KEYWORDS: ***Murujuga – Burrup – Rock art – Site type – Distribution***

OF TURTLES IN PARTICULAR: A DISTRIBUTIONAL STUDY OF AN ARCHAEOLOGICAL LANDSCAPE IN SOUTHERN MURUJUGA

R. G. Gunn and K. Mulvaney

Abstract. An audit of rock art and other archaeological sites was undertaken of a limited area of the Hamersley Iron lease, on Murujuga (Burrup Peninsula), Western Australia. An analysis of the finds found that occupation was focused on two rich resource areas, foreshore and inland waterholes. Rock art, however, was found throughout the area but was more concentrated around the inland waterholes, with secondary concentrations on the foreshore but not in association with the coastal midden. Examination of the variation of one particular motif, 'turtles', showed that while reflecting the pattern of overall motif concentrations, particular design forms did not occur over the whole area. One interpretation of the distribution could be that individual designs were produced (or owned) by particular groups or persons. It is also possible that the stylistic forms reflect chronological phases in the production of the rock art.

Introduction

Murujuga, the Burrup Peninsula of northwest Western Australia, is a rugged rocky landscape jutting out into the warm waters of the Indian Ocean. It is one of the many landforms that comprise the islands of the Dampier Archipelago. Since the 1960s it has been the focus of industrial development, providing the export facilities for iron ore and evaporated sea-salt. In the late 1970s construction started for what is now one of Australia's major liquefied natural gas plants. Under State Government support, continued industrial expansion has occurred, especially within the last six years. This is despite the now recognised National Heritage value of the rock art and cultural landscape of the Dampier Archipelago (Bednarik 2007a), including Murujuga, which will be severely compromised by these developments.

An audit was recently undertaken of select areas on the Hamersley Iron lease toward the southern end of Murujuga, an area known to be rich in archaeological features. Unlike a comprehensive survey, an audit is a summary examination to obtain a true and fair view of the archaeological resource. The work was undertaken as a preliminary to future industrial development to provide management with an indication of areas better avoided at the initial stages of planning. While not a detailed archaeological survey, the study permitted a preliminary analysis of the distribution of the features over a specific landscape and provides data for comparison with other areas of Murujuga.

The rock art of Murujuga has been a feature of study over the past forty years (Bednarik 1977, 1979, 2002, 2003, 2004, 2006, 2007b; Dix 1977; Dix and Virili 1977; Virili 1977; Green 1982; Lorblanchet 1983, 1985, 1992; Vinnicombe 1987a, 1987b; 2002; Veth et al. 1993, 1994; Gunn 2003, 2004a, 2006; Jo McDonald CHM 2005, 2006). These have mostly been broad-scale studies attempting to gain an overall appreciation of the art and archaeology of the region as a whole. As a result the region is now recognised as one of the World's richest areas of petroglyphs. However, little detailed work has been published on the distribution and variation of the archaeological record at a local level (however, see Green 1982; Harris 1988; Lorblanchet 1992; Lorblanchet and Jones 1979; and Turner 1981). This paper presents the results of one such local study.

Images of what look like, and are interpreted by local Aboriginal people as, turtles are a prominent motif in the rock art of Murujuga. Since many human figure motifs remain sensitive to the local Aboriginal people, turtles were selected for analysis, owing to the fact that they do not hold the same cultural restrictions, are widely distributed and occur in a broad variety of

Figure 1. *Murujuga and the location of the study area.*

Figure 2. *The study area in relation to King Bay and the Pistol Range (note the dark areas of exposed rock).*

forms, from simple outline to complex infill patterns (Green 1982; Vinnicombe 2002; Jo McDonald CHM 2006).

The study area

The study area, designated as the 'King Bay South Block', is located towards the southern end of Murujuga (Fig. 1). The block is approximately 2.1 × 0.9 km in extent and covers around 1.4 km^2 (144 ha) of land (Fig. 2). The block is bounded on the north by the sea, the east by a large tidal inlet, and to the south and west by existing vehicle tracks. The area includes a coastal strip, an elevated rocky plateau-like rise, two feeder creeks, two ephemeral waterholes (Muddy Pool and Turtle Pool), and a series of inland rocky knolls (Fig. 3). While both waterholes are fed by freshwater, these can be inundated by saltwater at unusually high tides.

Figure 3. *Muddy Pool from the AM knoll.*

For expediency, a flat grassy area above the beach line, a popular place for fishermen and weekend campers at the northern end of a long valley, was designated 'Garam Beach'; and a rocky point at the northern end of the study area, 'Pelican Rocks'. Although within the Hamersley Iron Lease, the area is not fenced and is often accessed for recreational visits by local residents. As a consequence, some graffiti production, vandalism and littering has occurred.

Topographically, the sea front is bounded by cliffs and slopes up to 10 m high. These continue around the headland and form the northern side of the interior valley. To the south of the creek, small rocky knolls rise from the plain to a maximum height of less than 10 m.

The block can be traversed on foot in less than an hour and the two waterholes are only ten minutes apart. The coastal strip and inland environments are therefore readily accessible from either of the waterholes or from the coastal midden.

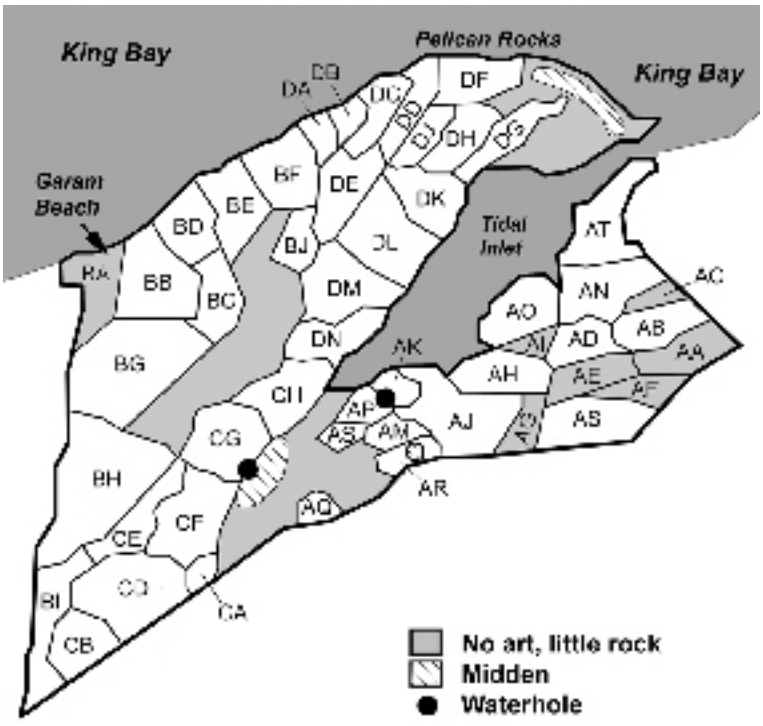

Figure 4. *The survey units.*

Methods

The 1.4 km² area of the block was examined by pedestrian inspection. The area was sub-divided into 55 units for convenience of the investigation and subsequent analysis (Fig. 4). The location of each archaeological feature observed was plotted with a hand-held GPS and also directly onto an aerial photograph. A GPS reading of each feature was recorded if it was greater than 5 m from its neighbour. In areas where features formed an almost constant array, GPS locations were taken at c. 10 m intervals. For petroglyphs, each panel was recorded with a cursory tally of motif types along with photographs of its location, panel and selective details. Other site types were recorded by area and sampled content, with photographs of location and selective details. The audit took around 60 person-days for what is, by Murujuga standards, not a particularly rocky area, and indicates the time requirements for detailed surveys on the difficult terrain of the archipelago.

The archaeological features

Individual archaeological features were taken as the basic unit of recording rather than any arbitrary site unit as, due to the near continuous concentration of features, the whole area could be classed as a single site or series of conjoining site complexes. Features recorded included rock art panels (rock faces with petroglyphs); standing stones (vertical, pencil-like stones chocked by smaller stones); stone artefact concentrations (flakes and cores), stone quarries, or singular unusual artefacts (such as large cores), as a light background scatter of flaked stone occurs across the area; an artificial stone wall; several stone arrangements; and two large and one small shell midden.

In total, 2847 archaeological features were located within an area of 1.4 km² (excluding the area of the tidal inlet; Table 1). This gives a density of 2033 features per square kilometre, orders of magnitude greater than other surveys conducted on Murujuga and several other islands of the Archipelago which range from 62–110 per km² (see Vinnicombe 1997: 54). There is a very close parallel with the distribution plot of these features and the occurrence of bedrock outcrops (Figs 5 and 6), and indeed, the only features not on bedrock were three shell middens and a stone arrangement. One of the large middens lies on the sandy point of the inlet, and the other on the grassy flat adjacent to Turtle Pool. The small midden lies on a creek bank at the base of an isolated knoll. Although this midden has been eroded by the seasonal creek flow, because of the shape of the landform it sits on, it is unlikely to

Feature	No.
Petroglyph panels	1889
Flaked stone	842
Grinding patches	141
Standing stones	87
Other stone structures	4
Flaking-stone quarry	1

Table 1. *Archaeological features recorded.*

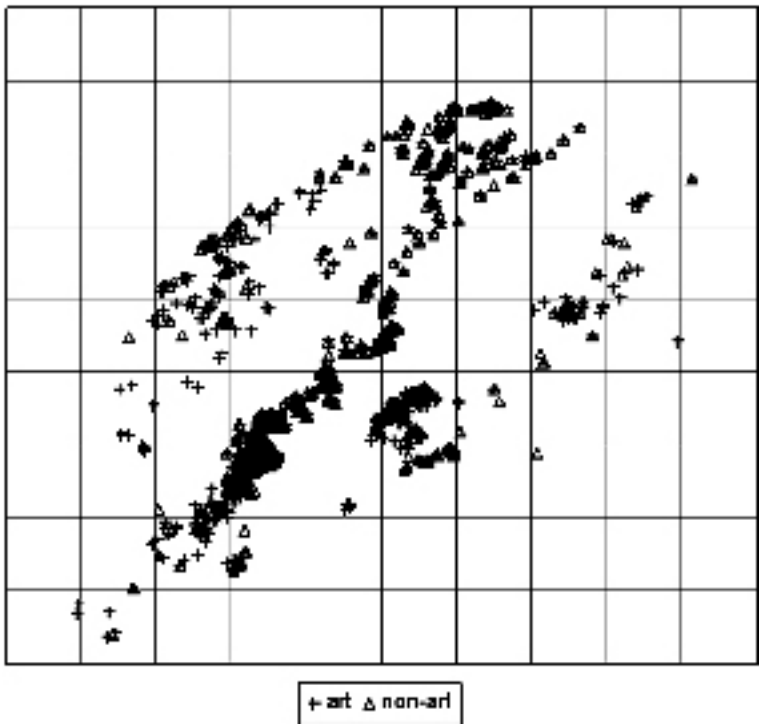

Figure 5. *Distribution of all archaeological features recorded.*

have ever been the size of the larger two. The location of the stone arrangement is not shown for security reasons but it is not closely associated with any other archaeological or outstanding natural feature.

The features included 1889 art panels, bearing 4015 individual petroglyphs or an overall density of 1349 panels and 2868 petroglyphs per square kilometre. As the rock outcrops occupy an area of 30 ha, this gives an overall density of 0.006/m² of the available surfaces, or around one petroglyph per 10 m². However, the actual density varied from small outcrops with over a hundred motifs, to large outcrops with no motifs. Motif density on individual panels also varied, with large panels completely filled with a single detailed motif, small panels with a single small motif, and medium-sized panels with a dozen small motifs and others of similar size with only single small motifs.

The flaked-stone features were either small scatters of flaked stone or isolated cores. All were of grey-black granophyre and while most were irregular flakes, a few had collections of blade flakes and the single quarry site (Fig. 6) appears to have been a location specialising in blade reduction (see also Veth 1982).

Grinding patches occurred on 141 horizontal bedrock panels. These have concentrations at both waterholes and along the creek-lines, with another large concentration adjacent to the foreshore in the BB area (Fig. 7). The number per panel ranged from one to four, with a total number of 159 patches. These ranged from 13 mm to 90 mm in length, with widths being around half the length. The median length was 30 cm, median width 16 cm and the width to length ratio ranged between 1 and 4.5, with a median value of 1.8. On morphological character, these grinding patches are the likely result of plant-food processing (see also Turner 1981).

Standing stones were located across most of the area (Fig. 6) but were more concentrated on the outcrop overlooking the creek-line and Turtle Pool. As there are many naturally standing stones within the larger outcrops, only stones that had been chocked were recorded here, although it is highly

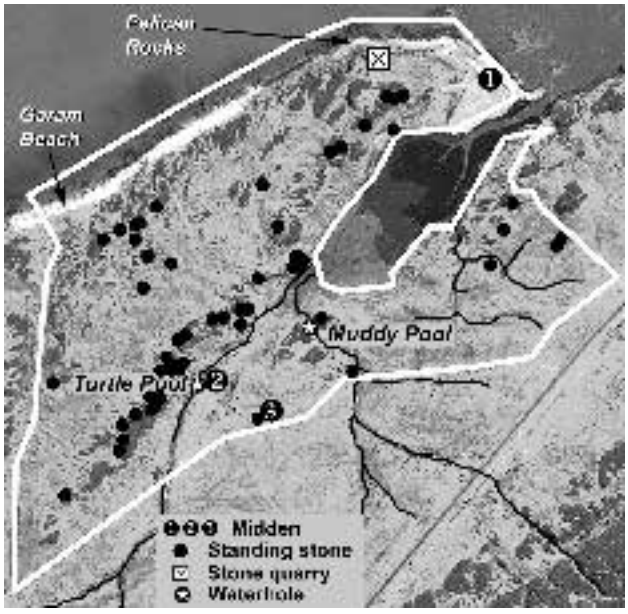

Figure 6. *Locations of major non-art features.*

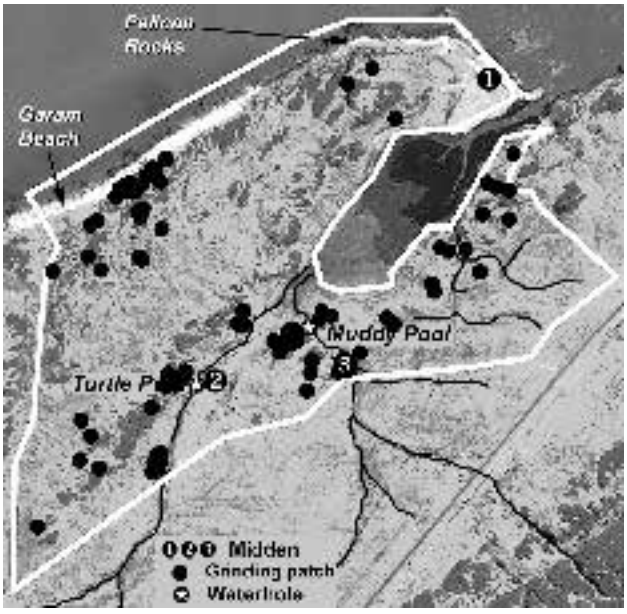

Figure 7. *Distribution of grinding patches.*

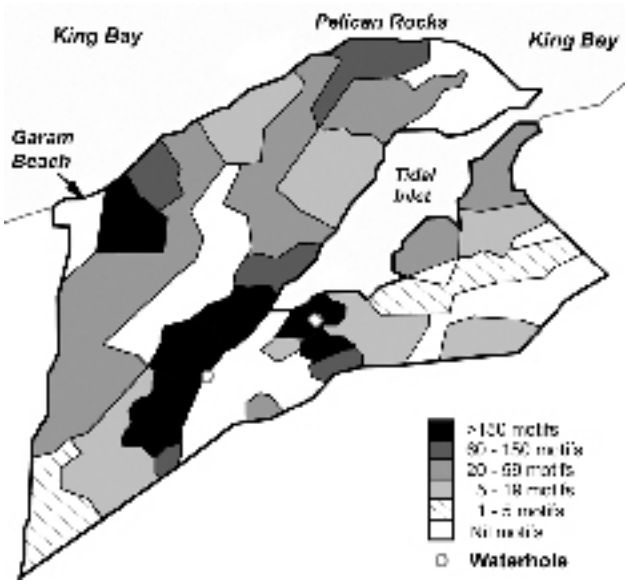

Figure 8. *Petroglyph densities.*

likely that a good number of those not chocked were also artificially placed. Immediately outside the study area, on the eastern side of the tidal inlet, is a significant concentration of over 96 standing stones on a single knoll, known as Echidna Hill. Within the study block, 97 individual standing stones were recorded from 87 locations. The maximum number per location was eight, but only seven locations had more than a single stone. The stones were generally small, ranging from 0.18 m to 1.3 m in height (median 0.55 m, with only three over 1 m tall; n=80). While the majority were placed on or near the crest of their respective outcrops, most were inconspicuous in their placement, being small rocks among larger rocks. For them to have been clearly visible from any distance greater than a few metres, they would need to have been painted or otherwise decorated, although there is now no evidence for such a practice. Also, no pattern of alignment with other cultural or natural features was detected.

Other stone features recorded were a stone-walled shelter, two singular stone cairns, and one stone arrangement. Due to the difficulty of distinguishing between made, used and natural pits on the rock slopes, clear evidence of use or modification was required for a 'pit' site to be recorded as an archaeological feature. On this basis, no 'pit' sites were recorded within the study area.

The petroglyphs

Petroglyphs occur throughout the study area (Fig. 5), although they tend to be concentrated in four areas: around the two waterholes, behind 'Garam Beach', and to a lesser extent around 'Pelican Rocks' (Fig. 8). Just over two-thirds of both the art panels and the motifs occur around the two waterholes, indicating that the waterholes provided the principal foci for rock art production (Table 2). Overall, the area has an average density of 29 motifs per hectare across the study area and 134 petroglyphs per hectare within the boulder formations.

Concentration	Panels		Motifs	
Turtle Pool (CG, CH, CF)	766	40%	1626	40%
Muddy Pool (AK, AM, AP)	451	24%	1099	27%
'Garam Beach' (BB)	123	6%	210	5%
'Pelican Rocks' (DF)	28	1%	62	2%

Table 2. *Motif concentrations.*

Of the 4015 motifs recorded, 3465 (86%) could be arbitrarily classified by type; with the other 550 being only fragmented remnants (Table 3). For the purposes of this study, the motifs were grouped into eighteen broad types with additional categories for 'other' (particularly amorphous areas) and fragments.

MOTIF TYPE	No. of motifs	*% of motifs*	No. of panels	*% of panels*	Max motifs/ panel
'Human figure'/ anthropomorph	932	*27*	577	*32*	13
Geometric element	740	*21*	540	*30*	7
Simple design	334	*10*	277	*15*	9
'Bird track'	278	*8*	161	*9*	13
Other	228	*7*	178	*9*	6
'Turtle'	175	*5*	166	*9*	3
Oval	169	*5*	145	*8*	4
Other animal	124	*4*	111	*6*	3
Other marine	120	*3*	96	*5*	8
'Macropod track'	61	*2*	47	*2*	5
'Human foot'	59	*2*	50	*3*	3
'Egg-set'	56	*2*	51	*3*	3
'Bird'	46	*1*	38	*2*	3
'Marine liver'	41	*1*	37	*2*	3
Complex design	39	*1*	36	*2*	3
'Macropod'	26	*<1*	23	*1*	3
'Marine tail'	20	*<1*	19	*1*	2
'Archaic face'	9	*<1*	9	*<1*	1
'Turtle run'	8	*<1*	6	*<1*	3
	3465	*100*	1828		
Classified motifs	3465	*86*	1828		24
Fragments	550	*14*	261		9
Total	**4015**	***100***	**1889**		

Table 3. *Overall motif frequencies.*

Figure 9. *Well designed and carefully executed motifs.*

There were 1032 panels (55%) that had only a single motif, 412 panels (22%) with two motifs, and 184 (10%) with three motifs. Twenty-eight panels had from 10 to 24 motifs (1.5%), although only three had 20 or more motifs. For the 577 panels with 'human figures', 67% had a single figure, 20% two figures, 7% had three figures and less than 1% had 10 or more. For turtles, 95% of the engraved panels had a single motif, 4% had two 'turtles', and <1% (a single example) had three 'turtles'. That is, there are no occurrences with more than three 'turtles' per panel.

Production and placement

Technique of production was not quantified as part of this investigation. It was clear, however, that the petroglyphs were mostly produced by direct percussion 'pecking' with pointed implements. In this sense, and contra Maynard (1977), 'pecking' and 'pounding' are both direct percussion techniques, with pecking producing distinct pits while pounding, made with a rounded mur-e, produces an image by shallow bruising of the rock surface (cf. Bednarik 1998). A small number of other motifs were produced by scratching or abrading (cf. Vinnicombe 2002: 15–16). In a few instances, motifs have combined two techniques and, in several examples, a motif in one technique has been later refreshed or modified in another. In the small number of superimpositions that could be readily interpreted, scratching and abrading both overlie pecking.

The quality of motif production varies greatly, from what appear to have been rapidly executed, unrefined shapes, to apparently carefully considered designs done with precise pecking that required a high degree of technical proficiency (Fig. 9). Although subjective, an assessment between excellence and inferiority of particular motifs (from either a Western or Indigenous perspective), mapping the quantity and distribution of motif quality is an aspect that deserves further attention.

The primary inclination of the art panels (horizontal <45° or vertical ≥45°) was recorded to examine the aspect of publicity (viewing exposure/display coverage). Vertical panels can be viewed by a greater number of people at one time and from a greater distance and therefore have the potential to have been used differently. Hence, vertical panels should be better suited for the placement of display art, 'markers'

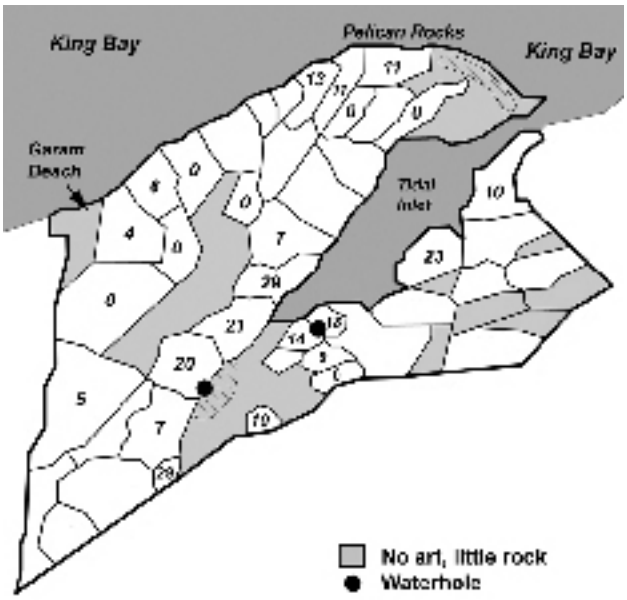

Figure 10. *Percentage of fragments for areas with >20 motifs.*

or instructional (rather than personal) art. Overall, 29% of the 1889 panels were vertical and these occur throughout the study area but with a concentration around Muddy Pool (38%, n=208). Probably not coincidentally, this is where the greatest number of 'cliff faces' occurs. Visually, however, only three motifs stand out for their placement. All are large (>1 m) and on prominent vertical surfaces. At Muddy Pool, a complex zoomorph (180 cm; Fig. 36) has been positioned near the crest of the outcrop. Although now difficult to see due to its weathering, at the time after its production it would have been a stunning sight from the flat plain below. At Pelican Rocks, a large and exquisitely designed 'pelican' motif (110 cm; Fig. 9a) has been placed conspicuously on a cliff face overlooking the open beach. Within the centre of the plateau, between the tidal arm and the sea, two large, horizontal eel-like motifs (170 cm and 110 cm) have been placed low down on a cliff face within a narrow gully. Consequently, they can only be viewed from directly in front of the panel and, unlike the former two, they are not in an area of dense petroglyphs. The lack of similarly outstanding motifs in the Turtle Pool and 'Garam Beach' areas suggests that these four figures would have had an extraordinary function.

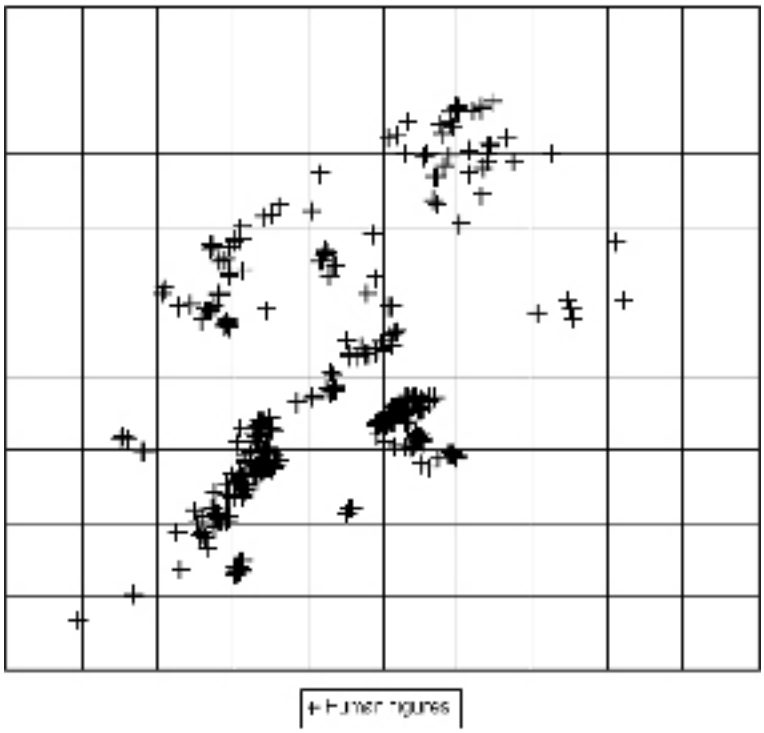

Figure 11. *Distribution of 'human figure' motifs.*

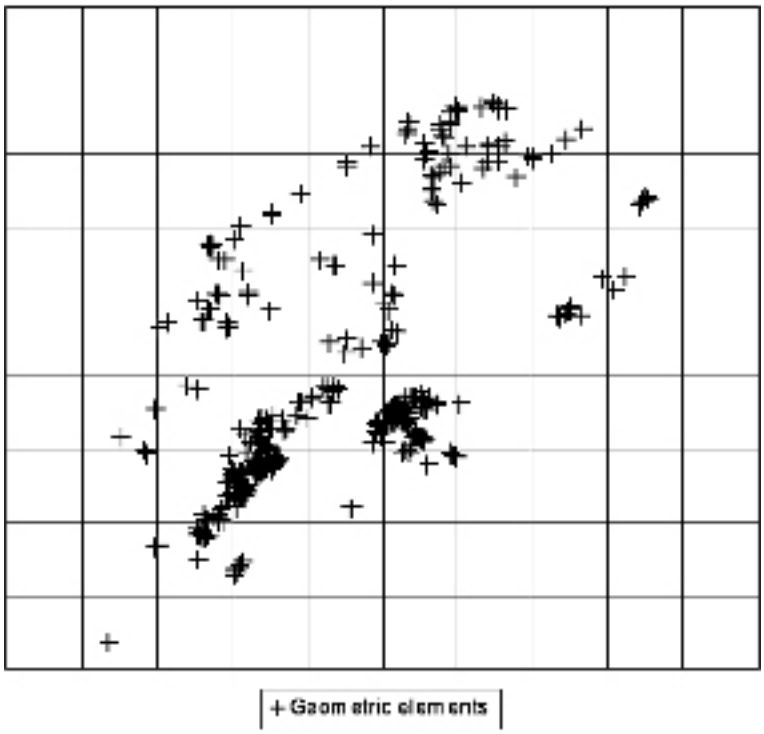

Figure 12. *Distribution of 'geometric element' motifs.*

Motif types and distributions

In the following, the labels given reflect those of common parlance among researchers on Murujuga and that used by contemporary Aboriginal custodians. These do not necessarily reflect the interpretations of the creators of the rock art or its past custodians and hence are offered purely as a convenient descriptive tool (cf. Clegg 1991; Bednarik 2007b: 241–3).

Fragments: This amalgam of markings comprises, as the name implies, segments of petroglyphs that preclude their being classified into recognisable subjects. The 550 fragments accounted for 14% of all petroglyphs. They occurred on 261 panels, with a maximum number of nine. Sixty-one panels had only fragments. They are not distributed evenly over the study area. Overall they are more numerous in areas with higher motif numbers, however, on a percentage basis, their distribution is variable, ranging from 0% to 30% regardless of overall motif numbers. The percentage of fragments is higher in the inland areas compared to those along the coast (Fig. 10), and particularly the areas around Turtle Pool. Whether this is due to earlier art production around the inland waterholes, as appears to be the case elsewhere at Murujuga, or is a factor of greater coastal erosion of the rock art (n.b. Bednarik 1994) remains unclear at this stage.

Human figures: 'Human figure/anthropomorphs' are the most numerous and widely distributed motif type, of which 932 were identified on 577 panels (Fig. 11). These occurred in a wide variety of schemata,

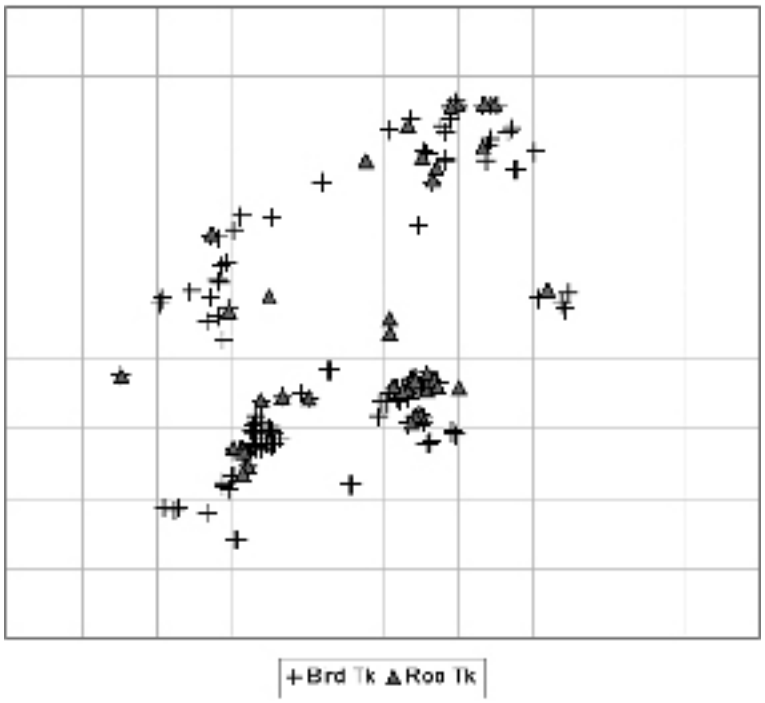

Figure 13. *Distribution of 'bird track' and 'roo track' motifs.*

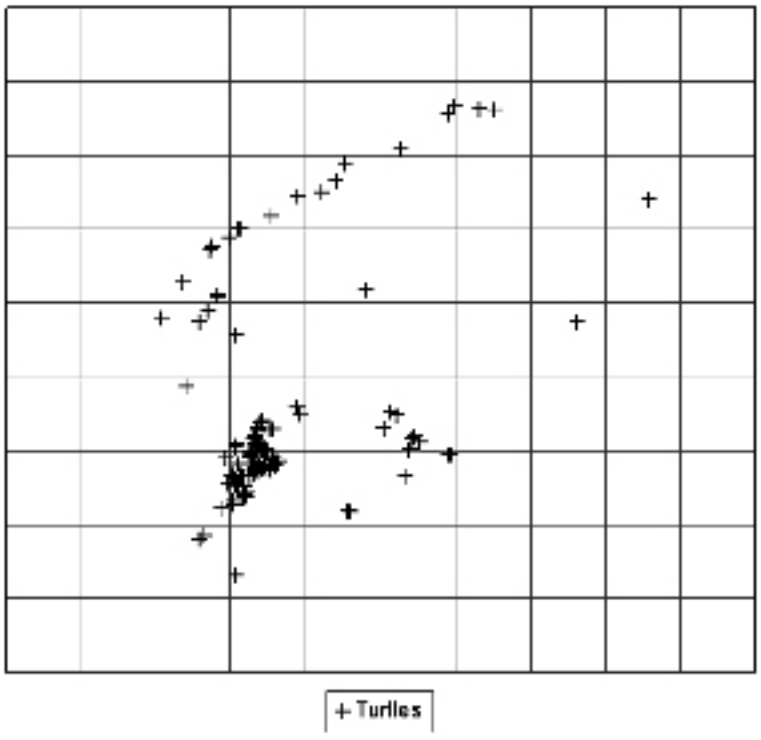

Figure 14. *Distribution of 'turtle' motifs.*

including profile and 'climbing-man' types. The most common form, however, was the frontal stick-figure. As the human figure depictions are particularly sensitive to custodians today, they will not be illustrated or further discussed.

Geometric elements and simple designs: Geometric elements (740 cases) consisted of a wide variety of types (e.g. semblance to L, T, V, K, C and U-shapes), each of which was rarely repeated more than a few times. As a group, the 540 panels (30%) on which they occur are relatively evenly distributed across the study area (Fig. 12). Simple designs (334 cases), such as two combined geometric elements (linear and dot; oval and bars), occurred on 15% of panels, and their distribution closely parallels that of the 'geometric elements'.

Bird and macropod tracks: 'Bird track' motifs (both three-toed and four-toed types) account for 8% of the total and occur on 9% of panels. They are distributed throughout the study area, although they are more common in the Turtle Pool location (Fig. 13). Panels with 'macropod track' motifs, which are fewer in number and generally less varied in their schemata than the 'bird tracks', occur throughout the area but, numerically, are concentrated on panels around Muddy Pool.

Turtles and 'other marine creatures': 'Turtles', which form one of the most visually apparent groups, account for only 175 motifs (5%), and occur on 166 panels (9%). These are focused on sites around the two inland middens, and particularly Turtle Pool (Fig. 14). This motif will be discussed further below. In contrast to turtles, other marine subjects account for 3% of motifs and are widely distributed throughout the area (Fig. 15). The class incorporates a broad variety of naturalistic representations including 'shark', 'dugong', 'stingray', 'porpoises' and a range of 'fish'. The most common fish-like form was a simplified and stylised design consisting of an ovate body with fish tail (Fig. 16).

Birds, macropods and 'other animals': Forty-six examples of 'bird' motifs occur throughout the area, and while varying in apparent species, tend to focus on coastal species such as 'cormorant' (Figs 17 and 18). All of the birds are represented as standing in profile; none are shown in flight. 'Macropods' are uncommon (<1% of the total art corpus), yet, unlike the bird motifs, they are concentrated on sites inland from the coast (Fig. 17). They are generally small in size (less than 20 cm). The larger versions tend to be more carefully produced and have greater detail in their infill (Fig. 19). However, no large outline types, diagnostic of the earlier art periods (Mulvaney in press), were recorded. A wide range of 'other animals' (including 'reptiles' and a possible eel) was recorded (Fig. 20). Most were well produced with a clear profile and showing idiosyncratic features, such that many may be amenable to etic speciation

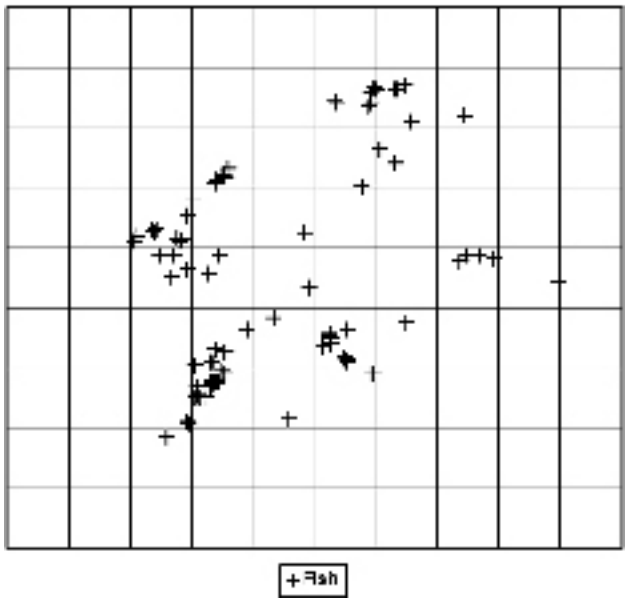

Figure 15. *Distribution of 'fish' motifs.*

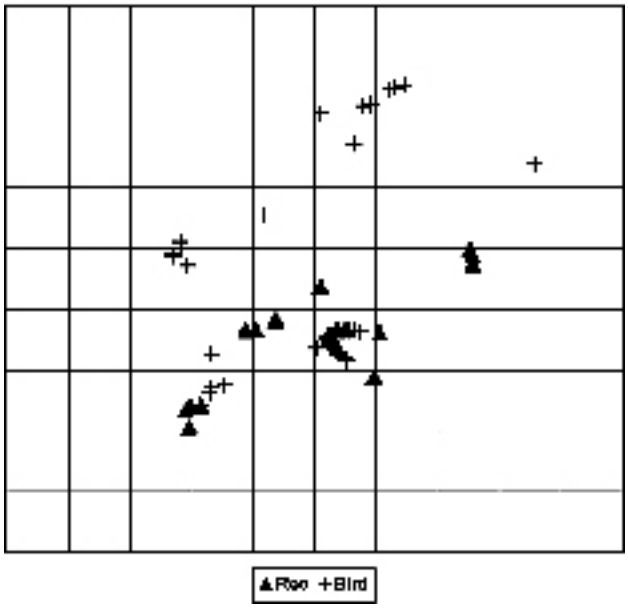

Figure 17. *Distribution of 'roo' and 'bird' motifs.*

Figure 19. *Examples of 'macropod' motif types.*

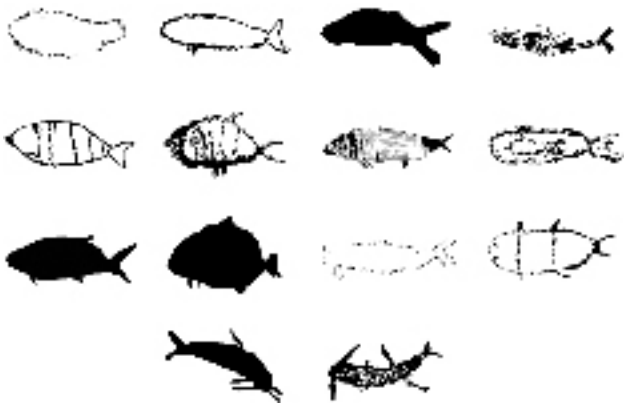

Figure 16. *Examples of 'fish' motif types.*

Figure 18. *Examples of 'bird' motif types.*

Figure 20. *Examples of 'other animal' motif types.*

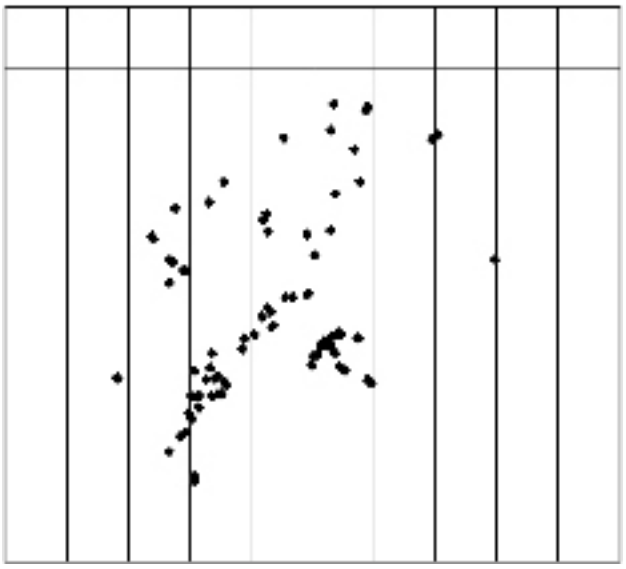

Figure 21. *Distribution of 'other animal' motifs.*

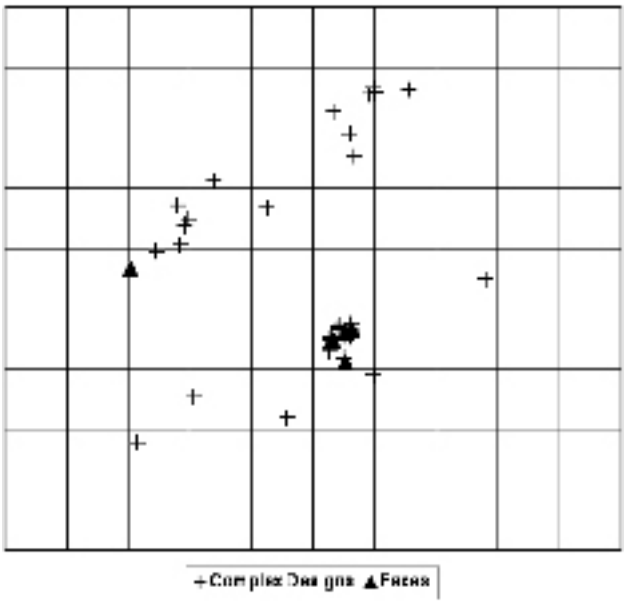

Figure 22. *Distribution of 'complex design' and 'archaic face' motifs.*

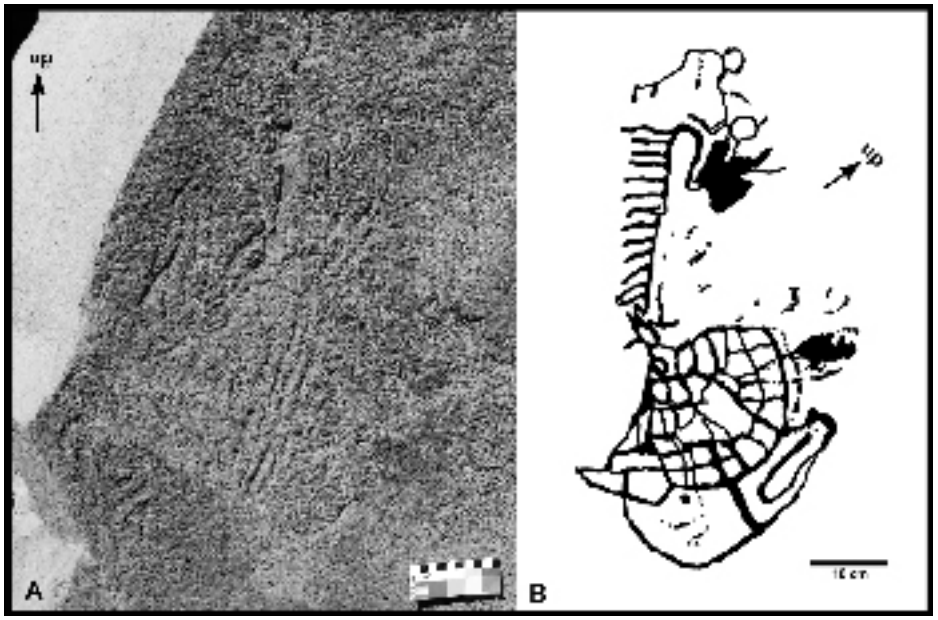

Figure 23. *Examples of 'complex design' motifs.*

Figure 24. *Examples of 'archaic face' motifs.*

attempts. Individual 'animals' are rarely represented more than once. As a group they occur throughout the study area but with a concentration in the vicinity of the two waterholes (Fig. 21).

'Archaic faces' and complex designs: These two motif types, although few in overall number, are generally considered to be amongst the oldest on Murujuga (>20 000 years; Mulvaney in press; but see Bednarik 2007b: 210–5). 'Complex designs' occur throughout the area but with a concentration around Muddy Pool (Fig. 22). Most are in a poor state of preservation (Fig. 23), suggesting both an early age for the type and its exclusion from the more recent repertoire. Eight of the nine 'archaic faces' recorded occur around Muddy Pool, with the other example at 'Garam Beach' (Fig. 22). This suggests, more so than any other motif type, a close relationship between the motif and a particular place. However, while most of the 'archaic faces' have the appearance of being very old and can only be detected under optimum lighting conditions, some are still clearly visible. This may suggest that variations of this stylistic form continued to be produced over a considerable period of time. The range of the 'archaic faces' exhibited here at King Bay South (Fig. 24; and see Vinnicombe 2002: 19) extends beyond the standard form, which is of outstanding eyes within a (partially) bounding 'face' variety, first recorded at the Cleland Hills (central Australia; Edwards 1968). As other

examples have now been located in several places, within or on the margins of the arid region of Australia, that involve a large degree of variation (the prominent circular 'eyes' remaining the primary feature), it is evident that a more rigorous analysis and definition of 'archaic faces' is now required (cf. Dix 1977; Lewis and McCausland 1987; David et al. 1992; Franklin 2004; McDonald 2005; see Bednarik 2007b: 232).

Marine tail and liver: Two other motif categories need mention, although their distribution has not been analysed as the sample size does not provide meaningful data. The 'tail' motif resembles that portion of either a whale or dugong. In the case of the liver, this is a bi-lobed form usually with a short tang at the apex. This image was identified as a stingray liver by Aboriginal informants consulted by McCarthy (1961: 132–3) when he was recording rock art on nearby Depuch Island. These bi-lobed images fall into two forms; those that are relatively fat, open and short, and those that are narrow, closed and elongated. The latter are taken to be shark rather than stingray livers. Indeed, in north-eastern Arnhem Land the totemic shark clan design painted on the chest of ritual participants has a marked semblance to the Pilbara petroglyphs.

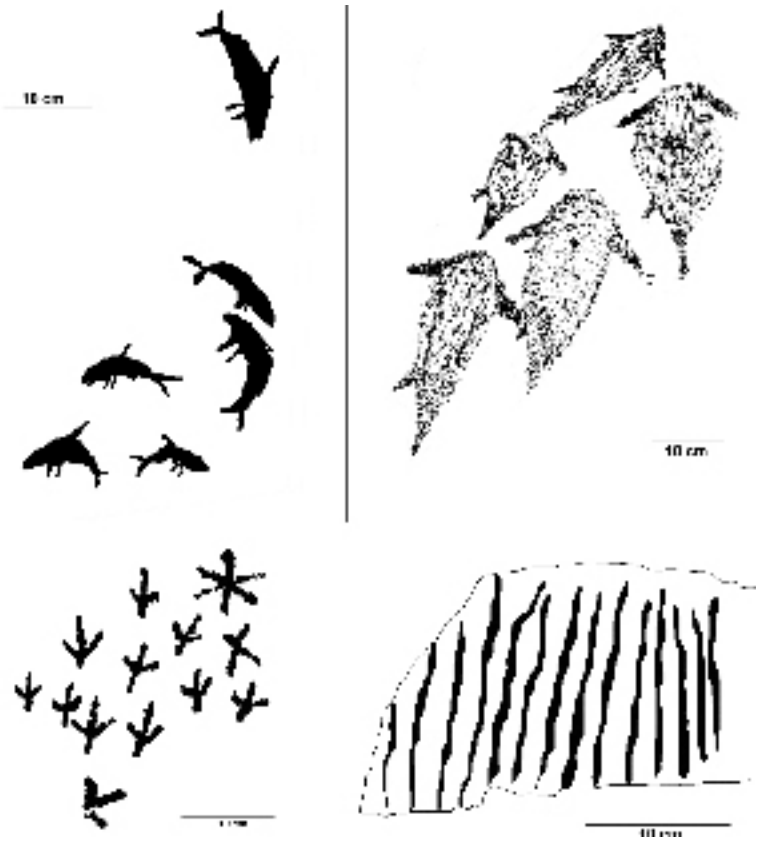

Figure 25. *Examples of compositions and arrangements.*

Other patterns

Compositions: For the greater number of panels, motifs appear to consist of singular representations. Even when in association with other motifs of the same or different types on the one panel, they invariably have differences in production technique, which is indicative of a discontinuous association. No elaborate panels such as the so-called 'climbing men panel' (Walsh 1988: 71; cf. Bednarik 2007b: 243) were recorded, although motifs within this distinctive style, with disjoined head and body, do occur. The very few examples of composition that do occur are either aggregates of similar motifs (Fig. 25) or human figures attached by a line to either a fish or macropod (suggesting fishing or hunting associations).

Placement: Almost one in three (29%) of the art panels have a vertical inclination. All motif classes are represented on these panels but none have more than 50% of their class represented. Hence there is no absolute preference for any motif type on vertical or horizontal surface. On the vertical faces, most classes are represented by 20–40%. Those types that are more common on vertical faces (>40%) are 'macropods' (54%), 'archaic faces' (5 of 9), other 'animals' (47%), and 'human figures' (45%). Those types that are uncommon on vertical faces (>20%), and hence more common on horizontal faces, are 'marine liver' (12%) and 'human feet' (8%). Hence motif types that are normally regarded (cognitively perceived) in profile in nature are more likely to be placed on vertical panels than geometric motifs or 'naturalistic' motifs represented in plan ('lizards', 'turtle'). This suggests

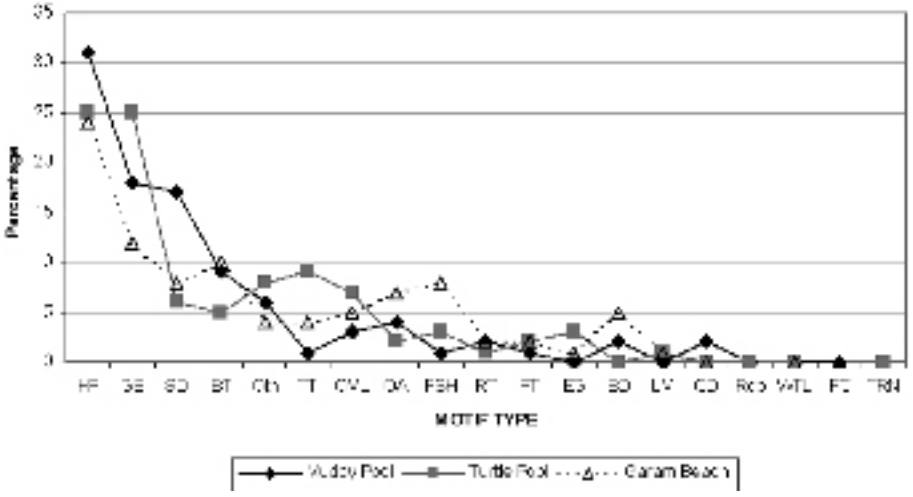

Figure 26. *Motif proportions for the three major art concentrations.*

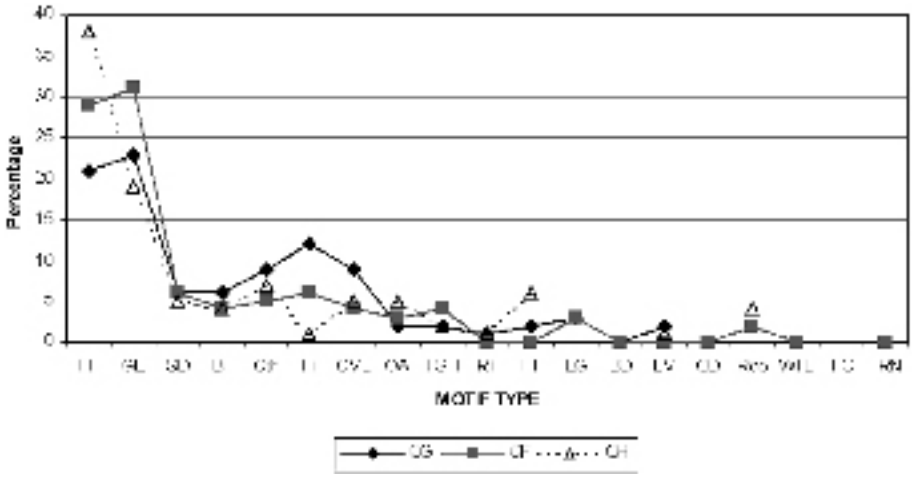

Figure 27. *Motif proportions within the Turtle Pool concentration.*

that, where possible, the artists have reflected the natural appearance of these motifs. While motif class placement was not decisive, as mentioned above, this is not necessarily the case for particular motif types such as particular bird or animal species where there is an intention of placement in the vertical.

Variation: The three areas of motif concentration (Muddy Pool, Turtle Pool and 'Garam Beach'; Fig. 8) have overall similarities in their motif repertoires (Fig. 26). The differences are one of degree rather than kind, with more human figures and geometric designs (both simple and complex) at Muddy Pool; more geometric elements, 'turtles' and 'turtle eggs' at Turtle Pool; and more 'fish', 'birds' and 'other animals' at 'Garam Beach'. While these may be meaningful in themselves, the pattern is repeated when the units within a single cluster are examined. However, in a study of site and subject distributions in the Withnell Bay area (5 km north) a similar pattern of location, adjacent resources and dominance of subject depiction was noted (Turner 1981). Within the Turtle Pool group, a few motif types stand out for their concentration in particular survey units of the group: turtle motifs in unit CG; geometric elements in unit CF; and 'human figures' and 'feet' in unit CH (Fig. 27).

More on turtles

The basic schema used to depict what we term turtle motifs is of an oval body with protruding, downward-turned fins, short head and tail. In plan, this is very similar to many of the fat-bodied human-figure motifs, and it is only the curve of the turtle fore-fins that distinguishes them from the 'human figures' (that have straight or jointed arms). Despite a common schema, through the use of a wide range of decorative infill designs of the shell carapace (the turtle's body), the artists have produced a number of distinctive patterns that can be distinguished as motif sub-types (classes). Overall, the motifs tend to be outline forms, over half of these with infill pattern comprising dots, linear, grid, simple (non-grid) or complex (two or more components) designs. Far less frequent were turtle images composed of a speckled, dot or solid area pecking.

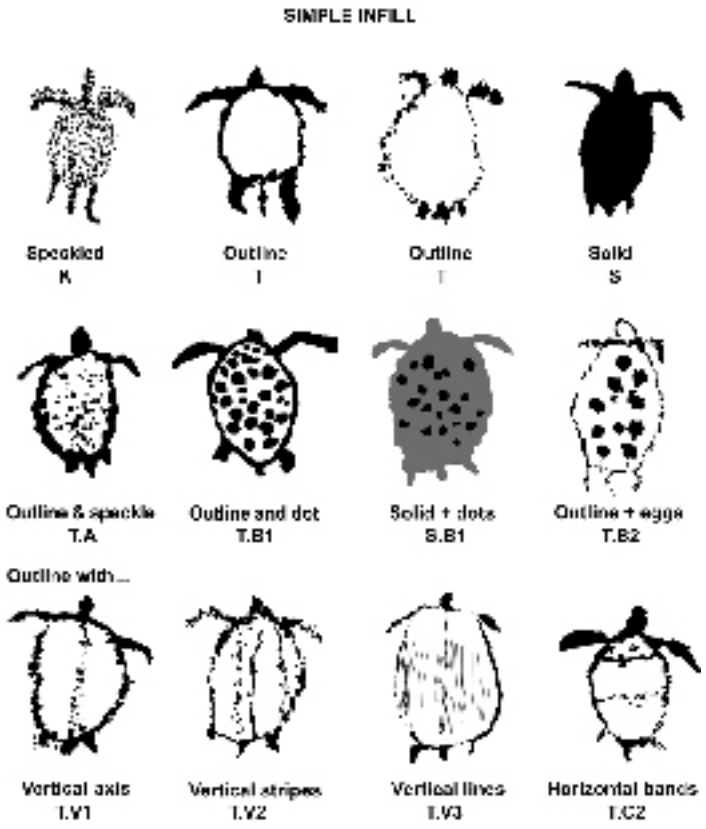

Figure 28. *The basic forms of the 'turtle' motif.*

The 175 turtle motifs recorded here were catalogued into 23 classes on the basis of their carapace pattern (Figs 28 and 29). Of these, only eleven classes (48%) had more than two representatives (Table 4), and the most common five classes accounted for almost three-quarters of the total (72%). Three classes had more than 10% of the motifs (outline only; solid; outline and speckle), but just one pattern type had more than 20% (outline only, 31%). This indicates that despite the wide variety of patterns available, preference was given to particular configurations. This high proportion of outline-only forms was also observed on the north side of King Bay, where in an area of 2.8 ha, 41 out of 62 'turtle' motifs (66%) had outline-only forms (Green 1982: 135).

In their overview of the Dampier Archipelago rock art, McDonald and Veth identified 68

different turtle designs (classes) based on the patterned infill of the shell (Jo McDonald CHM 2006: 102–4). Thirty-eight of the designs were single occurrences, and only six were widely distributed (op. cit. 2006: 104). Of the 22 classes recorded at King Bay South, 13 conformed to classes identified by McDonald and Veth, while nine were previously unrecorded types. Of the six most common types recorded by McDonald and Veth, four are also the most common types here (outline; solid; outline and speckle; outline and dots). No example of their class TU24 (outline with small round infill head, short line flippers) was recorded, and the only other type at King Bay South with more than ten examples was 'speckled', a class not previously recorded. The class 'outline with simple segments', which for the Archipelago in general is one of the two most common classes (Jo McDonald CHM 2006: 106), accounted for only three examples here (2%). On an Archipelago-wide scale, however, the class 'outline with simple segments' was more common in the northern Murujuga and 'solid' in the southern Murujuga area (Jo McDonald CHM 2006: 112), suggesting the findings here are consistent with the overall patterns for Murujuga.

This pattern is also consistent with the study of King Bay north, where solid forms account for 16% (n=10), outline with interior lines (n=2), outline with interior bars (n=3), with outline the dominant form (Green 1982: 135). That simple outline form does not dominate in the McDonald and Veth (Jo McDonald CHM 2006: Appendix 5) study may be a factor of the extensive delineation of variation of form in their study rather than a socio-cultural phenomenon around King Bay. Nevertheless, the high proportion of the type 'speckled' reinforces the finding of previous researchers that many of the features of the art of Murujuga are localised and that no one area can be seen as representative of the whole (Veth et al. 2003; Vinnicombe 2002; McDonald and Veth 2006: 114).

Within the King Bay South area the major 'turtle' classes are widely distributed throughout and while individual classes are not clustered, taken as a group, there is a significant conglomeration around Turtle Pool (Fig. 30). The same apparent randomness is also found with the minor classes but again, as an amalgamated group, these minor classes similarly cluster around Turtle Pool. The distributions of the 27 'turtles' with complex infill does, however, present a distinct pattern, with 19 motifs closely clustered around Turtle Pool, three around the nearby Muddy Pool, and five others scattered along the coastal strip. This suggests that Turtle Pool was indeed a focus of turtle imagery attention.

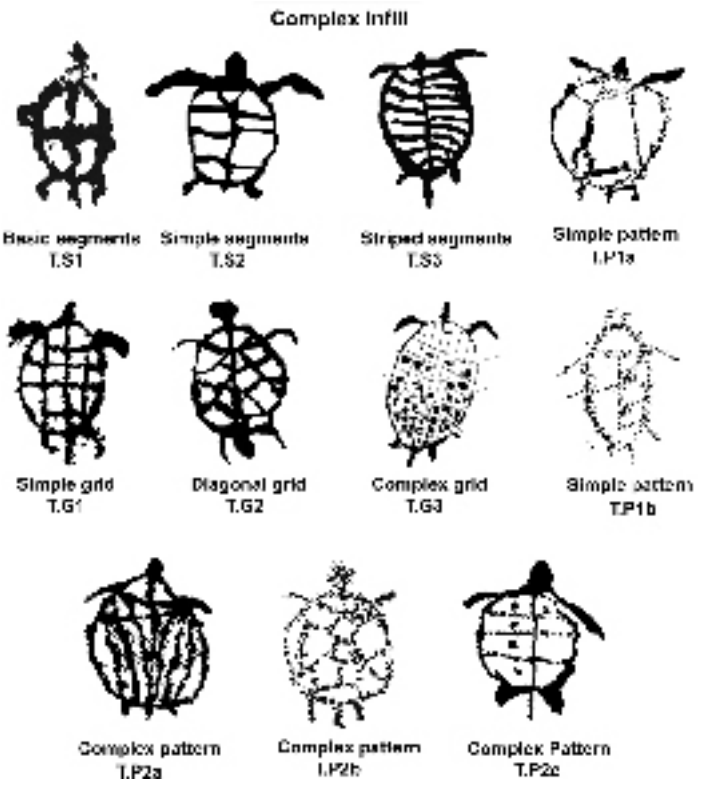

Figure 29. *The patterned forms of the 'turtle' motif.*

	FORM			Total	%
INFILL	Speckled	Outline	Solid		
None	13	54	24	91	*52*
Speckled		21		21	*12*
Dots		14	2	16	*9*
'Eggs'		9		9	*5*
Horizontal axis		8		8	*5*
Horizontal bands		5		5	*3*
Vertical axis		3		3	*2*
Vertical stripes		3		3	*2*
Vertical lines		3		3	*2*
Basic segments		2		2	*1*
Simple segments		2		2	*1*
Striped segments		2		2	*1*
Simple grid		2		2	*1*
Diagonal grid		2		2	*1*
Complex grid		2		2	*1*
Simple pattern		2		2	*1*
Complex pattern		1		1	*<1*
Speckled		1		1	*<1*
Dots		1		1	*<1*
'Eggs'		1		1	*<1*
Total	**13**	**136**	**26**	**175**	*100*
%	*7*	*78*	*15*	*100*	

Table 4. *'Turtle' motif form-infill frequencies.*

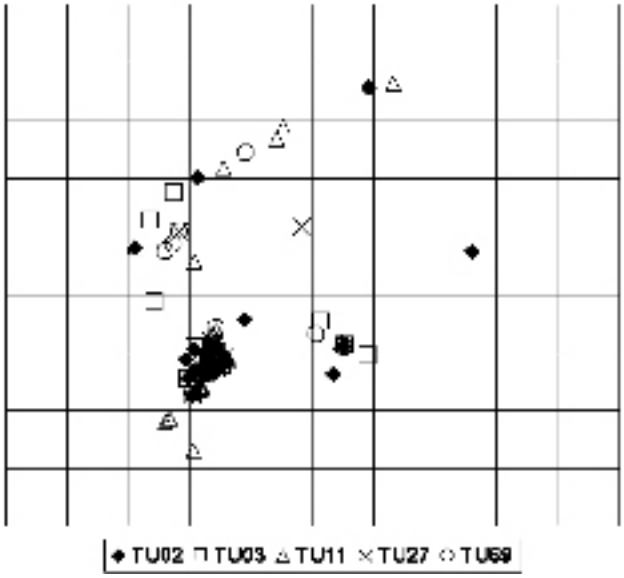

Figure 30. *Distribution of the more common 'turtle' classes.*

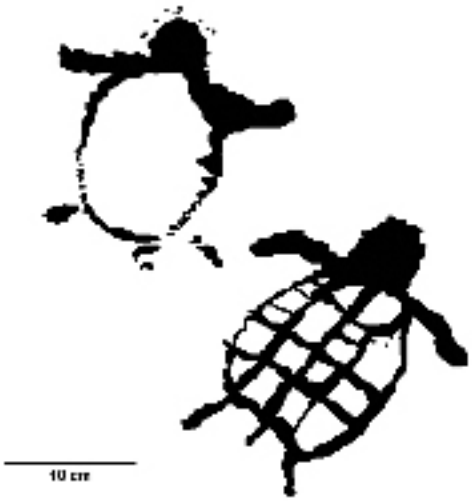

Figure 31. *Contemporary pair of 'turtles' on the same panel but with different infill patterns.*

One interpretation of the distribution of the more complex patterned forms could be that individual designs were produced (or owned) by particular groups or persons. Hence, a greater range would be found in the more commonly used centres, with outlying examples reflecting the area visited by an individual during his/her/their stay within the study area. Green (1982: 135) postulated the relationship of turtle image clusters with prominent landform that afforded 'lookouts' for spotting turtles.

Of the eight panels containing more than one turtle motif, four panels contain distinct individual designs (usually suggestive of some time difference in their production), three have apparently contemporary pairs but with different forms (Fig. 31), and only one has a contemporary pair that utilises the same form (relative age based on degree of patination). Hence, given the high proportion of singular representations, the association of turtle motifs on any particular panel is more likely to be coincidental than planned. Six of the eight panels with more than one turtle motif occur adjacent to Turtle Pool, while the other two are widely separated along the coastal strip.

Horizontal rock faces have 79% of the 175 turtle motifs, while 21% occur on vertical faces (≥45°). This is consistent with the overall trend for a preference for horizontal panels throughout the area (c. 66%). Slightly more patterned motifs occur on vertical panels (29%), however, this is not seen as significant as, within panel clusters, both patterned and basic types can occur on both surface inclinations, and none of those on vertical panels are particularly larger or more visually outstanding.

The physical size of images within the different classes is similar (Table 5), with most being 10 cm and 40 cm in length. The largest turtle motif, a 218 cm outlined 'turtle', is an exceptional individual as the next largest is only 45 cm. Excluding this exceptional figure, the size range is similar for both basic and patterned infill types. McDonald and Veth (Jo McDonald CHM 2006) found that overall, most examples ranged between 21 and 30 cm. The majority

Motif class			**Size**		
	No	%	min.	max.	median
T	54	*31*	9	128	17
S	24	*14*	9	34	17
T.A	21	*12*	14	38	23
T.B1	14	*8*	12	35	19
K	13	*7*	11	40	21
T.V2	9	*5*	9	25	15
T.G1	8	*5*	19	25	21
T.V1	5	*3*	16	22	20
T.S2	3	*2*	15	30	-
T.S3	3	*2*	17	33	-
T.C2	3	*2*	15	26	-
T.S1	2	*1*	-	16	-
T.B2	2	*1*	20	23	-
T.G2	2	*1*	15	24	-
T.P2b	2	*1*	22	32	-
T.P1a	2	*1*	9	27	-
S.B1	2	*1*	17	28	-
T.P2a	2	*1*	-	23	-
T.P2c	1	*<1*	-	14	-
T.G3	1	*<1*	-	38	-
T.V3	1	*1*	-	36	-
T.P1b	1	*<1*	-	29	-

Table 5. *'Turtle' class numbers and sizes.*

of motifs here are in the 11–20 cm size class (Table 6), and with a median of 20 cm. As with the turtle patterns, the size range of the turtle motifs was found to vary across the Archipelago (Jo McDonald CHM 2006: 112–3), with the smaller size frequencies in the present study area conforming to that of their southern and central Murujuga regions.

Size class	1–10	11–20	21–30	31–40	41–50	>50	Total
No. (all)	11	76	47	15	1	1	151
No. (patterned)	1	8	11	3			23

Table 6. *'Turtle' motif size frequencies.*

A variation on the turtle motif has twin front fins, occasionally also twin rear fins and in one instance, twin heads (Fig. 32). These are interpreted as representing mating turtles (Turner 1981: Appendix 1; Green 1982: 135; Vinnicombe 2002: 20). In another singular example, the outline of a 'turtle' has been retouched at a much later date, but with the head on the 'shoulder' of the former, suggesting rejuvenation with a change in the visual meaning of the motif.

Figure 32. *'Mating turtle' motif.*

Eight motifs referred to as 'turtle-runs' were recorded. These are interpreted as the trails left by turtles in the sand after crawling up the beach to lay their eggs (cf. Vinnicombe 2002: 20). One panel contained three representations and the others only one each. The panel with the three 'runs' also contained a 'turtle' motif (Fig. 33). None of the other 'runs' were directly associated with turtle motifs, however, the six panels containing the run motifs all occur around Turtle Pool (CF and CG areas). In support of this interpretation of the motif is a case one kilometre to the south-east of King Bay South, where a 'whale-tail' motif is surrounded by the 'turtle-run' motif. It is of note that the appearance of whales in the Archipelago waters coincides with the nesting months of turtle (Geoff Kruger, pers. com. 2007).

Figure 33. *'Turtle run' motif with 'turtle'.*

Aggregates of small disc-shaped motifs, 'egg-sets', are assumed to represent turtle eggs rather than emu eggs, which are commonly depicted in a similar manner at inland sites (although the latter are usually larger in size and fewer in clutch number). Considering that turtle eggs were a favoured summer food, this assumption is not unreasonable (Vinnicombe 2002: 21). 'Egg-set' motifs occur on 51 panels (e.g. Fig. 34), yet only two occur on panels with turtle motifs, therefore leaving the interpretation of this generalised motif open to other possibilities, such as sea-bird eggs, which are also laid in the area and were similarly sought after. However, of the 51 panels, 42 occur around Turtle Pool, where the majority of turtle motifs occur, a coincidence that is not seen as random.

On three panels containing 'egg-sets', the design contains an unusually high number of 'eggs'. The motifs are placed to cover most of their respective panel surfaces, and with very little space between the individual 'eggs'. With all three panels, the motifs are very weathered and occur on small and vertical faces. This arrangement gives them the character of cupule surfaces, a motif type commonly associated with early artistic production in the Kimberley (Morwood 2002), Victoria River District (Taçon et al. 1999), Arnhem Land (Edwards 1979) and central Australia (Gunn 2004b; note also Bednarik 1993). By their weathering, it is likely that these three panels predate the Holocene sea-rise and, therefore, they are unlikely to represent 'turtle eggs' despite their classification as such here. In addition, the large zoomorph (Fig. 35) was created on a surface that may well have been a cupule surface, but these are now so weathered that it is not possible to determine whether they predate the figure or were part of the motif's original infill.

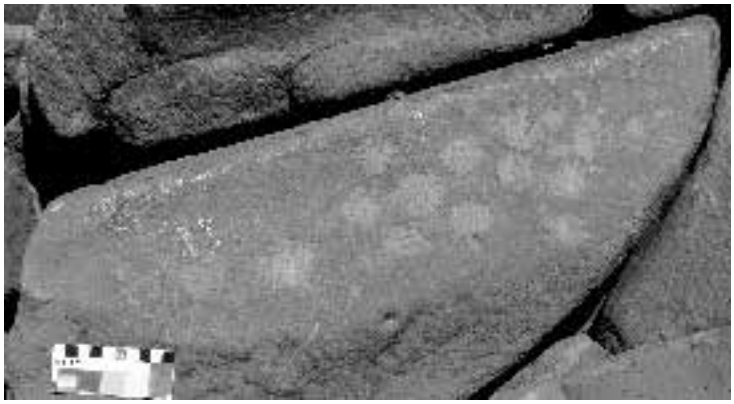

Figure 34. *'Turtle egg' motif.*

Figure 35. *Large zoomorph (?) motif on a prominent vertical panel at Muddy Pool (1.80 m high).*

Discussion

Dix and Virili (1977: 95), writing about the petroglyphs of the Dampier Archipelago, observed that 'turtles have patterns which suggest differentiation between species on the part of the artists'. It was anticipated that, with the high number of turtle motifs, a pattern would emerge to enable identification to species. There are five species of turtle that inhabit the waters of the Dampier Archipelago, the Green (*Chelonia mydas*), Loggerhead (*Caretta caretta*), Flatback (*Natator depressus*), Leatherback (*Dermochelys coriacea*) and Hawksbill (*Eretmochelys imbricata*). Identification to species within the rock art of the area is apparently possible with bird and fish images, so it would seem not unreasonable that this would extend to turtles as it does to other marine mammals (see Green 1982: 143). Turtle species display some variability in the general shape of their body, relative size of head, size and angle of flippers, and most obviously, in the plan view of the carapace. In particular, the Flatback is rounded whereas the Leatherback is elongated with distinct longitudinal ridges; the other three are similar with a tapering to the posterior end. However, within our King Bay South sample, no species-diagnostic features are apparent. As King Bay is not a turtle-nesting beach, there remains the possibility that species definition may well be highlighted in motifs produced in close proximity to those onshore locations utilised by particular turtle populations.

Within the study area, the superficial investigation of the distribution of a range of motif types, and the more detailed study of the turtle motif shows that there is considerable variation across the landscape. However, there is little in the way of discernible spatial patterning across all the petroglyph subjects. Clearly, the concentration of artwork at Turtle Pool, Muddy Pool and 'Garam Beach' and the location of large middens at Turtle Pool and beyond 'Pelican Point', the smaller midden immediately upstream from Muddy Pool, and the stone quarry/workshop at 'Pelican Point', indicate that utilisation of the area focused on particular resource areas (waterholes, mangroves and foreshore). There is little difference within the total corpus of artwork at each of these locations, suggesting that the four areas were used both concurrently and for similar purposes. The nature of the speciality of the three motifs (zoomorph; 'pelican'; 'eels') singled out for their artistic attributes of size and placement is, however, not elaborated by other archaeological aspects. Further, the distribution of standing stones, while related to the areas of occupation, is otherwise unrelated to that of the artwork patterns. Interestingly, this lack of patterning contrasts to the pattern identified in the Withnell Bay South area, where differences in the art repertoire were seen as reflecting site use and local resource exploitation (Turner 1981).

Chronologically, the higher proportion of petroglyph fragments around Turtle and Muddy Pools suggests that these areas might contain older art than along the coastline. This is supported by the distribution of motifs from the Pleistocene period (Mulvaney in press a, in press b): 'complex designs' and 'archaic faces', with eight of the nine faces recorded occurring at Muddy Pool, and possible 'cupule surfaces' around both waterholes. While this would be consistent with the newer coastal art deriving from the Holocene era, it might also be explained by natural deterioration experienced by the coastal panels (although this is considered unlikely). Weathering of petroglyphs across the archipelago is a further subject requiring attention.

The four thousand petroglyphs recorded from the King Bay South study area is high for an Australian petroglyph site (Jo McDonald CHM 2005: 152) and is comparable to the largest site in central Australia (cf. Edwards 1966; Forbes 1983; Gunn 2000) and Yunta region (Edwards 1966), although considerably smaller than the larger petroglyph sites in western New South Wales (Sturts Meadows, >16 000 motifs; Clegg 1987). It is not, however, a large number in terms of locations within the Dampier Archipelago, where up to 10 000 petroglyphs occur within valley systems; for example it is estimated that in Skew Valley the density is 40

motifs/ha (Lorblanchet 1992: 20). This compares with around 28 motifs per hectare at King Bay South. Yet it is far denser than some other areas (1.2 motifs/ha within King Bay-Hearsons Cove; Vinnicombe 1997). As there are also large areas of spinifex flats that are almost devoid of petroglyphs, it is clear that the petroglyphs occur in varying concentrations across the landscape. If, then, the petroglyph density for the study area were taken as representative or at least 'average' for Murujuga, this would imply that Murujuga contains around 370 000 petroglyphs (excluding those of the surrounding islands and mainland ranges to the south). This prediction coincides precisely with Bednarik's original census of Murujuga petroglyphs in the 1960s, of between 350 000 and 390 000 motifs (Bednarik 2007b: 235–6). Consequently, the prediction of one million petroglyphs for the entire Archipelago (Bednarik 2002, 2007b; Jo McDonald CHM 2005: 152) is probably not unreasonable.

The concentration of rock art and other site types occurring around the inland waterholes shows that these were the primary local foci, with the estuary midden (where there is less outcropping rock) used almost solely for shellfish exploitation. The bay foreshore appears to have been used for only infrequent occupation, most probably by people camping at the inland freshwater reserves. A similar pattern was reported at Skew Valley (Lorblanchet 1992), although the preponderance of shell noted by Lorblanchet was not as evident here.

Conclusion

This small study has shown that while there is considerable variation across the study area, there is little in the way of patterning of the art, subject, style and form. This is interpreted as indicating, at least during the late Holocene, that a similar pattern of occupation and utilisation was practised across this small area of Murujuga. A detailed comparative study of other areas across Murujuga is now needed to further elaborate the various foci and any art patterns elsewhere across the Archipelago. Also, using a larger study area, some common patterns may be detected amongst the less frequent, older (early Holocene or Pleistocene?) artwork.

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R. G. (ben) Gunn
(La Trobe University)
329 Mt Dryden Road
Lake Lonsdale, VIC 3380
Australia
E-mail: *gunnb@netconnect.com.au*

Kenneth Mulvaney
(University of New England)
340 Elliott Crescent
Dampier, W.A. 6713
Australia
E-mail: *kmulvane@une.edu.au*

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