

4

Stone Structures: A New Classification

EMMA BECKETT

Stone structures, features and arrangements are important, geographically fixed archaeological resources. Broadly defined as anthropogenically moved or placed stone, structures can provide a range of information about past human behaviours. These range from the symbolic arrangements that encapsulate highly significant cultural places to somatic structures relating to subsistence behaviour and keeping the body alive (Beckett 2021: 97).

Stone structures are found throughout Australia, but the density and variety of structures found on Murujuga are unique (McDonald and Veth 2009). The specialised nature of this site type has been under-recognised; holistic consideration and a method for consistent analysis has been long overdue. This new classifica-

tory system was developed during doctoral research affiliated with the broader Linkage Project (Beckett 2021) and aimed to provide a flexible method that can be applied consistently to stone structures throughout the archipelago and more widely.

Development

The overall aim in constructing a typology is to help identify patterns of behaviour by highlighting similarities and differences in an assemblage (Clarke 2014: 26). The initial aim was to record stone structures using terminology that was consistent with previous projects but it soon became clear that a new approach to classification was required. Previous terminology was inconsistent across projects, did not provide clear definitions and perpetuated confusion about the origins of some structures. Analysis also showed that this problem was not unique to Murujuga: a more consistent approach to recording stone structures was needed nationally (Beckett 2021: 25).

Many stone structure typologies provide limited definitions, with little or no information beyond the 'type'. There is also a tendency to conflate form and function – a serious problem for the development of a useful and reproducible classificatory system. Previously used Murujuga structure types include standing stones, placed stones, cairns, circular and semi-circular structures, house structures, cockpits, linear structures, walls, terraces, fish traps, hunting hides, stone pits, complex arrangements and historical structures (see Chappell 1982; Gara 1984: 21; McDonald 2005b: 65; McDonald 2006: 146, Table 49; McDonald and Veth 2009; Rhoads et al. 1984; Veth et al. 1993: 215; Vinnicombe 1987a: 32; Vinnicombe 1987b: 69). The conflation of form and function in structure typologies originates in good logic: researchers are aiming to understand function so their natural inclination is to go for function-first typologies (e.g. fish traps, hunting hides and house structures).

When no function is discernible, these typologies then revert to form, with a potential for overlapping types and confusion when a subsequent researcher has difficulty identifying a functional type.

The classificatory system described in this chapter advocates a form-first approach. This focuses on observable and quantifiable differences between structures and is based on clear definitions. This approach aligns with that used for motif classification (see Chapter 3), with a focus on recognisable and standardised terminology.

A form-first approach does not mean that function is ignored: an understanding of why structures were created and how they were used was the goal of this analysis. A review of documented and inferred stone structure functions was undertaken (Beckett 2021: 86). Although form and function are not analogous, some correlations can be made between behaviour and various construction elements and structure form; however, these correlates should be considered as a starting place for interpretation of any individual structure.

The previously ad hoc approach to structure classification in Murujuga has resulted in scepticism about whether some structures were in fact anthropogenic, a serious problem that has led to a reluctance to engage with this important resource (McDonald and Veth 2009: 53). A review of structure construction and geomorphological processes likely to create features that could be mistaken as anthropogenic highlighted a number of criteria that should be considered when recording stone structures (Beckett 2021: 137–181).

A new classificatory system

The typology described in this chapter was built and tested on a sample of 2,940 structures, 502 of which were recorded during the Dynamics of the Dreaming

project (see Figure 4.1). The majority of the structures analysed were from legacy data sets or visited as part of other projects (Beckett 2021: 181).

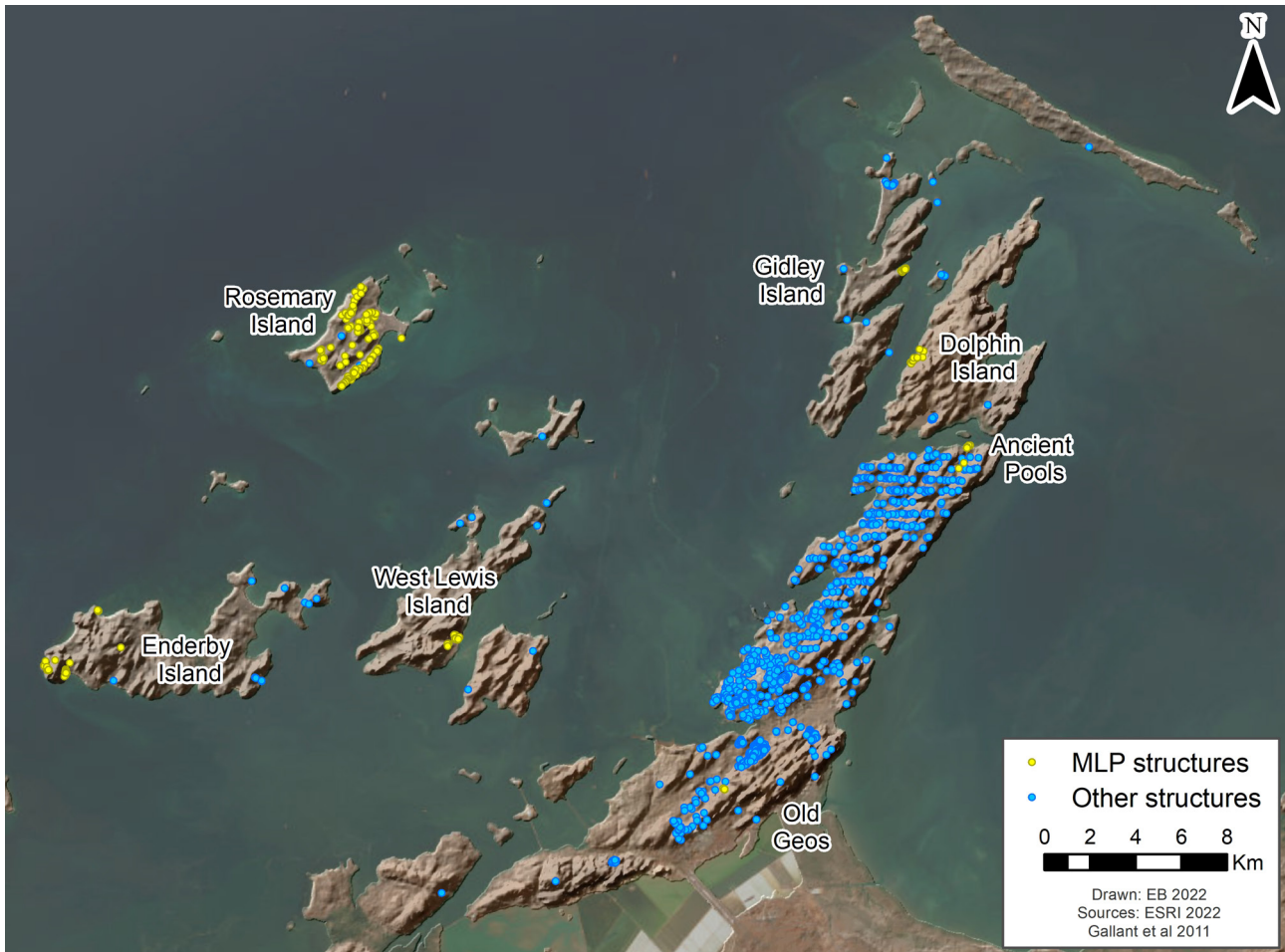


Figure 4.1. Stone structures used in development of the typology, including those recorded as part of the Murujuga: Dynamics of the Dreaming project.

Nine stone structure types are defined: modified gnammas, discrete placed stones, standing stones, clusters or piles, barriers, landscape walls, clearings or enclosures, bedrock pits and historical structures.

The new types roughly align with previously recorded types, but there are important differences in the ways that they have been identified and defined. The nine types are defined based on three key attributes: construction, landscape context and form. These attributes

define variants within each type, allowing for a flexible and multi-scalar classification. Within the nine types there are 20 subtypes or variations that can be linked to common associations of shape, relief, technique and modification. These subtypes describe the variability within individual types and additional variants can be added in the future without impacting on the analyses of this assemblage.

Construction

Construction should be the primary consideration when recording a stone structure. Five construction types have been identified: placed, clustered, stacked, cleared and dressed. The nature of construction helps focus the recorder on the structure while also considering

any natural geomorphological processes that might have caused stone movement. If no construction can be recognised, the recorder should seriously consider if a structure is indeed anthropogenic (Beckett 2021: 137–181).

Placed construction

Structures with placed construction include modified gnammas, discrete placed stones and standing stones. Placed constructions consist of a stone or stones

positioned with some degree of precision, usually on a level outcrop or in a rock crack. Good indicators of anthropogenic intervention include modification to a

rock's position; patina over the placed rock and/or on the underside/contact point between the placed and natural surface; and observable geological differences. Balancing, wedging, chocking or embedding stones

contribute to ensuring a placed stone stays in place. Observation of these characteristics also provides good evidence of anthropogenic involvement.

Clustered construction

Clusters/piles and barriers may have a clustered or stacked construction. Clustered constructions are created by stones that have been grouped together, either placed at intervals, touching or in low piles. Clustered structures are defined by their low relief, with

the structures being one or two stones high. Consideration must be given to the landform surrounding these structures and to the possibility of various types of mass movement.

Stacked construction

Structures with stacked construction include clusters/piles, barriers, landscape walls and historical structures. Stacked constructions comprise a number of stones that have been stacked or thrown together. These structures can have low to very high relief, defined as follows:

1. Low relief – mainly one though occasionally two stones high
2. Moderate relief – two to four stones high, generally <50 cm
3. High relief – roughly four stones high, generally 50–99 cm
4. Very high relief – generally >100 cm

When recording structures with stacked construction, consideration should be given to the landform surrounding the structures and various types of mass movement. Piles at the base of slopes, particularly very steep slopes, should be considered carefully. Modifications to stacked structures (e.g. negative flake scars amongst the stones) are an important indicator the stacking is not a natural phenomenon (Beckett 2021: 168). Calcrete fragments found in amongst stacked stones also generally indicates human intervention as this deposit forms naturally as a solid layer (Beckett 2021: 170).

Cleared structures

Cleared structures involve the removal of stone, usually from a central area (e.g. clearings/enclosures or bedrock pits). Many of these structures will have evidence that cleared stones were replaced (stacked) on the outside

of the cleared area. A consideration of the types of mass movement and the lateral movement from trees and shrubs can help confirm anthropogenic involvement.

Dressed structures

Dressed structures have been created using European masonry techniques, including dry-stone walling and the modification or 'dressing' of stones into a squared

shape. Historical structures at Murujuga are the only variety to have been created with a dressed construction technique.

Recording forms

Recording forms for each structure type were developed for this project. These forms are hierarchical and consist of multiple pages that contain attribute information which can be selected by the recorder. The recording forms are integrated with rock art and other site types for use on an Apple iPad (see Chapter 3).

All CRAR+M iPad forms were built in Filemaker Pro© by Sarah de Koning,¹ using terms, images and definitions

from Beckett (2021). The stone structure recording forms begin with a landing page (Figure 4.2) which displays for selection each of the nine structure types. Each button has an embedded schematic to aid with the initial decision-making process. Selection of the relevant type opens a new form with additional information for the recorder to complete.

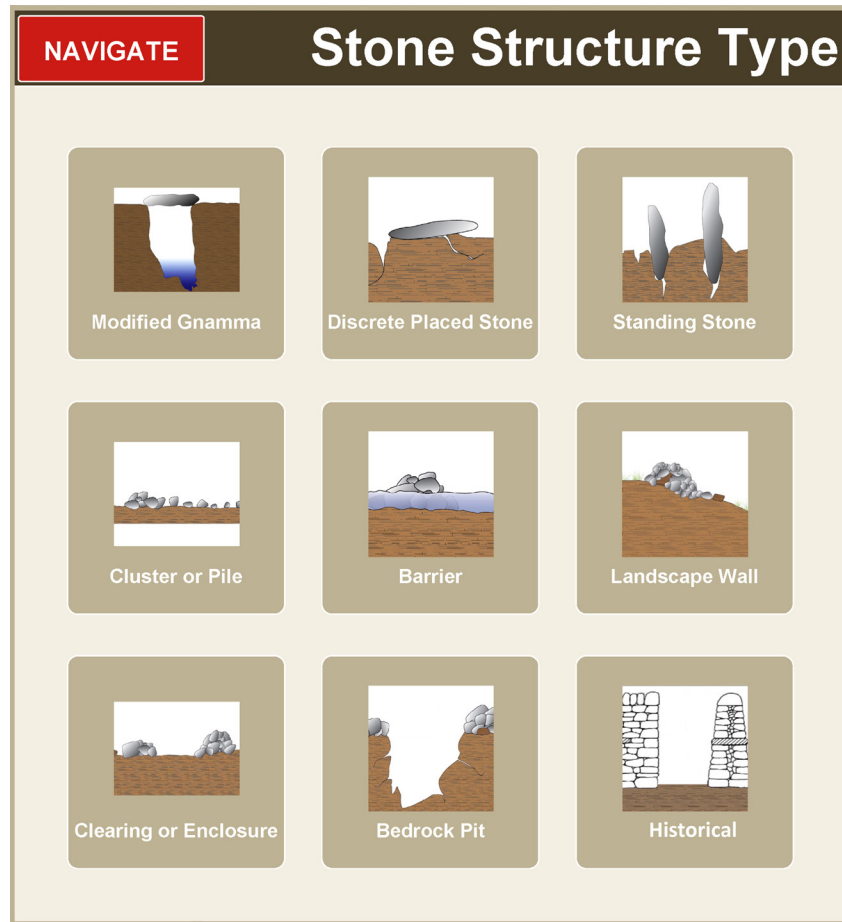


Figure 4.2. Stone structure recording form landing page with nine core types: modified gnamma, discrete placed stone, standing stone, cluster or pile, barrier, landscape wall, clearing or enclosure, bedrock pit and historical.

The current design of these forms focuses on single structures (not multiples) to preserve the distinct spatial location of these as individual structures. Recording as grouped/multiple structures with a single point would lose information. Future iterations of these forms may include a count field to allow for increased efficiency during recording.

Once all the fields are filled out the recorder presses the 'Finish' button (see bottom of Figure 4.3): they are returned to the 'Stone structure type' page where they can begin another recording. The 'Navigate' button returns the user to the first page of the recording forms where other archaeological material, such as rock art / artefacts, can be selected (top left, Figure 4.2).

Types, variants and fields

Each button or field within these recording forms transposes information into an attribute table which can be exported for analysis. Where possible the form layout is consistent between each type; that is, for all structures the following attributes are recorded:

- Structure ID – every form has an inbuilt warning message if this number is not entered.
- Centroid Waypoint – a separate handheld recording device (generally Garmin GPS units) has been used throughout this project. An inbuilt warning message will show if a waypoint number is not entered. Large structures, such as landscape walls or barriers, allow for starting and final waypoints to be collected.
- Dimensions – every form allows for a numeric input for length, width and a 'third dimension' (height or depth).
- Modification – a series of checkboxes (battering, flaking, rubbing, engraving, grinding and NA) allow for multiple modifications to be selected and each is recorded. Modification is an important attribute that can confirm a structure is anthropogenic.
- Description – this text field allows the recorder to add additional observations made in the field, including relevant observations about landscape context.

- Associated Material Culture – this text field allows the recorder to input additional information about any associated and/or nearby cultural material.
- Attribute fields for construction, relief and shape vary depending on the structure and are discussed within each type, below.

Modified gnammas

A gnamma is a natural cavity that collects water, formed primarily through erosion. The 'Modified gnamma' structure type refers to any instance where a stone (or stones) has been positioned near a water source. Stones create shade or provide cover over the water or can be arranged in a specific shape (Figure 4.3). These structures have a 'placed' construction type, which is automatically recorded when this type is selected. Modified gnammas are likely to function to protect or extend the availability of fresh water. These structures are therefore associated with subsistence and innovation behaviour (Beckett 2021: 321).

MODIFIED GNAMMA

ID

Structure ID

Length

cm

Width

cm

Third Dimension

cm

Centroid Waypoint

MODIFICATION

☐ Battering

☐ Flaking

☐ Rubbing

☐ Engraving

☐ Grinding

☐ NA

DESCRIPTION

Include description of landscape context

OTHER ASSOCIATED MATERIAL CULTURE

Describe all other associated cultural material, including their IDs if they were recorded

FINISH

Figure 4.3. Modified gnamma iPad recording form.

Discrete placed stones

These structures are individual or small groups of placed stones. As all discrete placed stones are placed constructions, this attribute is automatically recorded. Discrete placed stones tend to be found on level or cleared ground, often on outcropping bedrock platforms. The recording form requires selection of discrete or placed stone in one of the three variants: manuport, slab on block or horizontal (Figure 4.4 and Figure 4.5).



Figure 4.4. Three variants of discrete placed stones: (a) manuport, (b) slab on block, (c) horizontal.

'Manuport' is a common term used to describe objects that are moved from their natural context but have not been obviously modified (i.e. they are not artefacts). Such structures must display evidence of being placed as their construction technique. Manuports are generally different from the surrounding natural rock. They may be a different geology, display differential patination/weathering or have a remnant coating crust that could not have formed on the rock where it is currently situated (Figure 4.4a).

'Slab on block' constructions were originally defined as a stone structure type by Benson-Lidholm (1983: 40) as 'a sheet of exfoliated [*sic*] granite, supported at least on one end by a stone block or blocks'. Structures of this ilk are simple to construct, with the top stone being a sheet or a large block, although several examples across Murujuga involve large blocks estimated to weigh many tonnes (Figure 4.4b).

'Horizontal' stones are elongated manuports and could also be considered as 'fallen' standing stones, albeit this is a formation process that is difficult to prove (Figure 4.4c).

Manuports and horizontal stones are interpreted as low-energy signalling/communication behaviour. Slab on block constructions have been previously interpreted as lizard traps with subsistence functions (Anthropos Australis and Context Anthropology 2010; Benson-Lidholm 1983: 40; Randolph 2011). This interpretation demonstrates sophisticated niche construction and forward planning but has not yet been proven. Structures with this form have also often been found within complex arrangements with possible ceremonial functions (McBryde 1963: 143) and some of the very large blocks used in Murujuga are significantly in excess of what would be suitable to trap a lizard.



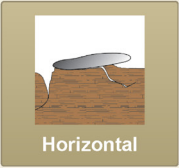
DISCRETE PLACED STONE ID

Length cm Width cm Third Dimension cm Centroid Waypoint

MODIFICATION

☐ Battering ☐ Flaking ☐ Rubbing
☐ Engraving ☐ Grinding ☐ NA

VARIATION

 Manuport  Slab on Block  Horizontal

DESCRIPTION

OTHER ASSOCIATED MATERIAL CULTURE

FINISH

Figure 4.5. Discrete placed stone iPad recording form.

Standing stones

Standing stones are elongated stones placed upright with a large proportion of the stone protruding above the surrounding rock surface, consistent with legacy projects (e.g. ACHM 2003; Chappell 1982; Vinnicombe 1987a). They are often found in prominent outcrops with a good vantage of the surrounding landscape.

The natural direction or bedding of the rock should be considered when recording this structure type. Elongated stones are commonly found in natural geological contexts across Murujuga and, while it is uncommon for these to be aligned vertically, these do exist as a naturally occurring feature that mimics (or vice versa) a standing stone. While these unusual natural features may have cultural values, such geological features should not be recorded as archaeological.

Standing stones have a placed construction, and this attribute is automatically designated in our

recording form. Additional fields are: another dimension, technique, direction stone is pointing, angle from the ground, composite shape and clustering.

In addition to the standard three measurements, the standing stone form contains a field for height above ground. This measurement is the amount of the standing stone that is protruding above the ground surface and is useful for considering how visible a stone might be in the broader landscape.

Four different techniques are identified as keeping a placed standing stone upright. Standing stones may be 'embedded' in sediment; 'wedged' between bedrock slabs; 'chocked' upright using smaller stones; and loosely 'propped' upright against another stone or bedrock (Figure 4.6). If none of these techniques are identified, a recorder should consider if discrete placed stone is the more appropriate type for the structure being described.



Figure 4.6. Three of the four standing stone techniques: (a) embedded, (b) wedged, (c) chocked.

The standing stone recording form asks about directionality: the cardinal direction the standing stone is oriented towards (Figure 4.7). This field is a dropdown list that provides summarised directions for selection. The angle from the ground can also be recorded, again simplified to four options. If the stone is fully horizontal, it should be recorded as discrete placed stone. Future iterations of this form will provide a direct link from this page to the horizontal variation of a discrete placed stone.

The form allows for recording stone structure variation as clustering or composite shape. No distinct shapes were identified within Murujuga, however, standing stones are often sorted by this attribute (Hook and Di Lello 2010; Law and Slack 2020) and this field was included for broader utility of the recording form, beyond this region.

In this classificatory system Murujuga standing stones are sorted based on density. In the field, standing stones are recorded as either 'isolated' or 'clustered'. Later, these two categories are subdivided into five variants using the percolation method (Maddison and Schmidt 2020: 270), and a 30m search radius. This algorithm then categorises standing stones as being isolated (1 stone) or as having low (2–4 stones),

moderate (5–20 stones) or high (>20 stones) density. A ridgeline on Rosemary Island presented an exception to this clustering algorithm definition. Here, the cut-off was increased to 100 m and the cluster was classed as being 'sparse' but with a very high quantity of stones (>50) (Beckett 2021: 119).

Standing stones are generally interpreted as having ceremonial functions as *Thalu* (increase sites) or marking the presence of specific resources (DoE 2016). Analysis suggests that this interpretation may be too simplistic and standing stones are likely to represent a range of symbolic functions. It is proposed that isolated and low-density clusters of stones are more likely to be linked to low-energy symbolic behaviour, such as marking places and events important to an individual or family group. More visible sites with a moderate or high quantity of stones are more likely to have been used to signal outside of the immediate social group to people either without detailed knowledge of a place or those who were visiting and where territorial or ceremonial signalling was required. Standing stones are an additional component of the complex symbolic lives of the people who erected them throughout the archipelago.





STANDING STONE				ID
Stone Length	Stone Width	Stone Breadth	Height Above Ground	Waypoint
<input type="text"/> cm	<input type="text"/> cm	<input type="text"/> cm	<input type="text"/> cm	<input type="text"/>
MODIFICATION <input type="checkbox"/> Battering <input type="checkbox"/> Flaking <input type="checkbox"/> Rubbing <input type="checkbox"/> Engraving <input type="checkbox"/> Grinding <input type="checkbox"/> NA				
TECHNIQUE <input type="checkbox"/> Wedged <input type="checkbox"/> Chocked <input type="checkbox"/> Embedded <input type="checkbox"/> Propped				
DIRECTION STONE IS POINTING				<input type="text"/>
ANGLE FROM GROUND <div>     </div>				
CLUSTERING <input type="radio"/> Isolated <input type="radio"/> Clustered		COMPOSITE SHAPE <input type="radio"/> Linear <input type="radio"/> Circular <input type="radio"/> Amorphous <input type="radio"/> Curvilinear <input type="radio"/> Angular <input type="radio"/> NA <input type="radio"/> Arc <input type="radio"/> Squared		
DESCRIPTION <input type="text"/>				
OTHER ASSOCIATED MATERIAL CULTURE <input type="text"/>				
<input type="button" value="FINISH"/>				

Figure 4.7. Standing stone iPad recording form.

Clusters or piles

Clusters and piles are structures created from small stones (5–50 cm in length) that have been grouped together in a range of distinct and/or amorphous shapes. Clusters/piles are found in a variety of landforms although they are usually on level ground or at a gentle incline. Structures have been identified in very high and in moderate elevation on level ground, intertidal,

shoreline, beach rock terrace, hillside and hilltop areas (Figure 4.8).

The recording form provides a checkbox to allow for different combinations of stacking, clustering and clearing to be selected. The recorder should select the dominant construction technique first, as the form recognises the order they are selected.



Figure 4.8. Examples of discrete clusters or piles (a) curvilinear shape on the Northern Burrup; (b) circular shape on Rosemary Island; AND (c) circular shape on Cape Bruguieres.

Variants are either 'discrete' or 'arranged'. A discrete cluster/pile consists of a single structure as compared to a series of mounds grouped together. As with standing stones, each cluster/pile should be recorded individually regardless of whether it is a discrete or arranged variant. The designated range of shapes includes mound, linear, curvilinear, arc, circular, angular, squared and amorphous (Figure 4.9). Arranged variants can also be a part of larger composite shapes. If a single mound was part of a larger arc then 'mound' would be first selected (under the heading of shape) followed by 'arc' (under the heading of composite shape). Each mound in

the composite shape should be recorded separately with further information provided in the comments.

The 'relief' field records how robust a stacked construction is: these structures are generally of low to moderate relief.

Discrete clusters/piles are likely to have functioned in a similar way to isolated and low density and/or quantity standing stones. Multi-component structure sites found elsewhere in Western Australia are likely a symbolic representation of ceremonial activities both open access and closed secret/sacred (Hook and Di Lello 2010; Palmer 1977).

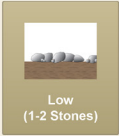
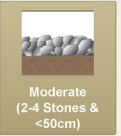

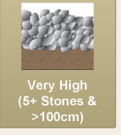

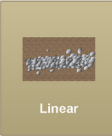
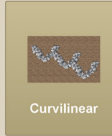
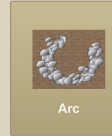

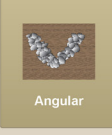
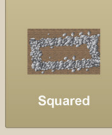

CLUSTER OR PILE			ID
Length <input type="text"/>	Width <input type="text"/>	Height <input type="text"/>	Structure ID
cm	cm	cm	
MODIFICATION <input type="checkbox"/> Battering <input type="checkbox"/> Flaking <input type="checkbox"/> Rubbing <input type="checkbox"/> Engraving <input type="checkbox"/> Grinding <input type="checkbox"/> NA		CONSTRUCTION <input type="checkbox"/> Clustered <input type="checkbox"/> Stacked <input type="checkbox"/> Cleared	
RELIEF <div>  Low (1-2 Stones)  Moderate (2-4 Stones < 50cm) </div> <div>  High (5+ Stones & 50-99 cm)  Very High (5+ Stones & >100cm) </div>		SHAPE <div>  Mound  Linear  Curvilinear  Arc </div> <div>  Circular  Angular  Squared  Amorphous </div>	
VARIATION <input type="radio"/> Discrete <input type="radio"/> Arranged		COMPOSITE SHAPE <input type="radio"/> Linear <input type="radio"/> Circular <input type="radio"/> Amorphous <input type="radio"/> Arc <input type="radio"/> Curvilinear <input type="radio"/> Angular <input type="radio"/> Squared <input type="radio"/> NA	
DESCRIPTION <input type="text" value="Include description of landscape context"/>			
OTHER ASSOCIATED MATERIAL CULTURE <input type="text" value="Describe all other associated cultural material, including their IDs if they were recorded"/>			
<div>FINISH</div>			

Figure 4.9. Cluster or pile iPad recording form.

Barriers

Barriers are structures that extend between areas of (naturally) raised ground. These structures are most frequently found on the shoreline or associated with contemporary or historical water bodies, including drainage channels (Figure 4.10).

These structures can be built using either clustered or stacked construction methods. Dominant shapes are linear, curvilinear, arc and angular and these options are included in the recording form.



Figure 4.10. Barrier structures on (a) Tozer Island, (b) Enderby and (c) Tozer Island.

Four variants (bowl, bottleneck, bar and dam) are defined to describe the shape made by the barrier and surrounding landform. A schematic of each is embedded on the button on the recording form (Figure 4.11).

'Bowl' barriers extend across confined areas, generally a small inlet. 'Bottleneck' barriers extend across a narrow opening behind a tidal lagoon. These areas can also be fed by a creek / drainage channel and therefore the water can either be salt dominated

or brackish. 'Bar' barriers extend from the (current or historical) shoreline to a small island of higher ground. 'Dam' barriers extend across narrow drainage channels blocking off any water flow.

The most likely function for barrier structures is as fish traps; however, some of these structures are part of larger, more complex arrangements which may also have had ceremonial functions.

BARRIER			ID <input type="text" value="Structure ID"/>	
Length <input type="text"/> cm	Width <input type="text"/> cm	Height <input type="text"/> cm	Starting Waypoint <input type="text"/>	Final Waypoint <input type="text"/>
MODIFICATION <input type="checkbox"/> Battering <input type="checkbox"/> Flaking <input type="checkbox"/> Rubbing <input type="checkbox"/> Engraving <input type="checkbox"/> Grinding <input type="checkbox"/> NA			CONSTRUCTION <input type="checkbox"/> Clustered <input type="checkbox"/> Stacked	
VARIATION <div>Bowl</div> <div>Bottleneck</div> <div>Bar</div> <div>Dam</div>		RELIEF <div>Low (1-2 Stones)</div> <div>Moderate (2-4 Stones < 50cm)</div> <div>High (5+ Stones & 50-99 cm)</div> <div>Very High (5+ Stones & >100cm)</div>		SHAPE <div>Linear</div> <div>Curvilinear</div> <div>Arc</div> <div>Angular</div>
CLUSTERING <input type="radio"/> Isolated <input type="radio"/> Clustered		COMPOSITE SHAPE <input type="radio"/> Linear <input type="radio"/> Curvilinear <input type="radio"/> Circular <input type="radio"/> Angular <input type="radio"/> Amorphous <input type="radio"/> Squared <input type="radio"/> Arc <input type="radio"/> NA		
DESCRIPTION <input type="text" value="Include description of landscape context"/>				
OTHER ASSOCIATED MATERIAL CULTURE <input type="text" value="Describe all other associated cultural material, including their IDs if they were recorded"/>				
<input type="button" value="FINISH"/>				

Figure 4.11. Barrier iPad recording form.

Landscape walls

Landscape walls comprise multiple stones stacked together to form a structure which is longer than it is wide. These structures are constructed from stacked stones approximately 20–30 cm in length and are found inland in slightly elevated ground.

The human origin of these structures has been debated in the literature, so observation of modifications to these structures is important and details should be provided in comments within the 'Other associated material culture' field of the recording forms. Some stones with negative flake scars in these structures provide evidence that they were thrown into position (Beckett 2021: 137–181); engraving of stones amongst these structures has also been observed (Site File DPLH 8972).

Three variants of landscape walls have been identified using a combination of 'relief' and 'profile' characteristics. These are recorded as observed in the field and then later sorted into high/retaining, low/moderate and depressions/enclosures (Figure 4.13).

High/retaining walls have high or very high relief, generally four or more stones high (>50 cm). The profile is related to the ground directly upslope from the wall and can be a gutter or level area of retained sediment. The ground behind the wall can range in size from narrow to a large level platform over 1–2 m wide. These structures tend to be in moderate to gently sloping ground and can be isolated or clustered in a large extensive complex that incorporates natural outcrops, making the exact shape difficult to define (Figure 4.12).



Figure 4.12. Landscape walls: (a) aerial image of Kangaroo Tanks site (DPLH 9307); (b) MX-17 (DPLH 19468).

Low/moderate walls are constructed with low to moderate relief (less than four stones or <50 cm in height). The extent of these structures can be difficult to define amongst naturally occurring rocks. The profile of these walls usually does not retain sediment, therefore select 'other' as the profile. Criteria to distinguish natural accumulations and anthropogenic modifications must be applied to distinguish these landscape wall variants.

Depressions/enclosures are a similar relief to low/moderate walls but can be distinguished by their enclosed shape, exaggerated by clearing. These structures are often found in more elevated ground, such as hill crests. The dominant construction type is stacking, with the central area being ill-defined, undulating and not completely clear of stones. As with low/moderate walls, consideration of criteria used in confirming anthropogenic modification is important. These structures are different from the clearing or enclosure type (see following section).

The simplest and most persuasive explanation for the function of all landscape wall variants is that they were related to subsistence behaviours and landscaping. There is compelling evidence to suggest that these structures may have provided 'rock mulch' to help retain moisture, preserve nutrients and reduce runoff (Buck 2017). This strategy is deployed elsewhere in the world in similarly arid environments (Baer et al. 2008). If this explanation is correct, the high/retaining variants are constructed in areas more prone to runoff while the low/moderate variants are used more widely. Depressions/enclosures could also have been used to help retain moisture and nutrients or to protect food plants from adverse elements or fire (Baer et al. 2008: 104; Buck 2017: 22). Ethnographic evidence also indicates more complex mythological components to some, if not all, of these sites (Morse et al. 1996: 35).













LANDSCAPE WALL			ID <input type="text" value="Structure ID"/>	
Length <input type="text"/> cm	Width <input type="text"/> cm	Height <input type="text"/> cm	Starting Waypoint <input type="text"/>	Final Waypoint <input type="text"/>
MODIFICATION <input type="checkbox"/> Battering <input type="checkbox"/> Flaking <input type="checkbox"/> Rubbing <input type="checkbox"/> Engraving <input type="checkbox"/> Grinding <input type="checkbox"/> NA			CONSTRUCTION <input type="checkbox"/> Clustered <input type="checkbox"/> Stacked <input type="checkbox"/> Cleared	
RELIEF		PROFILE	SHAPE	
 Low (1-2 Stones)	 Moderate (2-4 Stones < 50cm)	 Retaining	 Linear	 Curvilinear
 High (5+ Stones & 50-99 cm)	 Very High (5+ Stones > 100cm)	 Gutter	 Circular	 Amorphous
		 Other	 Squared	
CLUSTERING <input type="radio"/> Isolated <input type="radio"/> Clustered		COMPOSITE SHAPE <input type="radio"/> Linear <input type="radio"/> Circular <input type="radio"/> Amorphous <input type="radio"/> Arc <input type="radio"/> Curvilinear <input type="radio"/> Angular <input type="radio"/> Squared <input type="radio"/> NA		
DESCRIPTION <input type="text" value="Include description of landscape context"/>				
OTHER ASSOCIATED MATERIAL CULTURE <input type="text" value="Describe all other associated cultural material, including their IDs if they were recorded"/>				
<input type="button" value="FINISH"/>				

Figure 4.13. Landscape wall iPad recording form.

Clearings or enclosures

Clearings and enclosures are level areas created by the removal of stones, often from a central area, and stacking or clustering nearby. These structures are found in a variety of landscapes and differ from landscape walls in that the dominant element is a residual cleared, often level, space. Stones can be stacked or clustered around

the cleared space in a haphazard manner or a circular, semi-circular or amorphous shape. Relief is generally low-moderate and stacked stones display evidence of having been thrown into position by the presence of 'flaking' modification.



Figure 4.14. Clearings or enclosures: (a) level clearing on Rosemary Island; (b) modified outcrop at Nganjarli Gorge.

Three variants of clearing/enclosure have been identified: level clearings, modified outcrops and scattered heaps (Figure 4.14 and Figure 4.15).

'Level clearings' are often found in rocky ground with the removal of stones in stark contrast to the surrounding rocks. These structures have a central enclosed space, usually larger than a metre in diameter, with a surrounding concentration of stacked or clustered stones.

'Modified outcrops' are structures constructed by clearing and stacking stones amongst the steep rocky slopes of Murujuga. Caution must be applied with these structures as they are often found in association with natural accumulations of sediment and calcrete which create level, vegetated areas. These areas may be related to subterranean springs discharging water through geological fissures. Research is ongoing to investigate this.

Anthropogenic modification can be confirmed by observation of the various modifications as well as the presence of fragments of calcrete amongst the stacked components of these structures. Calcrete forms as a solid mass *in situ* and while tree roots can move rocks laterally, multilayered stacking cannot be created without additional human intervention (Beckett 2021: 137–181).

'Scattered heaps' are haphazardly collected stacked or clustered piles adjacent to a cleared area. Unlike clusters/piles, the stacked component is not well defined but it is always associated with a dominant cleared component. Calcrete is not usually present. Anthropogenic modification can be identified by observation of stacked stones, negative flake scars and associated artefact scatters. Level gravel accumulations containing stone artefacts, known as 'Burrup patches' (ACHM 2003: 33; Vinnicombe 1987a: 23), are also often associated with these structures.

Clearings/enclosures appear to have been constructed to form level areas for people to sit or lie in. These areas are frequently associated with other cultural material, such as artefact or shell scatters and/or rock art assemblages. This indicates task-specific activities occurred in these site complexes and that these sites may have been created for shelter or habitation. Level clearings often have stacked components that would have provided the elements necessary for people to shelter from the weather (it is assumed by using organic elements, such as shrubs, spinifex clumps or tree branches). Modified outcrops also often contain comfortable shaded areas to sit.











CLEARING OR ENCLOSURE			ID	Structure ID	
Length	Width	Height	Starting Waypoint	Final Waypoint	
<input type="text"/> cm	<input type="text"/> cm	<input type="text"/> cm	<input type="text"/>	<input type="text"/>	
MODIFICATION <input type="checkbox"/> Battering <input type="checkbox"/> Flaking <input type="checkbox"/> Rubbing <input type="checkbox"/> Engraving <input type="checkbox"/> Grinding <input type="checkbox"/> NA			CONSTRUCTION <input type="checkbox"/> Clustered <input type="checkbox"/> Stacked <input type="checkbox"/> Cleared		
VARIATION	RELIEF	SHAPE			
 Level Clearing	 Low (1-2 Stones)	 Moderate (2-4 Stones < 50cm)			
 Modified Outcrop	 High (5+ Stones & 50-99 cm)	 Very High (5+ Stones & >100cm)			
 Scattered Heap		 Angular  Arc  Circular  Squared  Amorphous			
CLUSTERING		COMPOSITE SHAPE			
<input type="radio"/> Isolated <input type="radio"/> Clustered		<input type="radio"/> Linear <input type="radio"/> Circular <input type="radio"/> Amorphous <input type="radio"/> Arc <input type="radio"/> Curvilinear <input type="radio"/> Angular <input type="radio"/> Squared <input type="radio"/> NA			
DESCRIPTION					
<input type="text" value="Include description of landscape context"/>					
OTHER ASSOCIATED MATERIAL CULTURE					
<input type="text" value="Describe all other associated cultural material, including their IDs if they were recorded"/>					
FINISH					

Figure 4.15. Clearing or enclosure iPad recording form.

Bedrock pits

Bedrock pits are created through the removal and excavation of smaller stones to expand natural cavities in disaggregating bedrock. These structures are found throughout the rocky slopes of Murujuga. Although clearing is the dominant construction type (and all bedrock pits will have a cleared construction), many of these structures also have stones stacked along the

edge of the resultant pit (Figure 4.16).

Modification such as engraving and flaking (i.e. negative flake scars) helps to confirm these structures as anthropogenic. Other evidence includes calcrete crusts or differential weathering on the patina of the stones making up the stacked (replaced) portion of the structure (Beckett 2021: 170).



Figure 4.16. Bedrock pits: (a) DPLH 9214, (b) aerial image of two bedrock pits at Swamp Castle Site (DPLH 9400).

The length and width measurements are taken perpendicular to one another at the highest point of stacking/replaced stones. If one pit wall is natural and no stacking is present, the measurement is from the wall edge. The height measurement is also taken from the bottom to the highest point of the pit. Relief refers to the height of the replaced stones around the edges of the main depression: deep pits can often have low relief walls (Figure 4.17).

Most bedrock pits appear circular in shape because of the removal of stones around a central structure area; however, other forms exist, and these can be selected on the recording form. Composite shapes can be recorded on the form, but most bedrock pits will be isolated/clustered.

Previously the main interpretation for 'smaller pits which contain neither soil nor vegetation' is that they were constructed as 'hunting hides' (Gara 1984; Vinnicome 1987: 34); however, it is likely that these structures actually represent a range of multilayered and recursive functions that include technological/subsistence behaviours. This could include their use as hides/lookouts and as a by-product of raw material or other resource (e.g. stone or water) extraction. Some of these structures may have been used as shelter by mythological beings (DPLH Site File ID#25578), supporting complex somatic and symbolic functions for these places.

BEDROCK PIT

ID

Length

cm

Width

cm

Height

cm

Waypoint

MODIFICATION

☐ Battering
☐ Flaking
☐ Rubbing
☐ Stacked
☐ Cleared

☐ Engraving
☐ Grinding
☐ NA

RELIEF

Low
(1-2 Stones)

Moderate
(2-4 Stones & <50cm)

High
(5+ Stones & 50-99 cm)

Very High
(5+ Stones & >100cm)

SHAPE

Angular

Arc

Circular

Squared

Amorphous

CLUSTERING

☐ Isolated
☐ Clustered

COMPOSITE SHAPE

☐ Linear
☐ Circular
☐ Amorphous
☐ Arc

☐ Curvilinear
☐ Angular
☐ Squared
☐ NA

DESCRIPTION

OTHER ASSOCIATED MATERIAL CULTURE

FINISH

Figure 4.17. Bedrock pit iPad recording form.

Historical structures

A variety of historical (and contemporary) structures have been identified across the archipelago as a result of pastoral, whaling and pearling activities.

It is useful to distinguish between these and the other eight types already described. Historical structures were only peripherally examined during the development of this typology and more detailed work is required to develop these forms and expand on the variants described here.

The term 'historical' is used loosely and is a catch-all to highlight structures meeting one or all the criteria

below:

- existence of documentary evidence revealing use during the recent past;
- associated with historical artefacts (e.g. glass, ceramics, metal and/or processed pearl shell) and with evidence that suggests these artefacts are contemporary to the structure;
- squared building foundations (Figure 4.18b);
- European masonry techniques, including dry-stone walling, dressed squared stones and stone flooring/flagstones (Figure 4.18).



Figure 4.18. Historical structures: (a) 'dressed' stone on West Lewis Island; (b) West Lewis Island WL001-BLD01 during excavations.

At Murujuga many historical activities and settlements relied on boats for transport and historical structures and settlements tend to be found near the coast. Settlements were either directly involved in maritime trade, with pearling activities (i.e. careening ships in the off-season) or collection of goods transported by ships.

Structures may have dual functions or have been modified during the historical period, adding to the complexity of identification. The dominant attributes should designate the type recorded and the forms provide ample space for comments to explain the designation.

Historical structures range from low to very high relief and include placed, stacked and dressed construction techniques, the most distinctive of which is the dressed stone in combination with dry-stone walling. They are found in a variety of shapes, though most were square. The variants include buildings, industrial ruins, grave markers, historical cairns and 'other' remains (Figure 4.19).

While this terminology has functional connotations, the form-first approach is still very much embedded in the definition and categorisation of these variants.

'Buildings' include a range of structures which may have had a variety of functions throughout the more

recent past (Burcham 2019). Buildings are usually square or angled in shape and display evidence of European dry-stone walling construction techniques (dressing and structural engineering).

'Industrial ruins' included the remains of structures that cannot be considered to be buildings (e.g. the whaling tripots), although some may be associated with historical settlements.

A number of 'grave markers' have been identified and these are considered as separate structures because they reflect a very different signature. While these relate to historical events – for example, on the deaths of pearlers – some of these constructions have been erected in the more recent past as memorials.

Historical 'cairns' also employ the dry-stone walling techniques although usually with undressed stones. These structures are not necessarily derivative of other historical structures but can be associated with historical and contemporary evidence, such as artefacts.

'Other' structures are those which show evidence of being historical – based on the four criteria outlined above – but may not be able to be identified.

Further discussion of historical structures can be found in chapters 11 and 13.

HISTORICAL			ID <input type="text" value="Structure ID"/>	
Length <input type="text"/> cm	Width <input type="text"/> cm	Height <input type="text"/> cm	Starting Waypoint <input type="text"/>	Final Waypoint <input type="text"/>
MODIFICATION <input type="checkbox"/> Battering <input type="checkbox"/> Flaking <input type="checkbox"/> Rubbing <input type="checkbox"/> Engraving <input type="checkbox"/> Grinding <input type="checkbox"/> NA			CONSTRUCTION <input type="checkbox"/> Dressed <input type="checkbox"/> Stacked <input type="checkbox"/> Cleared	
VARIATION <input type="button" value="Building"/> <input type="button" value="Industrial Ruin"/> <input type="button" value="Grave Marker"/> <input type="button" value="Cairn"/> <input type="button" value="Other"/>	RELIEF <div> <p>Low (1-2 Stones)</p> </div> <div> <p>Moderate (2-4 Stones & <50cm)</p> </div> <div> <p>High (5+ Stones & 50-99 cm)</p> </div> <div> <p>Very High (5+ Stones & >100cm)</p> </div>	SHAPE <div> <p>Angular</p> </div> <div> <p>Arc</p> </div> <div> <p>Circular</p> </div> <div> <p>Squared</p> </div> <div> <p>Amorphous</p> </div>		
COMPOSITE SHAPE <input type="radio"/> Linear <input type="radio"/> Arc <input type="radio"/> Angular <input type="radio"/> Amorphous <input type="radio"/> Curvilinear <input type="radio"/> Circular <input type="radio"/> Squared <input type="radio"/> NA				
DESCRIPTION <input type="text" value="Include description of landscape context"/>				
OTHER ASSOCIATED MATERIAL CULTURE <input type="text" value="Describe all other associated cultural material, including their IDs if they were recorded"/>				
<input type="button" value="FINISH"/>				

Figure 4.19. Historical structure iPad recording form.

Murujuga: Dynamics of the Dreaming project

A total of 2,940 structures were included in the development of this typology, of which 502 were recorded during the Murujuga: Dynamics of the Dreaming Linkage Project (MLP) (Figure 4.1). Stone structures were recorded in all the areas targeted for systematic survey.

Seven of the nine types were recorded during the MLP across the archipelago (Figure 4.20). The majority (43.8%) were standing stones followed by landscape walls at 16%, bedrock pits at 13.3%, historical structures

at 12.3%, clearing/enclosures at 8%, discrete placed at 3.3% and clusters/piles at 1.8%. A slightly higher number of structures (56% or $n = 246$) in the assemblage (excluding historical structures) are inferred to have symbolic functions (discrete placed, standing stone, cluster/pile), while a large number of structures have inferred somatic or more utilitarian functions (landscape wall, clearing/enclosure, bedrock pit).

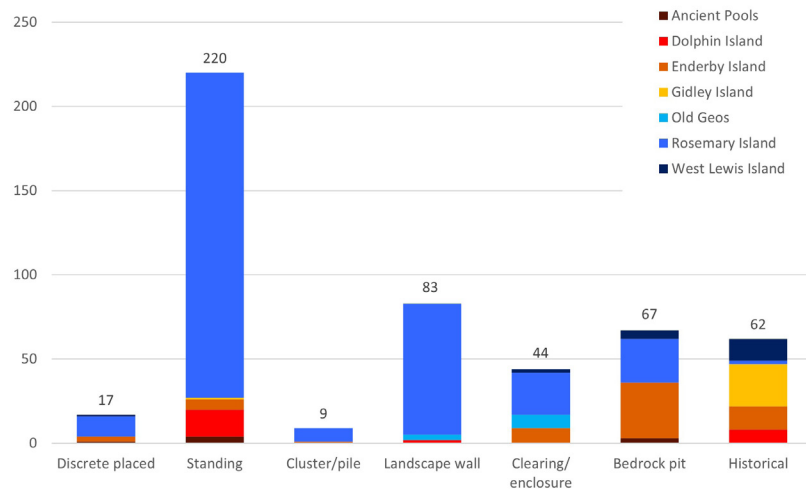


Figure 4.20. Stone structure types recorded during the project (n = 502).

Structures recorded during the MLP reflect the project's target areas, and these are detailed in subsequent chapters. A high proportion of structures were recorded on Rosemary Island (Figure 4.20), the focus of three MLP field seasons (see Chapter 7 and Berry 2018). Structures on Rosemary Island appear in higher numbers and densities than in the target areas on Enderby Island (Chapter 5) or at Ancient Pools (Chapter

14) where survey was intensive but restricted to smaller sample transects. At the Old Geos site (Chapter 15) the fieldwork focus was excavation and the structures recorded were near the excavations. Most structures on Gidley Island and West Lewis Island are related to historical pastoral and pearling activities. These structures were approached differently (see chapters 9, 11 and 12).

Summary

Nine new Murujuga stone structure types and 20 subtypes (variations) have been defined based on construction, shape and landscape context. This approach addressed and refuted the argument that many Murujuga structures were non-anthropogenic. The focus on construction minimises the confusion with natural features, and the taxonomic confusion which has resulted from more function-first approaches. This typology provides clear definitions and consistent hierarchical terminology which describes the variability encountered in this large data set. This 'form-first' approach avoids the creation

of overlapping types and can accommodate additional stone structure types, providing consistency for future description and interpretation. The new MLP recording forms based on this typology will ensure future recording of these structures is consistent. This research, including the full audit of the archipelago's stone structure record, has addressed previous debates about the nature and interpretive potential of stone structures and has begun to explore the extraordinary complexity of this element of the Murujuga modified landscape.

Notes

1. The form images have been slightly modified to allow them to fit consistently on to a page.

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