split into pre-contact and post-contact via radiocarbon dating of shells and calibration as per Stuiver and Reimer (1986) and chronological grounds including oral traditions and local knowledge. Local Aboriginal people guided Clarke to the excavation sites resulting in no particular excavation strategy being used. A summary of the middens has been presented in Table 4-3.

Table 4-3. Summary of midden sites, their age and contents with post-contact sites shaded grey (adapted from Clarke 1994:136-411).

Site name	Date	Artefacts	Faunal remains
Murnerriburna	Post-contact	Ground axe · Ground stone fragment · Ochre	·
Old People's Waterhole	Post-contact	Glass	·
Dirrangmurumanja*	Pre-contact*	Ground stone fragments	Fish
Dirrangmurumanja*	Post-contact*	·	Fish · Turtle · Shark
Yingilalyumanja	Post-contact	Ground stone fragments · Quartz flakes · Ochre	Fish
Malmudinga	Pre-contact	Quartz flake · Ochre	Fish · Shark · Crab · Macropod
Lerrumungumanja Rock Shelter	Post-contact	Quartz core · Quartz flakes · Quartzite flakes · Silcrete flakes · Ochre	·
Lerrumungumanja Midden	Post-contact	Macassan pottery · Flakes · Ground stone fragments · Iron · Ochre	Fish · Rodent · bird · turtle · shark
Makbumanja Midden	Post-contact	Quartz flakes · Quartz core · Glass flake · Glass · Metal · pottery · Glass bead	Fish · Turtle · Shark · Crab · Reptile · Mammal
Ararrkba	Pre-contact	Quartz flakes · Quartzite flakes · Quartz pebble core · Ochre	Mammal · Turtle
Murrumurrirrabinilangwa	Post-contact	·	Fish · Turtle · Crab · Crocodile
Angwurrkburna	Pre-contact	Chert flakes · Quartz flakes · Quartzite flakes · Quartzite cores · Chert cores · Ochre	·
Angwurrkburna	Post-contact	Glass · Quartz flakes · Quartzite flakes · Silcrete flake	Fish · Shark · Crab · Reptile · Mammal
Mamiyarrka	Post-contact	Iron	·
Marngkala Cave	Post-contact	Quartz flakes · Quartzite flakes · Silcrete flakes· Quartz core · Pottery · Beads · Iron · Bronze/brass · Ochre	Fish · Shark · Turtle · Macropods · Bandicoots · Rodents · Flying foxes · Quolls · Birds · Reptiles

Site name	Date	Artefacts	Faunal remains
Marngkala Rockshelter	Post-contact	Glass · Pottery · Broken bronze knife · Silcrete flakes · Quartz flake · Quartzite flake · Ochre	Fish · Turtle · Shark · Crab · Reptile · Mammal
Dadirringka	Pre-contact	Pottery · Quartzite flakes · Ochre	·
Dadirringka	Post-contact	Quartzite flakes · Ochre	·
Aburrkbumanja	Post-contact	Ground stone fragment · Glass bead · Quartzite flake	Fish · Turtle · Crab
Milyipilyumanja	Post-contact	Quartz core · Quartz flakes	·
Mungwujirra	Post-contact	Quartz flakes	·
Arumumanja	Post-contact	·	Fish

** Indicates excavations with high levels of disturbance.*

Of these studied sites two were classified as pre-contact sites, 14 were deemed post-contact sites and three had stratigraphic layers of pre-context deposits and stratigraphic layers of post-contact material. The midden at Dirrangmurumanja has high levels of disturbance and it is thought that the midden has been excavated previously for mining activities and what Clarke excavated was an upside-down spill heap. No middens contained dugong remains despite being known to have a medium to high relative density in the waters of the Groote Eylandt Archipelago (Grech *et al.* 2011:1-7). However, eight middens contained turtle remains, one pre-contact midden (20%) and seven post-contact middens (41.2%), seven middens contained shark remains, one pre-contact midden (20%) and six post-contact middens (35.5%) and seven middens contained terrestrial fauna remains, one pre-contact midden (20%) and six post-contact middens (35.5%) (Figure 4-19). Terrestrial fauna remains include quoll, macropods, rodents, flying foxes and birds. One post-contact midden contained the remains of a crocodile at Murrumurrirrabinilangwa. Additionally, all of the pre-contact turtle, shark and terrestrial fauna was located in one midden site at Malmudinga, the terrestrial fauna was identified as a macropod and the midden also included crabs, a quartz flake and ochre. All of these middens with species of interest were located on Groote Eylandt except for one midden on Bickerton Island, Aburrkbumanja, which contained fish, crab and turtle remains (Clarke 1994:403-408).

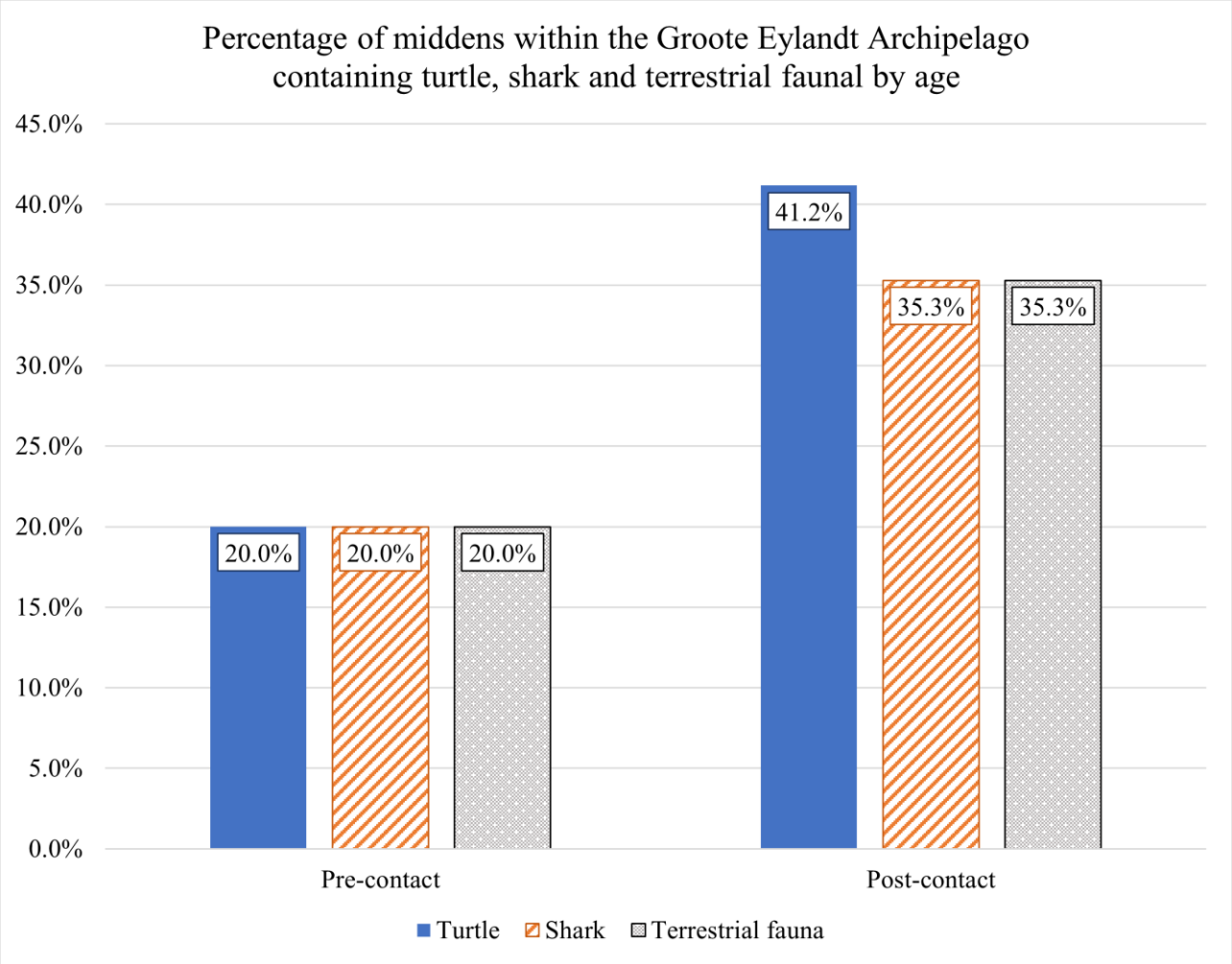
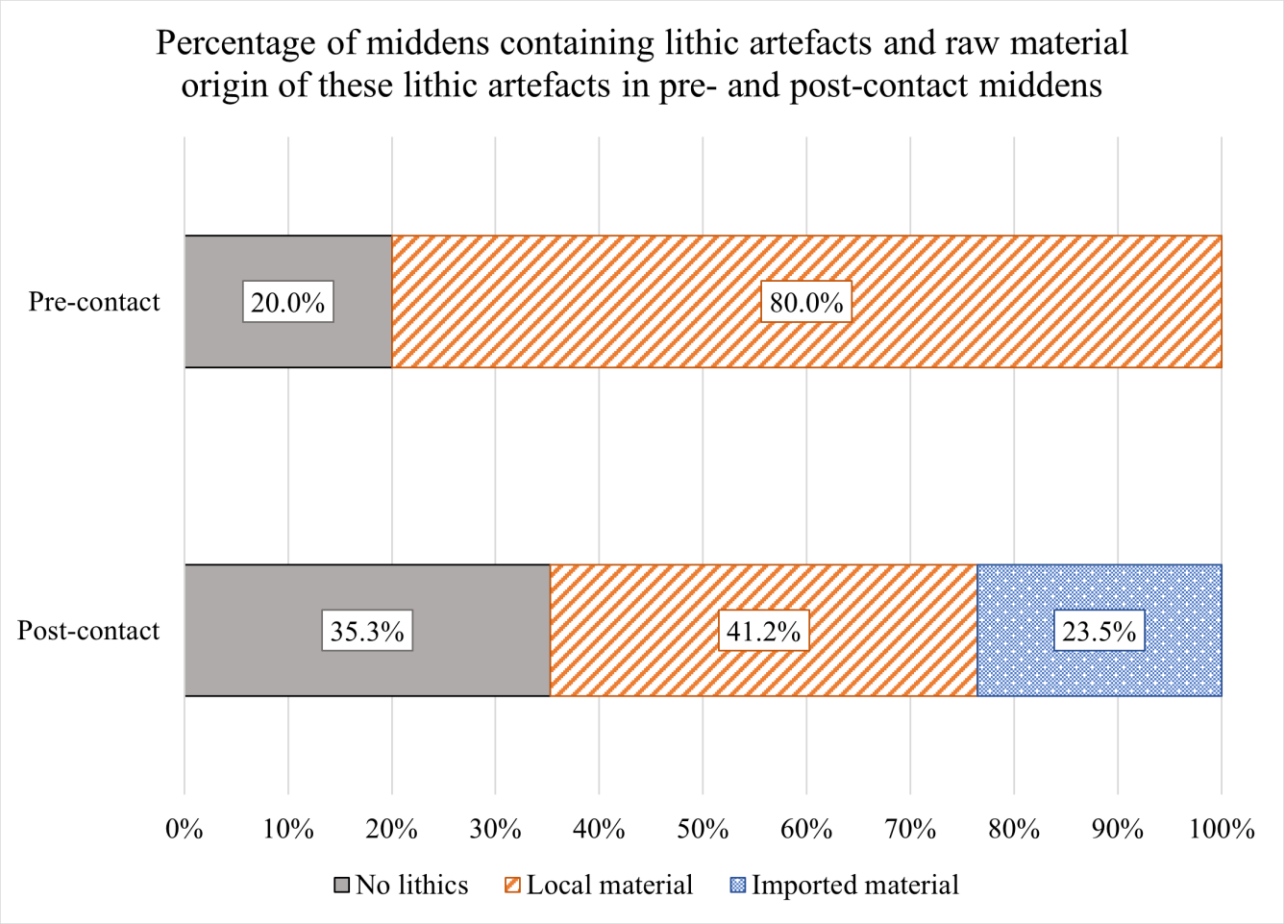
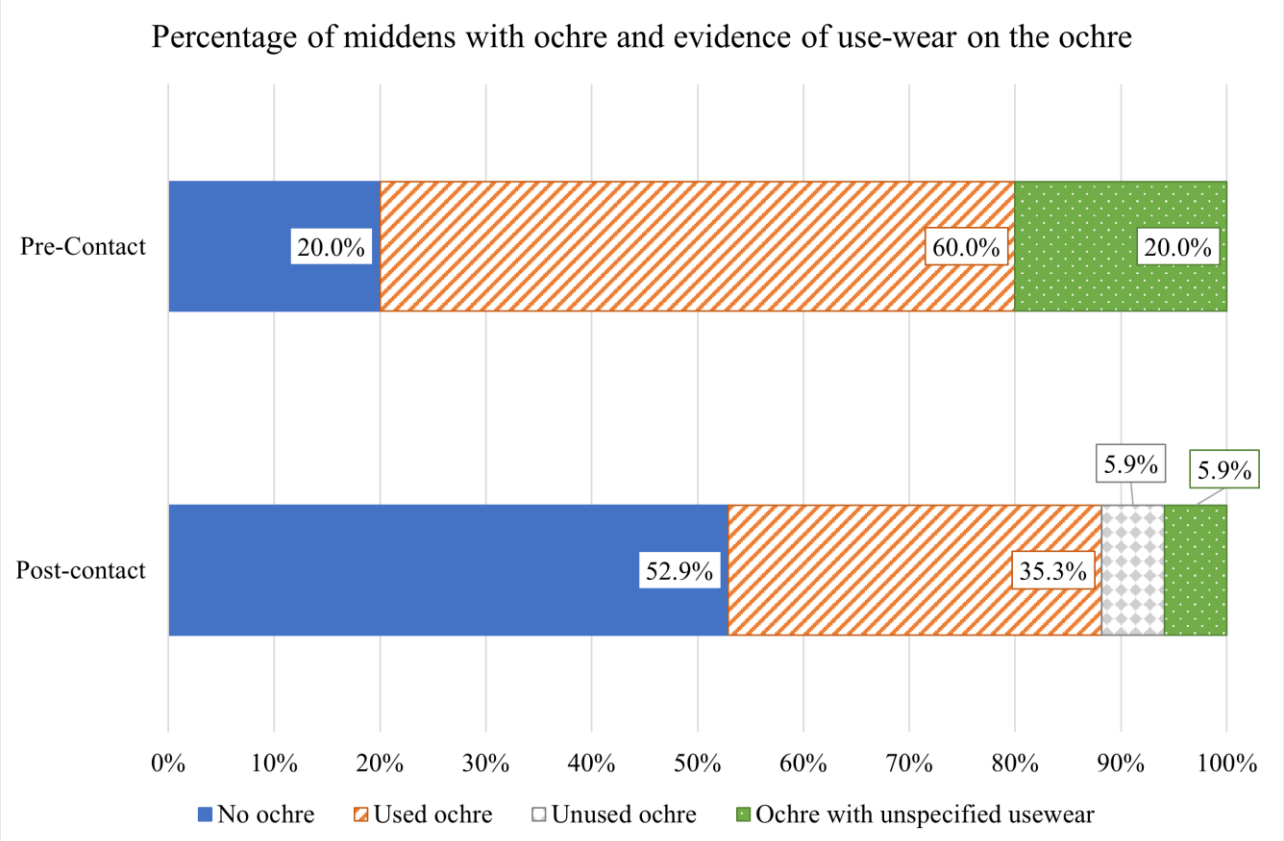


Figure 4-19. Percentage of middens within the Groote Eylandt Archipelago containing turtle, shark and terrestrial fauna by age.

Clarke (1994) noted the presence of lithic artefacts and their origin within the middens at Groote Eylandt Archipelago. Local source materials for the archipelago include sandstone, quartz, and quartzite. Silcrete was known to have been traded to those living on the island from mainland Australia, most likely from Walker River/Blue Mud Bay (Clarke 1994:301). The majority of pre-contact and post-contact sites contained lithics, with 80% (n=4) of pre-contact sites containing lithics and 64.7% (n=11) of post-contact sites. However, only post-contact sites contained imported lithics, accounting for 23.5% (n=4) of the midden sites (Figure 4-20). Over half of the midden sites excavated by Clarke contained ochre (54.6%, n=12). Of these, there were four from pre-contact sites accounting for 80% of pre-contact middens, and eight from post-contact contexts accounting for 47.1% of post-contact middens. The ochre was analysed for evidence of use in the form of facets and striations, this was specified for the majority of sites. At the pre-contact sites, 60% (n=3) contained evidence of use, while one was unspecified, accounting for 20% of the pre-contact assemblage (Figure 4-21). At the post-contact sites, 35.3% (n=6) of middens contained ochre with use-wear, one midden had no evidence of use-wear accounting for 5.9% at Murnerriburna, and one was unspecified accounting for 5.9% of the assemblage (Figure 4-21).



4-20. Percentage of middens analysed by Clarke (1994) that contained lithic artefacts and their origin by midden age.



4-21. Percentage of middens analysed by Clarke (1994) that contained ochre and their use-wear by age.

The shell middens on the Groote Eylandt Archipelago cover nine land systems; Bartalumba, Blue Mud, Bundah, Dalumbu, Groote, Keefers Hut, Marangala, Queue, Umbakumba (Table 4-4). Groote land system contains the most middens of Clarke's study, a total of eleven middens. All of the middens with both pre-and post-contact dating were located in this land system (n=3), and 57.1% of the post-contact middens (n=8). The Groote land system is characterised by a rugged dissected plateau of quartz sandstone, covering the majority of Groote Eylandt and primarily found on the island (DEPWS 2021). Following this, one post-contact midden, accounting for 7.1% of post-contact middens each was located on Bartalumba, Blue Mud, Dalumbu, Keefers Hut, Marangala and Queue (Table 4-4). Bartalumba is a coastal parabolic dune field. Blue Mud is characterised by beach ridge pains and chenier plains. Dalumbu contains gently undulating sand plains in coastal areas. Keefers Hut is characterised by gently undulating rises with deep weathering. Marangala comprises of gently undulating sand plains. Queue contains gently undulating sandplains. The pre-contact sites are located in the Bundah and Umbakumba land systems, each containing one midden. Bundah land systems are located below elevated quartz and sandstone plateaus and comprise of sandy colluvial foot slopes. The Umbakumba land system is characterised as a coastal sand plain that is gently undulating and contains parabolic dunes (DEPWS 2021).

Table 4-4. Summary of percentage of middens in each land system divided by age.

Age → **Land System ↓**	**Pre-contact**	**Post-contact**	**Both**
Bartalumba		7.1% (n=1)	
Blue Mud		7.1% (n=1)	
Bundah	50.0% (n=1)		
Dalumbu		7.1% (n=1)	
Groote		57.1% (n=8)	100.0% (n=3)
Keefers Hut		7.1% (n=1)	
Marangala		7.1% (n=1)	
Queue		7.1% (n=1)	
Umbakumba	50.0% (n=1)		

Comparison of Macassan material in shell middens

At both locations Clarke (1994) and Mitchell (1994) listed the contact materials found at post-contact middens sites. This comes to an overall average of 41% of post-contact middens containing at least one fragment of metal, glass and/or pottery. The average is lower at the Groote Eylandt Archipelago with only 29% and higher at Garig Gunak Barlu National Park with 53% (Figure 4-22). The highest percentage of any imported material was at Garig Gunak Barlu National Park with 75%

of middens containing glass, all of the post middens containing at least one piece of flaked glass in addition to unflaked glass.

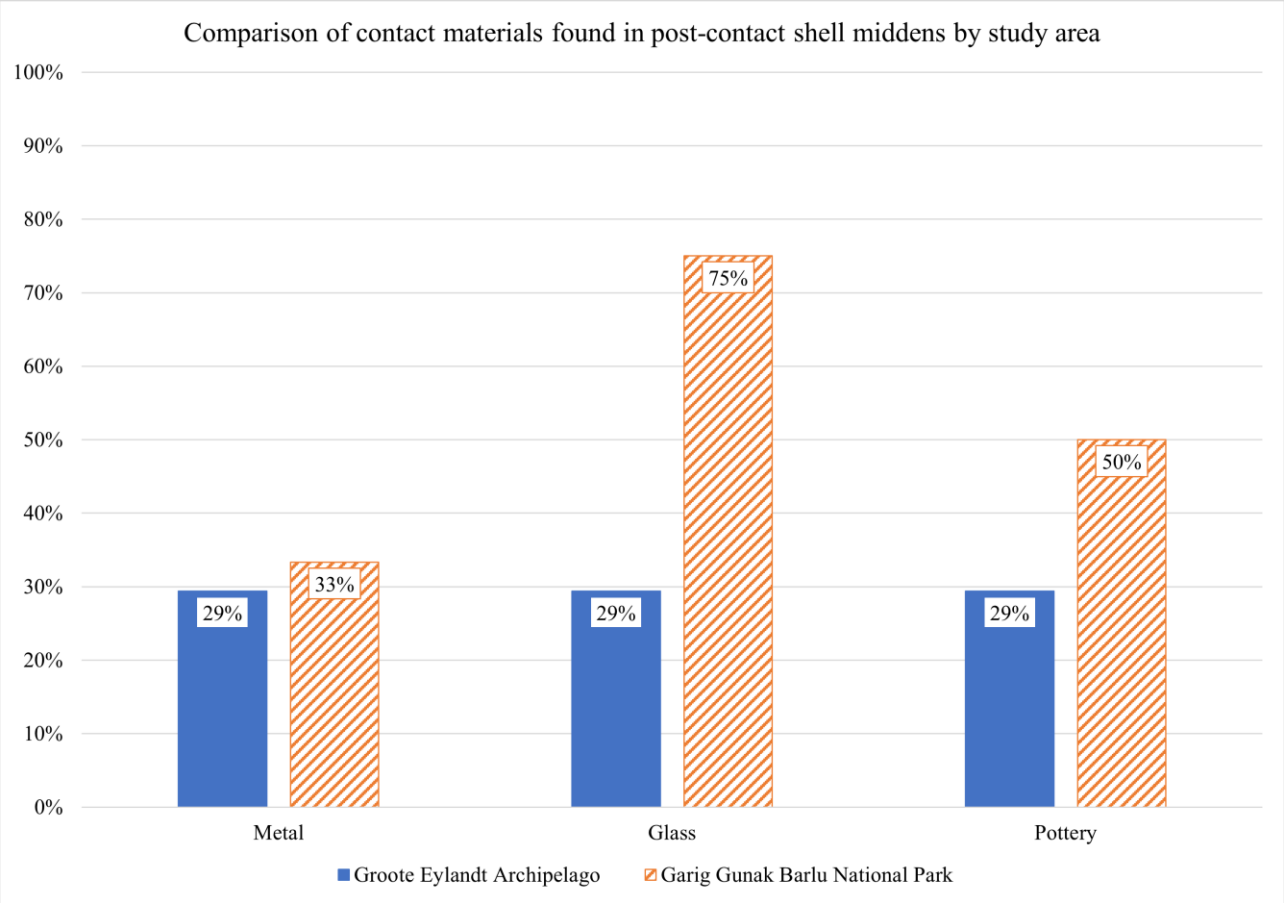


Figure 4-22. Percentage of contact materials found in post-contact shell middens by location. Garig Gunak Barlu National Park studied by Mitchell (1994) and Groote Eylandt Archipelago by Clarke (1994).

CHAPTER FIVE DISCUSSION

This research has set out to explore the interactions between the Macassans and Aboriginal Australians through the study of rock art and shell middens, seeking to answer the question of how did the introduction of dugout canoes influence the social and economic landscape of Indigenous Australians? Here the discussion of each aim presented in the introduction is delved into with support from previous research and introduces areas that will benefit from further investigation.

DStretch and rock art analysis

One of the project aims was to use new technology to analyse rock art images to get a clearer understanding of the depicted subjects. This was done through the use of DStretch, however, the discussion of rock art is a difficult subject without local knowledge and consultation, and even then, the meaning of art changes over time and differs per person. It serves a functional relationship with the community and is a part of a wider complex of culture (Morwood and Hobbs 2002:112-113). Thus, the question of "why" the rock art exists and is presented as it is will not be thoroughly discussed as the situation of this research will not lead to an accurate story of the purpose of creation (see Chapter 3 Limitations).

The use of DStretch and technology to analyse rock art is of great benefit to research. For this research the technology-enabled thorough analysis and identification of the subject analysis and structural analysis of the rock art. However, DStretch has limitations with the quality of the photograph used. Thus, gallery two at Djulirri benefitted minimally through the use of the program due to low image quality producing an indiscernible image when the majority of enhancements were applied. This limited the number of available images due to many sites being documented only a few times before the modern technological boom in camera quality (such as that in Chaloupka 1999:19). Still, the subtle colours around the gallery were highlighted so the full context of the structure could be seen. It is noted that almost 90% of the rock art depictions studied here and depicted in the prior literature show hunting activities, with just one studied here not depicting a clear hunt. However, not all show the results of the hunt, or the animal being hunted. The one canoe depiction at Marligur is that which has no weapons or clear depictions of a hunted animal near it. Painted in red ochre and x-ray style this piece is located further seaward from Djulirri along Marligur Creek. There are two possible reasons for this, one being that the rock art connects to the changes in occupation patterns that occurred after the introduction of dugout canoes (See Chapter 2 and below). Or the rock art is a depiction of a bark canoe, indicated through the vertical lines at the bow and stern of the canoe representing the string used the hold the canoe together. The other x-ray style canoe is located at Red Lily Lagoon and shows two people, one of whom is fishing. It is interesting to note that this depiction

overlays a large intricate crocodile both associated with the recent rock art style, estimated 2,000 years BP and the western third of Arnhem Land (Morwood and Hobbs 2002:115; Taçon *et al.* 2020:218). This determination of age and area of x-ray art was presented by Morwood and Hobbs (2002:115) and is supported by these depictions of Macassan contact rock art. Comparatively, where the rock art is without a doubt a depiction of a dugout canoe is canoe five, the whale hunt at Djulirri, and canoe one, a hunting scene. Both of these depictions have more figures in the canoe than possible with a bark canoe, being five and three figures respectively. This is a documented advantage of the adoption of the dugout canoe. These canoes also feature additional details with canoe one containing six vertical lines from the bow to the stern and canoe five containing a horizontal feature. It is unlikely that these marks are human error and they may reflect patterns found often on figurine versions of the dugout canoes and in some rock art depictions such as those on Chasm Island (Davies 2012:143-144; Rebecca Mirams pers. comm. 2022; McNiven and Brady 2012:79). These can include detailed cross-hatching and "waterline" marks which, at least on Groote Eylandt, can reflect the patterns of clan groups similar to depictions in bark art, possibly indicating who is fishing and/or whose canoe it is (Morwood and Hobbs 2002:108-110).

The most commonly depicted hunting tool is the harpoon, seen in all Djulirri canoe depictions. This supports the hypothesis of Mitchell (1996) that iron was adopted quickly into the community as the superior hunting tool. Mitchell also noted the effectiveness of such an advancement against turtles which are depicted in three canoe depictions, one after it had been harpooned and the other two with the turtle swimming away. This may denote the harder part of the hunt in seeking out and getting close enough to the turtle to harpoon it. The canoe depiction of a whale hunt also includes a likely spear-thrower held aloft by one of the figures in a similar fashion to canoe depictions found on Chasm Island (McNiven and Brady 2012:79). In one depiction and near multiple canoes fishing rods are represented in rock art. These also benefited from iron to be used as hooks when fishing and improved the chances of catching fish. By having hunting depictions so common in the use of canoes it shows that this was likely the main and/or most important function of the dugout canoe.

The magpie goose egg collecting depiction at East Alligator Lagoon stands out as unique against the assemblage. It is not unique due to the repetition, as there are multiple near-identical depictions at Djulirri, it is unique as the activity has not previously been associated with the dugout canoe or presented in rock art. The magpie geese are easy prey during the pre-wet season when food can be hard to come by, and they have large clutches of eggs upwards of 16 per clutch (Newton 2016:12-13; Whitehead and Tschirner 1990:157). Additionally, magpie geese are significant in the Dreamtime of the Kakadu region and surrounding areas, this importance led to specific management of the geese and hunting practices. Any deviation from the set rules in either care or hunting would

lead to a poor harvest the following season (Bayliss and Ligtermoet 2018:1084). This significance of the magpie goose and its connection to Dreamtime likely explains why the canoe depictions are over the top of previous rock art, why they are isolated from other art, and why the two figures are wearing a dillybag each and using sticks rather than paddles to push around the swampy marshland of the geese (Morwood and Hobbs 2002:107-108). The canoe depictions of magpie goose collecting are unique in this collection due to their activity depiction, this is likely a result of their location on the western edge of Arnhem Land where the Kakadu National Park Aboriginal communities had more direct interaction with those from Arnhem Land.

Overall, the use of DStretch has given a means for a more detailed and clear analysis of rock art in Australia. The depictions of canoes studied here show a number of activities and hunting patterns that reflect the changes previously described as a result of Macassan contact. Thus, from this limited sample, the rock art evidence supports a change in behavioural patterns post-Macassan contact and an importance of hunting with dugout canoes.

Likelihood of shell midden changes being influenced by dugout canoes

Secondly, this research sought to assess the shell midden research from northern Australia and determine the likelihood of dugout canoes and Macassan arrival influencing the spatial distribution of occupation sites. This was done through the analysis of shell middens within Arnhem Land, in the Garig Gunak Barlu National Park excavated by Scott Mitchell (1994) and the Groote Eylandt Archipelago excavated by Anne Clarke (1994). These were dotted along the coast on a range of landforms. All analysed sites, rock art and middens, are located within 2km of a waterway or coastline. The furthest distance is approximately 1.5km shared by the Old Peoples' Waterhole midden and Dadirringka midden both on Groote Eylandt. This is indicative of the importance of water to Indigenous occupation. Additionally, a few middens were noted by Clarke (1994) as being individually noteworthy. At Malmudinga the pre-contact deposit was large with a very thin layer of disturbed contact inclusions, this place was likely rapidly abandoned after Macassan contact as this site is close to a known Macassan camp. At Milyipilyumanja and Arumumanja on Bickerton Island are small deposits of a single instance of occupation. Both of these are dated as post-occupation middens and are situated at the thin "bridge" connecting the east and west portions of the island (Figure 4-9). There is a known Macassan site to the northeast of these middens and it is possible that the community was trying to find a new place to settle. The Lerrumungumanja Midden was noted by the Aboriginal guides as being a new occupation site after Macassan contact. In the same fashion, Aburrkbumanja was listed as being near a Macassan site as well. The Lerrumungumanja Rock Shelter, Angwurrkburna, Marngkala Cave and Marngkala Rockshelter all are near rock art galleries. These were unable to be studied during this research for canoe depictions, however, Clarke (1994)

does describe all of these as containing contact rock art. These galleries would benefit from further research to see if they fit the model of hunting depictions in canoes. The Groote Eylandt Archipelago shell midden sites support the hypothesis of change in sustenance patterns after the Macassan contact. There is an increase in turtle remains which are known to have been hunted more easily in dugout canoes and with iron from the Macassans, from previous research and rock art imagery investigations in this research. Additionally, there is an increase in foreign material used in lithics from pre-contact to post-contact sites. Despite an overall decrease in middens with lithics. This indicates an increase in travel from the Groote Eylandt Archipelago approximately 50km west to mainland Australia. As the dugout canoe is a more robust and larger boat than a bark canoe, this journey would have been easier, with a higher success rate and larger storage area for traded goods. Hence, the increase in imported lithic materials can be related to the introduction and adoption of dugout canoes in the peninsula. Furthermore, there is a decrease in the number of post-contact middens containing lithics which may point to an increase in the use of iron and introduced materials such as glass and pottery, rather than stone for some tools meaning less knapping required for upkeep due to their durability. Reinforced by the presence of glass flakes in the post-contact midden at Makbumanja. North of Groote Eylandt resides Chasm Island, which has no researched shell midden sites but does have a vast array of canoe depictions (McNiven and Brady 2012:79). These involve dolphins, dugongs, turtles, and a goanna. Three of these animals are located in middens close by within the Groote Eylandt Archipelago with the outliers being no dolphin in any middens and no shark in the depictions. If this discrepancy is attributed to human error, it would be a misinterpretation of the rock art rather than a misinterpretation of the remains in the midden.

At Garig Gunak Barlu National Park the midden sites show a change in occupation location after Macassan contact. The pre-contact middens are located near clusters of Aboriginal trepang sites and show no preference for being near Macassan trepang sites. However, the post-contact data aligns more favourably with Macassan contact sites with the average distance to Macassan trepang sites and Aboriginal trepang sites being closer than the pre-contact midden. This indicated a change of occupation to be more favourably positioned for the Macassan trades and interactions, but still close to previous areas of occupation. No middens studied by Mitchell (1994) are described as being located near a rock art site. But two of them, middens 7 and 9, are located near tamarind trees (an imported tree species via Macassan contact see Chapter 2 The comforts of home and other tangible evidence of contact), and one was located in the area of an Aboriginal trepang site, but the midden deposit was post-contact, midden 6. Additionally, the regression analysis showed, and graph of the distances showed that the pre-contact sites were equidistant to the Aboriginal and Macassan trepang sites. But the post-contact sites were consistently closer to the Macassan trepang sites than Aboriginal trepang sites. This supports the theory of a change in occupation to be situated closer too the Macassan trepang

sites and their location influencing areas of occupation. Contrary to in the Groote Eylandt Archipelago the number of pre-contact middens containing lithics is less than that of post-contact middens, with a decrease of 22.1%. However, there are imported materials used in lithic production prior to Macassan contact, a small number but still present. This supports the conclusion that the dugout canoe introduction made it easier to import materials as the Garig Gunak Barlu National Park is a part of mainland Australia and travel to different areas for resources could be done on foot. Whereas in the Groote Eylandt Archipelago travel was limited by water so the introduction of dugout canoes made a bigger impact as the bark canoe was less successful for this journey. However, this phenomenon can also be seen in Mitchell's research where there is a 46.5% increase in the number of middens containing imported raw materials. Expanding on the previous conclusion, the use of dugout canoes made it easier to travel from Garig Gunak Barlu National Park to parts of mainland Australia and other coastal islands. While the Groote Eylandt Archipelago had a minimal number of flaked glass, at Garig Gunak Barlu National Park six post-contact middens contained at least one piece, and two of these also contained tobacco pipes. Terrestrial fauna was located in 25% of the post-contact middens and included large difficult to hunt animals such as buffalo and pig. This agrees with the data from the Groote Eylandt Archipelago and the impact the introduction of metal had on successful hunting.

However, to support the correlation to the introduction of dugout canoes this phenomenon must not be seen in other places where there is no Macassan contact. Environmental changes are a known influence for causing changes to sustenance patterns as food becomes more or less available (Bourke *et al.* 2007; Tynan 2017). One such large shift in settlement patterns, social exchange and diet is presented by Bourke *et al.* (2007:98) between 800 and 600 years before present when significant climatic shifts reduced the availability of bivalves leading to agricultural developments in Arnhem Land. Furthermore, shell midden research on the area of Blue Mud Bay has shown general variability in the behaviour of Aboriginal communities and use of the landscape despite climatic changes in the region (Faulkner 2006; 2008). Furthermore, the tends of mollusc exploitation in Clarke (1994) aligns similarly with the more recent exploitation patterns presented by Faulkner (2006) that conclude an indifference to climate changes when compared to shifts that occurred to communities thousands of years ago. These studies focusing on shells as environmental markers do not include or indicate the occurrence of large climate shifts before and after the period of initial contact with the Macassans. Thus, from this midden analysis, the changes in sustenance patterns are more likely influenced by the arrival of the Macassans and the traded information rather than any sudden climatic shifts. The shell midden sites at Garig Gunak Barlu National Park and the Groote Eylandt Archipelago excavated by Mitchell (1994) and Clarke (1994) respectively show archaeological evidence of the change in

sustenance patterns and spatial distribution of Aboriginal communities from a time before Macassan contact and a time after contact with the introduction of dugout canoes.

Information transfer and distribution of dugout canoes in Australia

One question that stood out to me when beginning this research was the limited dispersal of the dugout canoe within Australia once it had arrived. While this was earlier attributed to Aboriginal Australians being unable to make their own, this has since been disproven and is known to have stemmed from the racist beliefs of early researchers. Thus, I set out to see if there was any insight from these excavations and depictions that may present some understanding into why this seemingly better new technology was not proliferating all of Australia. Despite being situated across Arnhem Land the rock art imagery of dugout canoes reliably showed figures engaging in hunting activities and the changes in shell middens in relation to the Macassan contact indicate this information exchange was a pivotal moment for indigenous communities. The sites are all near the coastline and the more inland rock art sites of Djulirri, Red Lily Lagoon and East Alligator River sit on major rivers and waterways that would have acted as water highways to reach the wider ocean. The presence of accessible rock art near studied midden sites that is available for additional research is variable, however, some insight is available through previous research. At Groote Eylandt bark art is the more common form of pictorial depictions, and a canvas that does not preserve as well, but here the researched contact bark art shows a lack of people on praus and larger sailing boats which suggest an unfamiliarity with the subject (Clarke and Frederick 2006; Ross and Travers 2013). Modern Aboriginal bark art paintings that were inspired by childhood memories and influences from rock art presented a more holistic knowledge of the praus, however, these were inconsistent and had the influence of hindsight and modern knowledge (May *et al.* 2009:381-383). This is contrasted to a place like Djulirri where large sailing ships and praus are shown in detailed x-ray style depictions with recognisable internal compartments. This comparison indicates differing interactions with the Macassan foreigners by region. Artist Rosa Marnga, from the Wunambal Gaambera tribe, and the Kwini tribe (both within the Kimberly region in Western Australia), recalls stories that only the leader of the Gaambera people would interact with the Macassans, others were required to go through him. These differences throughout Australia allude to differing perceptions of foreign visitors and levels of caution during interactions. Likely explaining the minimal dispersal of dugout canoes throughout Australia. Areas without direct positive Macassan contact, possibly from unsuccessful trading attempts of an undesirable item, newly introduced diseases, or conflict, led to communities being wary of the new technology (Brady 2013:144-145; Ganter 2018:267; Macknight 1972:73-75; Russel 2004:15).

Finally, the presence of introduced material within middens is quite small., averaging 41% of middens containing at least one piece of metal, glass and/or pottery. This indicates that the trade of goods to the Macassans may have been seen as "not worth it" by some communities due to the low yield of commodities. This conclusion is considered preliminary and community engagement would benefit it greatly, as midden sites are "old garbage dumps" and thus it is possible that the imported material was of a high value and was rarely discarded amongst local goods. It is then likely that the isolation of communities from the Macassans directly and variable interactions with the foreigners may have led to more inland and separate communities being wary of the new technology and choosing not to invest resources into dugout canoes.

Previous assumptions about dugout canoes

Finally, as touched on before, through the years new information and analysis have come to light that changes previous assumptions about the social and economic impact of dugout canoes. Generally, unintentionally these assumptions can proliferate throughout the research as fact with little evidence presented to support it. One of these that will be discussed here is that previous studies point to the time of contact between the Macassan traders and Aboriginal Australians to be the first half of the 18th century as this is when VOC records indicate a high international import and praus appear in rock art (Knaap and Sutherland 2004:98-99). However, there are some outliers to this that can be seen in this and previous research. Taçon *et al.* (2010b) presented radiocarbon dates of praus at Djulirri with one beeswax praus having a minimum date of 1664 AD if not earlier. Within this research Clarke (1994) located a smaller pottery sherd in a pre-contact midden dated to 930 +/- 60 years before present at Dadirringka. Dadirringka is located on the southwestern portion of Groote Eylandt at the base of Diduwa (Castle Rock) the highest point on the west coast. However, this pottery sherd is of a low temperature sandy temper and is different to the Macassan earthenware fragments. It is possible that this sherd could have shifted down the stratigraphy due to post-depositional processes, but there is no strong evidence to suggest this occurred. Clarke presents this evidence as supporting Macknight (1986:69) in an earlier date of Macassan contact. However, this data was re-evaluated in Macknight (2008) based on Knaap and Sutherland (2004) (see Chapter one for further information). The research of Knaap and Sutherland (2004) uses an analysis of VOC records that indicate the 1720s as the earliest possible date for contact. Here, however, with the more recent radiocarbon dating by Taçon *et al.* (2010b), I support the thought of earlier contact separate from the VOC, hence not seen in their records. This earlier Indigenous Indonesian led contact may also indicate how they knew when and where to travel for the trepang when there was an industry demand with the VOC. As the praus and outrigger canoes brought from Indonesia are considered to be developed watercraft it is likely they could cross seas from an earlier time, possibly with differing success while the techniques were still

being perfected. Any early contact would likely have been very small scale and sporadic in nature, possibly not originating from Makassar, but with no additional evidence of a different point of departure and/or group of people making this journey the most likely thought at this time that they were early Macassan sailors. But further testing of early Macassan pottery and additional shell middens and expansion of excavations within Groote Eylandt are required to support this.

Further research

Further research to improve this analysis would be the excavation of shell middens in areas of high concentrations of dugout canoe rock art imagery such as Djulirri and Chasm Island and a comprehensive survey of rock art in areas of excavated middens such as Groote Eylandt, Bickerton Island and along Garig Gunak Barlu National Park. This would present further evidence of the direct relationship between midden data of changes to sustenance patterns and the correlation to dugout canoe, when nearby rock art shows the community engaging in activities that are likely to cause these patterns, like those presented here. Overall this would add to the pool of knowledge about the Macassan contact period and the continuing effect it had on northern Australia.

Additionally, further research into Indigenous Indonesian pottery and early Indigenous led travel to Australia could lead to insights into the pre-contact pottery found at Dadirringka on Groote Eylandt. Whilst starting with the Macassan route, this should not be confined solely to what we know of who travelled and how they travelled under the VOC. Another Indonesian or island community making the journey is also likely.

Finally, this research would benefit from modelling of distribution outside of Arnhem Land where contact is still known such as on Vanderlin Island, Sir Edward Pellew Group approximately 160 km south of Groote Island (Sim and Wallis 2008:103). If these areas where direct contact is known also support the changes to distribution and sustenance patterns seen through Arnhem land the cause and model of change would be more robust.

CHAPTER SIX CONCLUSION

This thesis has endeavoured to lay new eyes on previous research and used technological advances to gain new information about rock art. The focus of research has changed through the course of study due to limitations on travel and accessibility as Australia evolved through the coronavirus pandemic. This has shifted the focus from a purely rock art study to incorporate previous midden data and develop a broad pattern of behavioural changes. The previous studies that presented their data in a manner that facilitated further study were that of Anne Clarke (1994) and Scott Mitchell (1994). As a focus point, this research indented to explore the influence of dugout canoes on the social and economic landscape of Indigenous Australians. Intending to add some physical evidence to the long-held belief that the introduction of dugout canoes led to further travel and changed sustenance patterns. The majority of this evidence is based on the ease of the task being performed in a dugout canoe compared to a bark canoe, rather than any physical or empirical evidence of a change in the behaviour of Aboriginal communities.

In this thesis, I have shown that the use of new technology can lead to greater insight into rock art depictions in Australia. These depictions show a range of hunting activities and prey associated with dugout canoes. They support the analysis of other canoe depictions in rock art around northern Australia. Furthermore, the shell midden data from excavations undertaken by Clarke (1994) and Mitchell (1994) supports the change in distribution and sustenance patterns post-Macassan contact. The post-contact middens across both studies contained an increase in turtle, dugong, shark and terrestrial fauna bones that indicate an advancement in hunting capabilities. Furthermore, both areas had an increase in imported lithic raw material, from none in pre-contact sites in the Groote Eylandt Archipelago and a lesser amount at Garig Gunak Barlu National Park, indicating that the introduction of dugout canoes facilitated this increase in seaward travel to more easily collect different materials, and that it was particularly prominent for island communities. But if these canoes were so great, why are they not used all over Australia? I propose that there was a dissonance between some Aboriginal communities and the foreigners that did not facilitate the desire to take up foreign technology. The percentage of middens with Macassan materials is relatively small and may not have been seen as a fair trade to some Aboriginal communities. Additionally, in retellings of interactions, the trade of goods can be through one central person that would still generate some distrust even when trade was still being undertaken, especially in areas with minimal translators. Finally, the data presented by Clarke (1994) alludes to the possibility of early contact with the Macassans and other foreigners through a pre-contact pottery sherd. While Clarke presents the possibility of an agreement with an early contact date that has since been re-evaluated by the original author (Macknight 1986; 2008), a more recent article has been published presenting an earlier date from radiocarbon dating of a

beeswax prau at Djulirri. Therefore, I support the possibility of an earlier Indigenous Indonesian led travel to Australia prior to VOC involvement and their records. This also presents the possibility of an avenue of further research that is increasing in evidence. Any earlier contact would likely have been very small scale, sporadic in nature and possibly not connected to Makassar at all.

In conclusion, this thesis has presented an analysis of rock art and a re-analysis of shell midden data that provides evidence to support the theory that the introduction of the dugout canoe changed the distribution and sustenance patterns of Aboriginal Australians. This research supports the growing argument of an earlier date of first contact with the Macassans and proposes social differences and minimal value in interaction as the reason for the stunted proliferation of the dugout canoe through Australia. Overall, the dugout canoe provided Indigenous communities with a means to travel further with ease and facilitated more successful hunting of high value foods which altered the social and economic landscape of Indigenous Australians.

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APPENDIX ONE PICTORIAL ANALYSIS OF CANOE DEPICTIONS IN ROCK ART

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Figure 7-1. Stages of analysis for canoe one at Djulirri. a) original photograph by Daryl Wesley, b) DStretch enhancement with YWE matrix, c) DStretch enhanced image with canoe scene traced in Sketchbook application, d) final isolated drawing.

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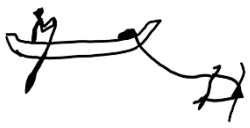

d)

Figure 7-2. Stages of analysis of canoe two at Djulirri. a) original photograph by Daryl Wesley, b) DStretch enhancement with YWE matrix, c) DStretch enhanced image with canoe scene traced in Sketchbook application, d) final isolated drawing.

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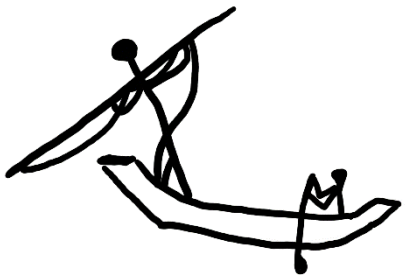

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Figure 7-3. Stages of analysis of canoe three at Djulirri. a) original photograph by Daryl Wesley, b) DStretch enhancement with YWE matrix, c) DStretch enhanced image with canoe scene traced in Sketchbook application, d) final isolated drawing.

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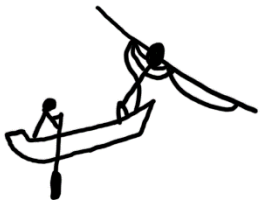

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Figure 7-4. Stages of analysis of canoe four at Djulirri. a) original photograph by Paul Taçon, b) DStretch enhancement with LAB matrix, c) DStretch enhanced image with canoe scene traced in Sketchbook application, d) final isolated drawing.

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Figure 7-5. Stages of analysis of canoe five at Djulirri. a) original photograph by Paul Taçon, b) DStretch enhancement with LAB matrix, c) DStretch enhanced image with canoe scene traced in Sketchbook application, d) final isolated drawing.

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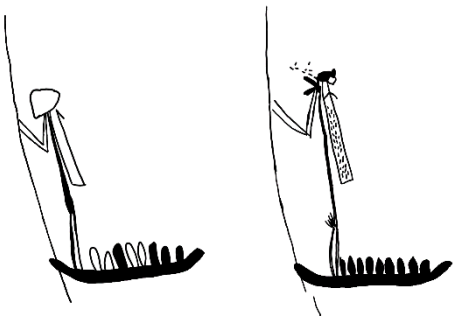

c)

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Figure 7-6. Stages of analysis of canoe six on the left and canoe seven on the right at East Alligator River. a) original photograph by Daryl Wesley, b) DStretch enhancement with LAB matrix, c) DStretch enhanced image with canoe scene traced in Sketchbook application, d) final isolated drawing.

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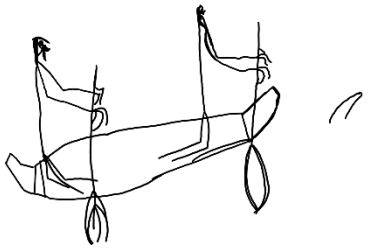

c)

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Figure 7-7. Stages of analysis of canoe eight at Marligur. a) original photograph by Daryl Wesley, b) DStretch enhancement with LRE matrix, c) DStretch enhanced image with canoe scene traced in Sketchbook application, d) final isolated drawing.

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Figure 7-8. Stages of analysis of canoe nine at Red Lily Lagoon. a) original photograph by Daryl Wesley, b) DStretch enhancement with LDS matrix, c) DStretch enhanced image with canoe scene traced in Sketchbook application, d) final isolated drawing.