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PETROGLYPHS OF THE DAMPIER ARCHIPELAGO: BACKGROUND TO DEVELOPMENT AND DESCRIPTIVE ANALYSIS

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Abstract. The purpose of this paper is two-fold: to draw attention to the prolific petroglyphs and associated archaeological sites of the Burrup Peninsula and adjacent Dampier Archipelago in the north-west of Western Australia, and to outline the sequence of events that led to the impact of industrialisation in this area. Aboriginal heritage values have been consistently overlooked in favour of industrial development. An appeal is made for the urgent implementation of an effective plan of management for the surviving cultural traditions of this outstanding precinct.

The setting

The Dampier Archipelago and associated Burrup Peninsula, located on the Indian Ocean coast of Western Australia's Pilbara region about 1550 km north of Perth, has long been known as the locale of a prodigious distribution of Aboriginal petroglyphs¹. The density of motifs and the range of subject matter, techniques and patination qualify this body of art as among the richest expressions of pre-literate documentation in the world.

The Dampier Archipelago, comprising some forty-two rocky islands and islets, is the visible component of a relatively recently drowned landmass, the shorelines of which stabilised about 6000 years ago. Formerly known as Dampier Island, the 'Burrup Peninsula' is the largest landmass in the archipelago. This projection of land, approximately 27 km long and 5 km wide, is an artificial peninsula associated with recent industrial development. Because all the youngest archaeological evidence in the area relates to island exploitation, I have chosen to use the name 'Burrup' without the appended 'Peninsula', as the latter term gives a false impression of what the country was like when it was occupied by the Aboriginal population (Fig. 1).

Geology and climate

The Burrup is characterised by steep slopes and ridges composed of masses of boulders piled apparently haphazardly one on top of the other, giving the impression of having been dumped there by a super-human agency. The massed boulders are, however, the result of ancient in situ weathering and are therefore not true scree slopes as they have often been described (DAS 1984a; Vinnicombe 1987a; Veth et al. 1993; Murphy et al. 1994; Lantzke et al. 1994).

The geological substrate of the Burrup is jointed Archaean and gneissic granite, with intrusive jointed outcrops of Proterozoic gabbro and granophyre, more precisely termed granophyric rhyodacite (Gordon 1996: 7). The rock mass has domed upwards and cracked along major tension joints, allowing deep weathering to occur and resulting in the linear formation of long narrow valleys that intersect the land surface. The different sizes of boulders that comprise separate outcrops, varying from relatively small to very large boulders and from rounded to angular, can be explained by this differential jointing coupled with different periods of time to which the intrusions have been exposed to weathering (Gordon 1996). The granophyric rhyodacite, with its interlocked fine-grained structure, is one of the strongest rock types known in Australia. This factor has considerable bearing on the long-term prospects for preservation and dating of the associated art.

There are several varieties of granophyric rhyodacite on the Burrup, but most typically the porphyritic rock is blue-

¹ In the past, the term 'engravings' has commonly been applied to the rock art of the Burrup Peninsula and associated Dampier Archipelago. However, a recent publication (Bednarik 1998) has re-focused attention to the fact that the term 'engraving' implies the use of particular tools, in particular burins, which are uncommon in the archaeological toolkit of the area (cf. Bednarik 1991). In addition, the majority of the rock art in the Burrup area has been made by pecking and pounding, to which the term 'engraving', which implies the application of linear friction, does not apply. In order to conform with international rather than local usage, I have therefore avoided using the term 'engraving'.

grey with a surface cortex weathered to a deep reddish brown. The texture of the matrix may be coarse, medium or fine, depending upon the rate of cooling and solidification at the time of extrusion. The quicker the cooling, the denser and finer is the grain size. The denser the matrix, the easier it is for a stone worker to control fracture lines and to avoid splintering, a factor which is important when flaking stone tools and creating visual images on a rock surface. In some precincts, almost every boulder shows evidence of flake scars or is decorated with rock art.

Located north of the Tropic of Capricorn, the area has high temperatures in the summer and is characterised by erratic rainfall influenced by both the southern winter rainfall system and the northern tropical cyclones. There is no permanent surface water, but the huge impermeable boulders channel run-off into the narrow gullies that become ephemeral creeks during the wet season. The reliance on unpredictable rains and the associated seasonally replenished rock pools would certainly have been a determining factor to permanent occupation of the area. It is known that the Aboriginal people also dug soaks for water, and in Historic times, the crew of European vessels anchored off the Archipelago sometimes obtained water from such soaks (Gregory and Gregory 1884: 56). Aboriginal campsites with their associated shell mounds were usually centred on seasonal rock pools, and typically, this is where the greatest concentration of petroglyphs occurs.

For the Aboriginal people, the selection of different rock types for different purposes is governed not only by pragmatic and aesthetic considerations regarding fracture planes, durability and visual effect, but also by a belief system that attributes different spiritual and mythological qualities to different rocks (pers. comm., the late Y. Warri, 1997).

The Aboriginal inhabitants

The Aboriginal people who inhabited the Archipelago in recent times have been referred to as the *Yaburara* or 'down-stream' people (Gara 1984, 1993), but they were culturally and linguistically part of the *Ngarluma* group now centred in the Roebourne area (Hall 1971: 28; Von Brandenstein 1970: 435). The island people specialised in a marine economy and developed great expertise in negotiating the tidal currents on flimsy rafts or floats of mangrove poles which they propelled with their hands rather than using paddles. All the islands of the Archipelago show evidence of having been visited and utilised by Aboriginal people, probably on a seasonal basis (Green and Turner 1982a: 4).

The English navigator William Dampier, after whom the Archipelago is named, anchored off one of the islands in August 1699. Although he saw smoke in the distance, he does not mention any other sign of inhabitants (Masefield 1906, Vol. 11: 435). The first contact between European and Aboriginal people did not take place until Captain Philip Parker King undertook a survey of the north-western Australian coastline in the *Mermaid* in February 1818. King observed groups of men, women and children on the islands, and noted that they were adept swimmers. He described their floating logs of mangrove wood curiously joined together with flexible pegs, and reported that 'tracks of natives and their fire-places were everywhere visible, and around the latter the bones of kangaroos and fishes were strewn' (King 1827: 37).

The first land exploration to assess the region for future settlement took place almost half a century later, in May 1861, when F. T. Gregory and his party disembarked from the *Dolphin* at Hearson Cove on the eastern shore of the Burrup. While Gregory and his mounted companions explored inland, the crew of the *Dolphin* developed a friendly contact with Aboriginal people over a period of almost three months. Excerpts of Gregory's diary read as follows:

20th May 1861: This morning I made a rough survey of the cove and surrounding hills, and while so employed observed seventeen natives pass across the shoals at low water, carrying nets but no weapons; they did not appear to fear us, or inclined to come to the camp ... (Gregory and Gregory 1884: 58).

On the 19 July 1861, the exploration party returned to their old camping ground at Hearson Cove

which we found occupied by ten or a dozen natives, engaged mending their nets. Coming upon them suddenly, they would not stop to carry off their gear, although not half an hour before they had been employed assisting a boat's crew from the 'Dolphin', in loading with wood and water ... (Gregory and Gregory 1884: 73).

Strangely enough, no mention was made of the presence of petroglyphs until a few years after Gregory's visit, when J. P. Stow wrote:

The sandhill by which we were camped was a camping ground of the natives. There were many old fireplaces, fish and turtle bones, and breakwinds of bushes. ...

There were sketches of fishes, turtles, lizards and different kinds of birds, including emus. One aboriginal artist made a sketch of a turtle in the sand (Stow 1881: 65, 66).

The above comment is somewhat less dismissive than a later settler who bluntly stated: 'They draw rude figures on stones' (Richardson in Curr 1886: 297-8).

A reprisal raid that has become known as The Flying Foam Massacre took place in 1868, when numerous Aboriginal men, women and children were pursued and shot down on the Burrup by a combined force of police and volunteers (Gara 1983; Veth et al. 1993: 49-58). One of the settlers who participated in this event was John Withnell, who ran stock on properties in the Roebourne and Karratha areas, and who had considerable interactive experience with the Aboriginal inhabitants. Excerpts from his many observations include:

They have very many rock engravings; every hill that has suitably hard stone will have some kind of figure tattooed thereon. They do not choose the softer rocks, and mainly prefer the basalt and granite (Withnell 1901: 29).²

² It is interesting that Withnell uses the term 'tattoo'. This is a more accurate description of the way in which the petroglyphs were made than the more usual term 'engraving'. It is also of note that 'thalu' sites, usually associated with standing stones and sometimes with petroglyphs, were identified by Aboriginal elders who took part in archaeological surveys of the Dampier Archipelago. Many of the larger anthropomorphic and animal figures, together with their tracks, were identified with ancestral creator beings, and some of the attenuated figures were described as 'spirit people'. These observations confirm that mythological and ceremonial significance is still attributed to the art in certain contexts. In addition to recognising the

Although strange, some of their magicians maintain that they are able to leave their bodies in a trance, and in spirit visit other lands and converse with long-departed spirits (p. 4).

Withnell also describes ceremonial *thalu* or 'increase sites', some of which incorporate rock art:

A Tarlow (*thalu*) is a stone or pile of stones set apart as a hallowed spot, dedicated to the ceremony of willing that certain things such as children, birds, animals, insects, frogs, reptiles, fishes and grass seeds etc., be made to multiply and increase, each living thing having a separate tarlow all of which belong to the head of each family, as master of the craft, descending from father to son ... They must journey to that shrine, for it cannot be done elsewhere. ... They all have a different ceremony in willing each thing required; in some they hammer the cairn or boulder with other round stones and go through many speeches ... They carry with them on this mission whatever weapons or utensils are used in gathering or procuring the thing to be willed. For instance, if they are willing grass seeds they take wooden scoops; if kangaroos, spears; if turkeys, nets etc. They all dress differently, and make free use of feathers, charcoal, and white and red clays. The women also take part and inherit these tarlows (p. 5–6).

Gregory's favourable reports on the potential of the Pilbara area led directly to white settlement. The pearl shell that abounded in the sandy shallows around Cossack and Nickol Bay, which the Aboriginal people used as decoration and traded for ceremonial purposes, was soon collected in bulk by enterprising white settlers. This profitable trade was followed by larger commercial enterprises and from 1870 onwards, the Flying Foam Passage in the Dampier Archipelago became a major centre for pearling. A whaling station was also established on Malus Island to process humpback whales, a commercial venture started by American whalers as early as 1840. Later, the islands were used for pastoral purposes as well as providing shelter and campsites for commercial fishermen from Point Samson and Onslow. During this period turtles and their eggs were taken commercially around the Dampier Archipelago and a turtle meat canning company operated at Cossack (Pilbara 21 1992: 40).

The pattern of exploitation included indentured Aboriginal labour which, together with introduced diseases such as smallpox and influenza, contributed in no small measure to the decimation of the Aboriginal population in the Archipelago and the final breakdown of their social fabric (Gara in Veth et al. 1993: 59–62; Gara 1984: 10).

Early commercial exploitation of the natural environment

The opening up of the Pilbara to the pastoral industry and associated commercial exploitation of the natural environment soon necessitated back-up amenities. The small tidal port of Cossack, originally known as Tien Tsin, was established in 1863 to service the pastoralists. Generous Government land regulations resulted in the arrival of settlers from Victoria and the south-west of Western Australia. Little over one hundred and forty years ago, there were no white settlers in the area and Aboriginal people were the sole occupiers of the land.

In 1866, Roebourne was established as the administrative centre for the north of the Swan River Colony and in 1887, the discovery of gold in the Pilbara led to further inroads into Aboriginal territory. There was also a need for a bigger and better port; eyes turned to Depuch Island.

According to the Aboriginal belief system, Depuch Island is the resting place of an important ancestral being who left many engravings as a sign of the Law he carried. Depuch Island is also associated with a ceremonial dreaming track with corresponding sacred songs (Palmer 1977).

As early as 1908, the State Mining Engineer reported on the West Pilbara goldfields and proposed a railway from the coast to Marble Bar. He suggested that Depuch Island might provide a satisfactory port for the district if connected to the mainland by a causeway (Ride et al. 1964: 16). No action on this proposal was taken for over fifty years until, in 1961, the press reported that surveys were being made to determine whether Depuch Island should be developed as a deep water port for iron ore interests in the Pilbara district (*Daily News* 14/1/1961 and 4/12/1961; see also Ride et al. 1964: 16). This announcement followed the lifting of restrictions by the Commonwealth government on the export of iron ore from Western Australia. The Government's action heralded an immediate industrial boom and within a few years, over \$2200 million was invested in iron ore production facilities, railways, ports and new towns (Pilbara 21 1992).

Development activity was accompanied by scientific investigations and the Western Australian Museum sent a team to study the resources on Depuch Island (Ride et al. 1964). Prior to this, F. D. McCarthy, then curator of the Australian Museum in Sydney, had made detailed records of the numerous outstanding petroglyphs on Depuch Island and collected aspects of associated mythology from Aboriginal people (McCarthy 1961). This record was expanded by the Museum team, some of whom also made a brief visit to the Dampier Archipelago to investigate and record data there (Crawford 1964: 21).

As a result of these investigations, the feasibility of using Depuch Island as a port was shown to be unacceptable on the grounds of its exceptional Aboriginal heritage, and attention was diverted instead to the Dampier Archipelago. Although subsequent investigations commencing in 1967 have proven that areas of the Archipelago have a heritage value equal to, if not greater than, that of Depuch Island, it has not yet been possible to convince Government that the Burrup should receive the same protection as was accorded to Depuch Island over thirty years ago.

In 1964, the Western Australian government signed contracts between mining interests in Western Australia and steel manufacturers in Japan after which, it appears, the tide of development could not be turned (press release by Minister for Education and Native Welfare, in Ride et al. 1964). Despite early reports (initially by R. Bednarik, later by

prolific evidence of stone having been quarried and converted into artefacts, and places where food was formerly gathered, ground and cooked, the Aboriginal participants in the surveys were profoundly aware of the spirits associated with the pragmatic evidence that was being recorded. Many incidents occurred which clearly demonstrated their belief that the spirits of their ancestors were ever present and interacting both with themselves and the land on which the sites are located.

F. Virili, W. Dix and B. Wright) indicating that the Aboriginal heritage in the Burrup was under threat, all development proceeded in a way that severely compromised future efforts to protect Aboriginal sites.

During the planning and implementation of industrial growth, the interests of Aboriginal people in the area were ignored. This was despite such published statements as the following:

The Pilbara district of northern Western Australia is without doubt the richest and most exciting region of rock engravings in Australia. ... A matter of vital importance in the protection of our prehistoric sites is the attitude of the Aborigines themselves. Thus in north-east Arnhem Land, where bauxite is being mined, the sacred sites in the area were safeguarded at the request of the Aborigines. In other parts of Australia the Aborigines, removed as most of them are from their sacred sites, are rarely consulted about their protection. The encouragement of their interest, rather than its suppression, in the traditional relics of their people, would yield a valuable band of rangers. (McCarthy, Foreword in Wright 1968).

In 1966 Hamersley Iron Pty Ltd commenced iron ore production at Mt Tom Price and exported its first shipment of iron ore to Japan. To support mining interests, Dampier township was developed on the Burrup and in 1967, the Dampier solar salt fields were established there as a result of increased demand for industrial salt by the Japanese chemical industry.

Early site recorders

Robert Bednarik, the current editor of *Rock Art Research*, was employed as Project Manager from 1967 to 1970 by an engineering company serving the mining industry, and was mostly centred in Dampier. During that period he located and recorded almost 600 rock art sites on what was then known as Dampier Island, later the Burrup Peninsula. All his work was done on foot, as there was no vehicular access to most parts of the island at the time (pers. comm. 1996; Bednarik 2002). Regrettably, his detailed survey work remains largely unpublished. Subsequent references draw attention to the potential for dating rock art and to the threats posed by development (Bednarik 1977, 1979):

Due to the present industrial development in the Australian Northwest and the resulting population influx, the district's abundant prehistoric sites, the majority of which were comparatively safe until the early sixties, are becoming increasingly exposed to vandalism. Most vulnerable are rock engravings and surface occupational sites. Art galleries have been destroyed (e.g. Rio Tinto Gorge and Dampier power station site) or defaced, and there is evidence that collectors have become cognizant of camp site debris and, by their selective approach, will eliminate the possibility of any later statistical investigation (Bednarik 1977: 51).

Not before time, a government agency, the Department of Aboriginal Sites, was established in 1970 as a sub-Department of the Western Australian Museum. This was the initial stage in setting up an authority that took some responsibility for the recording and protection of Aboriginal sites in Western Australia. In order to give legal backing to the increasing demands for Aboriginal Heritage protection, the *Aboriginal Heritage Act* was passed by the Western Australian Parliament in 1972.

Following on immediately from the establishment of this new regulatory body, further discoveries were made and developments followed which were to impinge heavily on Aboriginal heritage in the Pilbara. Rich deposits of natural gas were discovered off the North-West Shelf in 1971 and in 1972, Hamersley Iron constructed a major iron ore shipping facility based on Parker Point and East Intercourse Island near Dampier. In addition, the first export salt was shipped from Dampier Salt's loading facility on Mistaken Island.

F. L. (Enzo) Virili was the Project Engineer for Dampier Salt from 1972 to 1976. During these years, he took an active interest in the rock art, but did not know of Robert Bednarik who had worked in the same area only a few years earlier. Virili was encouraged by Warwick Dix, the first Registrar of Aboriginal Sites at the Western Australian Museum, and was also assisted by other staff members, in particular Peter Randolph, Martin Thompson and Angela Calder. Dix [who had consulted Bednarik] also accumulated data on the distinctive 'archaic faces' which he presented as a paper at a rock art conference held in Canberra in 1974 (Dix 1977). Virili reported on his work at the same conference (Virili 1977), but the published version of his paper was subjected to editing; regrettably the following perceptive comments on management strategies in the face of development were not included in the final publication:

The rapid development in the West Pilbara is a factor that cannot be ignored, lest some of the sites be damaged or destroyed before they have been thoroughly studied and recorded.

In Dampier West vast developments and subsequent expansion have taken place with a minimum of disturbance to the Aboriginal sites of that area.

Many sites, because of their random location, may well be in the way of planned development in other areas of the Archipelago. The importance of each site can be evaluated only by a comprehensive survey, undertaken in advance.

Selection of sites to be conserved is necessary and compromises will have to be agreed upon by interested parties in order to prevent the destruction, even in the name of progress, of a unique Australian heritage that must be preserved for future generations (Virili 1974: 33–4).

Virili documented in detail twelve major site complexes, three of which contained more than 1000 engraved motifs at each locality. At four other sites there were between 500–1000 representations. None of these spectacularly rich sites is included in the rock art analysis in this publication.

Virili also drew attention to a midden in Skew Valley that was subsequently excavated by Robert Bevaqua of the W.A. Museum and then the French archaeologist Michel Lorblanchet. It was established that the site had been occupied as early as 6620 years ago and that petroglyphs covered by shell were older than 3800 years (Virili 1974: 17; Bevaqua 1974; Lorblanchet 1977; Lorblanchet 1978; Lorblanchet and Jones 1980). As well as re-excavating the midden, Lorblanchet, an authority on European cave art, made detailed records of 600 petroglyphs in Gum Tree Valley. Later, in 1975, Lorblanchet obtained funding from the Australian Institute of Aboriginal Studies to continue the work he had commenced in the Dampier region, and during 1984, he increased his catalogue of engraved records from Gum Tree Valley to 1300 motifs (Lorblanchet 1984). This large body of data, which included thousands of stone artefacts, is not included in the present analysis.

During his last study period in Australia, Lorblanchet visited other rock art localities, including Kakadu National Park. He advocated in his brief report that a Museum/Research Centre should be created at both Kakadu and Dampier as they were 'the most impressive clusters of sites I [have] ever seen' (Lorblanchet 1984: 4). Despite repeated emphasis on the unique cultural heritage of the Dampier region by scholars and visiting experts, no facility that promotes an appreciation of this priceless resource has been implemented in the Dampier region. Industrialisation, however, grows apace.

During 1977 and 1978, Hamersley Iron and Dampier Salt employed archaeologists to carry out surveys of land leases where development was planned (Brown 1979; Bindon 1978). In all areas, previously unrecorded sites were located.

Woodside and the exploitation of natural gas

As a joint Commonwealth and Western Australian State Government project, a special study of resource development in the Pilbara was initiated in 1974. Recommendations were made in the *Pilbara Study* (Australia 1974) that profoundly threatened the integrity of the Aboriginal heritage in the area. The plans included a wide access corridor running the entire length of the Burrup Peninsula and Dolphin Island to carry service amenities such as road, railway, gas, electricity and water. Some reference was made to sociological and environmental issues but Aboriginal heritage was not considered despite the fact that a report was written by the Registrar for inclusion in the *Pilbara Study* (Dix in DAS 1974). Dix's statement emphasised the need to consider sites during the planning stage of development, to identify reservation areas for permanent protection and to provide for supervision of sites in the Archipelago by a locally based officer.

Then, in 1978, extensive plans associated with the exploitation of natural gas off the North-West Shelf resulted in a detailed environmental assessment being carried out on behalf of Woodside Petroleum Development Pty Ltd (WPD 1979). This involved the Department of Aboriginal Sites in major survey work. There were two preferred site locations for the development of the onshore gas treatment plant and associated facilities: Searipple Passage at the northern end of the Peninsula and Withnell Bay/King Bay further south. A choice had to be made between the two localities. Bruce Wright and Leslie Maynard of the Department of Aboriginal Sites, together with Harry Butler who consulted for Woodside, undertook a preliminary helicopter and ground search of the preferred site locations in October 1978. Spectacular sites had previously been located in the area by ad hoc recording work done by Bednarik, Dix (1970, 1973) and Randolph (1973). A dense accumulation of Aboriginal evidence around Searipple Passage was confirmed, and as a result, the Withnell Bay/King Bay area rather than Searipple Passage was recommended for the proposed development (Wright 1979). An additional consideration was that industrialisation in this northern sector would have entailed access to, and therefore disruption of, the natural and cultural environment through the entire length of the Peninsula. No consultation took place with Aboriginal people who had traditional associations with the area. At a later date, when development plans were finalised, limited discourse was entered into with selected Aboriginal representatives from the Roebourne and Onslow communities.

Withnell Bay was selected as the site for the Gas Treatment Plant. The northern shores of King Bay would become the Supply Base and an area near Hearson Cove would accommodate the temporary workforce. Thereafter, irrespective of the findings of the full survey that followed, there was no flexibility that allowed for further negotiation regarding the siting of the principal areas chosen for development in relation to site avoidance strategies. In the final analysis, 720 sites were documented in the preferred southern lease area. Of these, 349 were destroyed to make way for development, 56 were partially destroyed and the remaining 315 sites that were on the periphery of the construction areas remained preserved in situ (Vinnicombe 1987a: 59).

While the salvage operations were in progress, the Minister for Mines created Temporary Reserve 6697H over Crown Land outside the existing industrial leases on the Dampier Peninsula (Burrup) in order to provide for the 'orderly industrial development of the Peninsula'. These reserves continue to be the current status of the land on the Burrup. The Dampier Peninsula (formerly Dampier Island) was officially renamed Burrup Peninsula in 1979 because of confusion with the Dampierland Peninsula north of Broome.

Numerous reports were produced by the Department of Aboriginal Sites (DAS) on the results of archaeological surveys of the areas already scheduled for development. These reports are listed in the Bibliography under DAS 1979 – 1981. Every study emphasised the need for proper management of the rich but vulnerable cultural heritage of the Burrup Peninsula.

The principal developer, Woodside Offshore Petroleum, subsequently contracted the Western Australian Museum to undertake the Dampier Archaeological Project as part of the mitigative procedures. The salvage work, which commenced in April 1980, lasted over sixteen months and involved a total of fourteen resident crewmembers (Rhoads et al. in DAS 1984b; Vinnicombe 1987a). Because of the huge volume of data that had to be processed and archived, and because of other commitments by the personnel initially involved in the field survey, reports on the work did not appear until 1984 (Rhoads et al. in DAS 1984b) and 1987 (Vinnicombe 1987a).

Conflicting values

Concurrent with the progression of development plans and associated salvage of the Aboriginal Heritage, the Department of Industrial Development commissioned a report on land and port planning of the Burrup Peninsula (Clough et al. 1980). This document focused on the industrial potential of the Peninsula and, astoundingly, concluded

that there was no serious conflict between industrial needs and conservation requirements. A short paragraph acknowledged that the area was rich in Aboriginal sites, and advocated detailed surveys of all development areas to locate the sites. No recognition of site protection and site management was taken into account in the overall plan (Clough/SLAM 1980: 6, 54).

The Registrar of Aboriginal Sites, Bruce Wright, rejoined with a comprehensive report titled *A proposal for the archaeological investigation and preservation of Aboriginal sites in the Dampier Archipelago* (Wright in DAS 1980a) in which he states:

It is one of the functions of the Western Australian Museum to administer the *Aboriginal Heritage Act* which charges the institution with the responsibility to record and protect sites on behalf of the community. It is in accordance with that responsibility that this proposal and its recommendations are submitted. We recognise that there is an urgent need to bring the research and preservation of prehistoric sites in the area to the attention of the Government of Western Australia and to seek immediate funding for Stage 1 of the Proposal from the State Government, or if funding is not immediately available, from the Commonwealth Government through the Australian Institute of Aboriginal Studies and the Australian Heritage Commission (DAS 1980a: 1).

In this 1980 report, Wright highlighted the Dampier Archipelago as a major archaeological resource for the study of prehistory in Australia and emphasised that it is an integrated site province with the potential to yield crucial information (Wright in DAS 1980a: 4). In the past, he noted, site recording undertaken in the Dampier Archipelago had been no more than short term and fragmentary responses to industrial development in the area. Numerous sites had already been damaged or destroyed during the development of facilities and the build-up of population since 1965. It was essential that the task of completing a comprehensive survey and study should be undertaken as a matter of urgency. Indeed, there was an immediate need for the site reconnaissance work to be completed for the whole of the Burrup Peninsula and Dolphin Island before any further plans for land-use, including the access and service corridor proposal, were finalised. It was the purpose of Wright's submission to make it clear that there were very substantial scientific interests on the part of the academic community of Australia, which had not yet been adequately taken into account in the planning and future developments for the area (Wright in DAS 1980a: 7–9).

Wright's proposal for the research and protection of sites in the Dampier Archipelago outlined four stages which involved:

1. Completion of site reconnaissance on the Burrup Peninsula, Dolphin Island and later on the remainder of the islands.
2. Site protection to include legislative action, physical protection, control of access, ranger supervision and public education.
3. Research to be conducted by a locally-based research team.
4. The establishment of a local research, storage, display and educational centre which would serve as both a research and public education facility.

Wright also recommended the need to involve Aboriginal people in nearby communities in the investigation and interpretation of subsistence patterns (Wright in DAS 1980a: 6–9).

In 1981 the State Cabinet adopted the Clough/Slam Report (1980) as a guide for the development of the Burrup Peninsula (Press release 19/1/81). No concessions were made regarding Aboriginal heritage values. The following year a report was issued by the *Dampier Archipelago Recreation Advisory Committee*, in response to which Bruce Wright updated his 1980 proposal with a revised budget. This met with as little Government support as the first proposal.

In an effort to make a positive contribution to document sites in areas where further development was intended, two officers from the Aboriginal Sites Department who had been involved in the Woodside survey of the Burrup Peninsula commenced a site recording program in the Dampier Archipelago in 1982. Their positions were funded by a grant from the Australian Heritage Commission through the Western Australian Heritage Council, and it was planned to augment the number of sites from this area for inclusion in the register of the National Estate:

In order to successfully divert development around Aboriginal sites of significance in the Dampier Archipelago and for purposes of protection, we need a concise level of documentation now in order to preserve this important heritage for the future (Green and Turner 1982a).

Initially, time was spent locating and talking with Aboriginal people living in Onslow and Roebourne. Several persons had knowledge that related directly to sites found on the islands. Tapes of stories involving people and places in the Dampier Archipelago were collected and a boat trip was made to allow these persons to see what the field project involved and how it was being implemented (Green and Turner 1982c: 4).

This excellent beginning was interrupted in September 1982 when Yindjibarndi Aboriginal people made an urgent request to the Western Australian Museum to document sites of significance threatened by the proposed construction of the Harding River Dam, which was required as a water supply for the planned industrial expansion on the Burrup. The combined energies of Green and Turner were diverted to the crisis on the Harding River (Green and Turner 1982a, 1982b), and the recording project in the Dampier Archipelago was never resumed.

By 1982, the construction of the Dampier-Perth natural gas pipeline was ready to commence, with associated surveys along the proposed alignment (Pickering 1982a; Brown 1979; O'Connor 1983). During 1984, the first phase of the North-West Shelf Gas Project became operational and gas was supplied to Perth via the pipeline. This coincided with the publication of the report *Dampier Archaeological Project: survey and salvage of Aboriginal sites on portion of the Burrup Peninsula, for Woodside Offshore Petroleum Pty Ltd* (Rhoads et al. in DAS 1984b).

That same year, 1984, Paul Seaman, head of the Western Australian Government's Aboriginal Land Inquiry, submitted his findings to the Minister with Special Responsibility for Aboriginal Affairs. During Seaman's consultation

with the Roebourne community, objections were raised that the Department of Aboriginal Sites, W.A. Museum, had 'involved itself very deeply in archaeological investigation of the Burrup Peninsula without consulting living Aboriginal people about their traditional interests in the Peninsula' (Seaman 1984: 54). The absence of Aboriginal participation in early planning led Seaman to recommend a reduced role for the Museum in Aboriginal heritage protection and an increased role for Aboriginal organisations. No action was taken on his recommendation and subsequent land rights legislation failed to pass the Western Australian parliament.

In the same year, Harry Butler, as consultant to Woodside Offshore Petroleum, reported on adverse third party effects on the natural environment of the Burrup Peninsula and drew particular attention to sensitive heritage areas (Butler and Butler 1984).

Also during 1984, three areas on the Burrup Peninsula were declared Protected Areas under the Aboriginal Heritage Act: the Dampier Climbing Men site off Withnell Bay; a portion of the north end of the Burrup Peninsula containing important sites; and site complexes at Skew Valley and Gum Tree Valley in the Dampier Salt leases (Government Gazette 1984a, 1984b). These sites are also listed on the Register of the National Estate, with meritorious comments from representatives of the Joint Academies Commission. Two other areas were proposed for special protection, Watering Cove and the Pistol Range, but formal procedures have not been progressed.

Aboriginal interests

CALM Island Survey

In 1987, the Department of Conservation and Land Management (CALM) invited members of the Aboriginal community in Roebourne to participate in an inspection of localities where unauthorised recreational holiday shacks had been constructed on the islands of the Dampier Archipelago. Apart from the abortive efforts by Green and Turner to record sites on the islands in 1982 (Green and Turner 1982a, 1982c), this was the first occasion in which Aboriginal people were directly involved in heritage surveys of the Burrup region. Continuing Aboriginal connection with this area was illustrated later that year when the Roebourne Aboriginal community staged a ceremony for members of the Aboriginal Cultural Material Committee (the advisory committee to the Minister for Aboriginal Affairs under the *Aboriginal Heritage Act*), at Hearson Cove, a public beach on the Burrup.

Karratha Heritage Trail

As part of Australia's bicentennial celebrations, a Heritage Trails program was established under the auspices of the Australian Heritage Commission and calls were made for projects that highlighted Aboriginal culture. The Karratha Heritage Trail, in the hills immediately south of Karratha township, was designed as a combined history and nature walk. Consultants were engaged to prepare a management report on the sixteen Aboriginal sites located in that vicinity (O'Connor and Quartermaine 1988) and, with the participation of some members of the Roebourne community, the trail was opened to the public. The path was planned so as not to impact midden and quarry sites and to avoid rock art of a sensitive nature.

Since the 1990s, procedures have been in place to ensure that Aboriginal people are consulted regarding development proposals and that they are actively involved in heritage surveys of the land that is to be affected.

Land claims

The *Native Title Act* was enacted in 1993 and the following year Aboriginal representatives of the Ngarluma and Yinjibarndi people lodged a native title claim over a large area of the West Pilbara, including the Burrup Peninsula. Since then, the claimants have subdivided into numerous independent groups, all claiming the Burrup as their traditional estate. To date, there has been no resolution to these conflicting interests.

Management plans for the Burrup Peninsula

As a result of increasing pressures on the Burrup Peninsula through the combined processes of development projects, recreational usage and tourism, the Department of Resources Development convened an inter-departmental meeting in Perth which advocated that a management plan for the Burrup should be developed under the auspices of Conservation and Land Management (CALM). A management initiative was approved by Cabinet in 1987 and a further inter-departmental meeting resolved to set up a Karratha working party with instructions to investigate funding options. A number of meetings were held in Karratha under the chairmanship of Keith Morris (CALM), with representatives from the Roebourne Shire, Department for the Environment, Lands and Surveys, Hamersley Iron, Dampier Salt, Woodside, Department of Aboriginal Sites (Western Australian Museum) and the Roebourne Aboriginal Community. Keith Morris was elected to co-ordinate a plan of management for the Burrup Peninsula with contributions from all the participants (Vinnicombe 1987b). Preliminary recommendations, which included the closure of the track north to Searipple Passage, were forwarded to the Department of Resources Development for approval, but further action was inhibited when CALM was informed by Government that it had no management authority on the Burrup Peninsula. This was despite the fact that CALM had been charged with responsibility for the management plan in the first place. There was a move to alter the vesting in order to overcome this problem, but the proposal was never carried through by Government.

Meanwhile, the Department of Aboriginal Sites had provided a custom-built gate which CALM subsequently erected where the track runs through a narrow cleft near the northern end of Withnell Bay, but in the event, the gate was

never locked. The developers have no authority outside their leases, while the Roebourne Shire Council has no vesting control, no management control and no funds. The gate still stands there today, a stark reminder of the abortive effort to restrict uncontrolled access to the northern end of the Burrup Peninsula. Four-wheel-drive tracks currently criss-cross the Peninsula like a maze, a further monument to the lack of Government commitment to instigate effective management of the irreplaceable natural and cultural heritage in the unique environment of the Burrup Peninsula (Department of Aboriginal Sites files, 1984–1988).

The Pilbara 21 Study

As recently as 1991, the *Pilbara Region Economic Development Overview* (Pilbara 21, 1991), which was commissioned by the State Development Department, made an astounding omission: no mention whatever is made of Aboriginal heritage, not even in the section on the tourism industry.

In 1992, a further discussion paper titled *A land use strategy for the Burrup Peninsula* (part of the wider *Pilbara 21 Study*), was commissioned by the State Development Department. This study proposes a model for resolving different land-use needs in the Pilbara with demarcated areas set aside for differing uses. Industry is located on the western third of the Peninsula and the transport corridor leading north to Legendre is retained. An earlier draft has a figure showing stippled areas of heritage significance which do not overlap with the proposed heavy industry zone, but neither do they conform with the boundaries of known site distribution in the area. The source of this erroneous and misleading mapping information is not acknowledged (Veth et al. 1993: 21–2). However, the *Pilbara 21 Study* does acknowledge the fact that Aboriginal cultural heritage is an issue of importance to all Australians even though it is silent on contemporary Aboriginal associations to the land:

The cultural values of the area are immense as it is one of the richest petroglyph (rock art) sites recorded. This is accompanied by intensive midden areas, camp sites, quarry sites, shelters and ceremonial stone arrangements. The area contains information and evidence of past occupation and a wide range of Aboriginal sites.

The Pilbara region is a major Australian rock engraving area containing a greater number and variety of figures than any other part of the continent (Pilbara 21, 1992: 1).

Although the study discusses the various cultural features, credibility is negated by the wholly erroneous deduction that shell middens located at a considerable distance inland appear to be associated with previous shorelines during a period when the sea level was higher (Pilbara 21, 1992: 2). In fact, the shell deposits have nothing to do with sea level changes, because the Aboriginal people carried great quantities of shells to these inland sites in order to camp near fresh water.

As part of the *Pilbara 21 Study*, the *Pilbara Regional Profile* was compiled. This contains a compendium of diverse information relevant to the Pilbara region (Pilbara 21, February 1992) and the *Pilbara 21 Final Strategy Report* (June 1992) outlines a policy to ensure recognition of the importance of preserving the Aboriginal culture of the region (p. 64).

Major heritage surveys

CALM systematic survey

In order to redress the continued absence of any systematic study of the Aboriginal heritage values of the Burrup Peninsula, a consultative survey was initiated by Conservation and Land Management (CALM) during the years 1991–1993 (P. Kendrick and H. Chevis) with funding from the National Estate Grants Program. To date, this is the only survey undertaken for management rather than industrial purposes, and planned according to scientific principles and not by commercially driven requirements (Veth et al. 1993).

The CALM survey, which covered a series of transects running east-west across the Burrup, stopped short of the areas on which there are industrial leases. The field component of the survey was carried out in 1992, with five consultants and up to thirty individuals engaged at different times. The Aboriginal community from Roebourne was actively involved throughout (Veth et al. 1994). The comprehensive report details the results of the survey which recorded 498 sites in 87.83 km of transect, totalling 8.78 km² (Veth et al. 1993).

The CALM report makes the following pertinent statement:

The cultural resources of the Burrup Peninsula have been visited over the years by numerous international rock art specialists, academics, heritage advisers and educational authorities. It is thus known worldwide for its rich and unique rock art, both through international publications and through direct visitation. There is a very real focus on the rock art component of the archaeology of the Burrup Peninsula on a world scale and therefore the onus for its responsible management on the Burrup Peninsula Board of Management must be stressed (Veth et al. 1993: 24).

The report also makes comparisons with the earlier Woodside survey and draws together a considerable amount of background and other relevant information. The detailed data were lodged with the Ngarluma community in Roebourne. Specific site details are, therefore, not able to be retrieved by routine desk-top research procedures conducted through the register of sites in the Department of Indigenous Affairs.

Preliminaries to the Maitland Survey

To further the investigations of areas proposed for industrial development, a number of studies were undertaken by consultants (e.g. Murphy et al. 1994: 7, 16; Robinson et al. 1996). The field and archival research established that there was a rich and varied suite of archaeological sites within and surrounding the proposed development area and the Aboriginal people interviewed expressed concern about the impact of developments on the heritage values of West Intercourse Island (Murphy et al. 1994). The report also published an Appendix submitted by Elizabeth Bradshaw on

newly recorded mound middens of astonishing size associated with an Historic pearling camp. It has been proposed that this exceptional suite of sites of high archaeological and Historic significance be nominated as Protected Areas under the *Aboriginal Heritage Act 1972* and to the Register of the National Estate. Nonetheless, *The Maitland Heavy Industry Estate Information Brochure*, published later in 1994, brashly stated that the results of the consultancy studies, including Aboriginal sites and heritage assessments, highlighted an ‘environmentally acceptable and feasible proposal’ (DRD/LandCorp, September 1994).

In fact, the consultancy report stipulated that any development or land rezoning proposals for West Intercourse Island should not proceed until complete archaeological and ethnographic surveys had been carried out. It also recommended that the proponent should note the aspirations of the Aboriginal people of Roebourne concerning compensation for disturbed sites and training and employment prospects should the Maitland Industrial Development proceed (Murphy et al. 1994: 17).

The Department of Resource Development reacted by commissioning yet another ‘preliminary’ study. This report outlines the ‘lightning survey’ conducted from helicopter drops and estimated that less than 1% of the proposed development area was covered (Lantzke et al. 1994: 8). As an outcome, 51 sites were identified, but there was insufficient time to record the locations in detail. The results nevertheless made it quite clear that the area selected for development had considerable archaeological and ethnographic potential. The recommendations were essentially the same as the previous reports—a more comprehensive archaeological survey of the area was required and the work should be conducted in association with the Ngarluma Aboriginal community in Roebourne:

After discussions within the community and with their legal representatives, the key custodians have stated that, in their opinion, the whole Roebourne community should be contacted prior to re-zoning. It is their opinion that this is the only way sufficient information will be available to Aboriginal people, developers and planners when considering possible future development within the study area (Lantzke et al. 1994: i).

Maitland Heavy Industry Estate: Aboriginal heritage survey 1997

As a direct outcome of the Maitland Heavy Industry proposals (O’Brien 1994) the Department of Resources Development and Landcorps appointed the Aboriginal Land Council in Roebourne to conduct a major heritage survey of the island areas to be affected by the proposed development. Later the same year, a further survey was conducted on the land scheduled for industrialisation between King Bay and Hearson Cove. Fieldwork commenced in April 1996, but before the results of the study had been presented, Premier Richard Court had already outlined ‘a vision to make W.A. the nation’s number one steel producer by 2000’ (*The West Australian*, 3/2/1997). The world-scale industrial development, he stated, was centred around land that had been set aside for this purpose on the Burrup Peninsula.

The final survey reports (Vinnicombe 1997a, 1997b) clearly spell out that the proposed Maitland Heavy Industry Estate coincides with a remarkably rich Aboriginal cultural heritage and that if development proceeds as currently proposed, a significant part of that heritage will be destroyed.

Despite the singular importance of the Aboriginal cultural traditions highlighted by these multiple surveys on the Burrup, the areas set aside for development remain as though already set in concrete. No changes have been made to the original designations for industrialisation, the plans for which were made before the details of the cultural heritage were known (see Fig. 2).

Studies resulting from Burrup heritage surveys

As a direct outcome of the 1980 Woodside survey, carbon samples from excavated sites, surface shell samples and auger samples were submitted for processing. The results are listed in the final report to Woodside (Vinnicombe 1987a). Elizabeth Bradshaw has since published additional dates relating to her study of the Pilbara coastal middens (Bradshaw 1995). The most recent date of 260 ± 80 BP is contemporaneous with the first recorded European exploration of the Dampier Archipelago, while the earliest, from an excavation on Rosemary Island, is $8250 \pm$ BP.

In addition, a number of academic studies have been carried out based on the data collected. A comprehensive rock art thesis by Nicholas Green included a systematic computer analysis of 1456 petroglyphs from King Bay, an area that has now been developed as a supply base for Woodside and therefore no longer exists as a discrete archaeological environment (Green 1982a). Green applied twenty-four variables to each motif, which were then cross-correlated in a series of tables. The results reveal a complexity of organisation and some specific trends, aspects of which are discussed in this paper. Although some variables selected proved less significant than others, this study is an essential reference for any future research on the art of the Burrup (Green 1982a: 126, 163).

Jan Turner (1981) analysed eleven concentrations of petroglyphs and abraded patches from two catchment areas within the Woodside survey. The rock art motifs were broadly classified into six principal subjects, but the primary objective was oriented towards spatial information rather than art information. Turner’s analysis suggested that the distribution of marine motifs tends to concentrate along the coast, while marsupials, many of which displayed a higher degree of patination than the marine fauna, are mostly further away from the shoreline. This raises the possibility that the art depicting land-based fauna may be of greater antiquity than the art associated with the exploitation of marine resources, that is, the older art may date back some 6000 – 10 000 years or more, to the era when the islands were still part of the mainland. Turner’s study also included an analysis of 142 grinding patches, some of which had been re-roughened by incised lines and/or by pecking. This observation implies repeated use of selected grinding patches over time: there was an abundance of rock at hand for new areas to be ground if this had been desired. Eight of the grinding

patches showed a surface patina of desert varnish, which suggests some antiquity. Conversely, other abraded patches presented a highly contrasting patination, which indicates that very little weathering has taken place since they were used. Instances were noted where patches had been ground on top of earlier petroglyphs while, conversely, some pecked motifs had been placed directly on top of abraded patches (Turner 1981: 42, 44). This relationship between grinding patches and art motifs can be noted throughout the Dampier Archipelago, and may have implications regarding women's activities (seed preparation) at some of the petroglyph sites.

Other studies listed in the bibliography include Bolton 1980; Dixon 1982; Harriss 1988; Keene 1981; Mattner 1989; Veth 1982 and unpublished draft papers by T. Gara and K. Mulvaney (see Vinnicombe 1987a: 25).

Elizabeth Bradshaw is currently compiling a PhD thesis for the University of Western Australia on the middens of the Pilbara coast. Since the area of study includes the Dampier Archipelago, the full results are awaited with interest (Bradshaw 1995). A further innovative PhD study by Kazi Jestribeek of the same university aims to explain the reasons for the placement and distribution of rock art throughout the Pilbara region. The Burrup Peninsula, as part of this region, is included in the sample. Jestribeek is applying the information exchange theory of style proposed by Wobst, together with geographic information systems analysis and standard statistical methodology such as cluster analysis and correspondence analysis, to examine the distribution and causes of formal variation in the rock art of the Pilbara (Jestribeek 2000).

Petroglyphs: descriptive analysis from previous studies

The Aboriginal perspective

According to the local Aboriginal belief system, petroglyphs are permanent signs left by ancestral beings. As the initiators of Aboriginal Law, these ancestral beings left designs in the rocks as records both of their own existence and as evidence of the Law they formulated (Palmer 1977: 44; Gara in Veth et al. 1993: 152). The petroglyphs are a constant and unchanging reminder of the behavioural pattern set down for all Aboriginal people to follow and the motifs continue to embody spiritual power. The Law dictates that obligations to look after these places of special potency are handed down from one generation to the next and are therefore an inherited responsibility. Should they be damaged or treated without due respect, spiritual powers could be unleashed that would have a harmful effect on individuals and on the land itself. Like electrical power, spiritual power can be damaging if treated incorrectly.

The Ngarluma have songs and associated mythology for many of the subjects depicted in the petroglyphs, therefore the designs carry multiple cultural references in addition to the simple likenesses they bear to actual objects. It was clear from information given by Aboriginal elders who participated in the surveys that rock art performed an important role in initiation ceremonies and the education of the young.

In the following discussion of the petroglyphs, it is essential that an attempt should be made to perceive and assess the images in terms of the Aboriginal world view and not merely as a set of statistics reflecting western-oriented techniques and subject preferences.

Data used for analysis

Data from the four most extensive areas surveyed since 1980 are included in the analysis presented in this paper. These surveys, in the sequence in which they were carried out, are as follows: Woodside 1980 (20.74 km²), Conservation and Land Management 1993 (8.78 km²), Maitland Heavy Industry Estate 1997 (6.4 km²) and King Bay/Hearson Cove 1997 (10.9 km²). The area covers some 47 km² and contains a total of 2009 sites, with an average site density of 43.9 sites per km². Site density is therefore exceptionally high, and depending on the type of terrain, ranges from 17.4 to 76.8 sites per km² (Rhoads in DAS 1984: 48; Vinnicombe 1997b: 46; Vinnicombe 1987a: 51, 1987c; Veth et al. 1993: 176).

The CALM 1993 site documentation form incorporated as many as fifty-six criteria recorded in a tick box format. These included the location of petroglyphs in relation to topography and geomorphic zone, the size of boulders on which petroglyphs occurred, the depth to which images penetrate the rock, and the occurrence of 'desert varnish'. During subsequent surveys, the number of variables was dropped to forty-five fields. This was partly due to the time involved in making the records, but also because an adequate sample of the more specialised criteria had already been gathered by CALM. The tabular information that follows includes only the data that are directly comparable from the various surveys.

Since numerous personnel were involved in the site location and recording programs, the data undoubtedly reflect some inconsistencies and biases. The tables are therefore intended as a general indication of trends rather than as a source of precisely determined facts.

Site definition

Because of the exceptionally high density of sites in the Dampier Archipelago (averaging 43.9 sites per km²), deciding where one site ends and another begins is often difficult. As an arbitrary guideline, and because precision is required for re-locating sites affected by heritage legislation, the convention has been adopted to amalgamate into a single site all evidence within a distance of 25 m. Conversely, if the nearest contiguous evidence is further than 25 m, a

different site number is allocated.³

Again, as an arbitrary definition for the Burrup, five or more stone artefacts constitute a site and are designated a site number, whereas less than five artefacts are recorded as an isolated find. With respect to petroglyphs and grinding surfaces, however, a single occurrence represents a mapped site. The rationale is that the making of a petroglyph or the act of grinding constitutes a conscious focus of activity, whereas a few stone flakes could arguably have been discarded in passing and need not necessarily have been a place where much time was spent.

Site location

The distribution of petroglyphs obviously coincides with the geological occurrence of rocks such as granophyric rhyodacite, and to a lesser extent gabbro and granite, that provide suitable surfaces for the production of rock art. Motifs occur in a variety of localities ranging from inconspicuous isolated boulders or low-lying rock outcrops almost hidden by spinifex growth, to steep ridges formed of massive piles of boulders heaped one on top of another. They are also found on in situ vertical or near vertical rock faces and on the horizontal surfaces of bedrock outcrops. The steep inclines bordering watercourses and rock pools are preferred localities, as are rock platforms along the seaboard, which were favoured fishing spots. Motifs may also be located near stone sources suitable for the manufacture of artefacts, and along geological fracture lines that provide the most practical corridor for walking from one area to another. In short, examples of art occur in most localities that formed a focus for human activity.

The CALM survey established that the distribution of petroglyphs in relation to the topography of a rocky slope was fairly even, with slight preferences for the bottom of the slope and the apex. It also established that the boulders selected as a base on which to place the glyphs, which may range in size from small portable stones to very large in situ slabs, measured an average length of 1.2 m, breadth 0.9 m and height 0.4 m (Veth et al. 1993: 100, 101, Table 8.1).

In short, these findings confirm that all rock surfaces and boulders, overwhelming in number as they are, should be inspected during site location surveys.

Site content

Although petroglyphs may occur in isolation, they are more frequently part of a site complex comprising more than one cultural component, for example stone artefacts, shell accumulations, grinding patches and stone features such as standing stones, stone pits and enigmatic stone features loosely described as ‘terraces’. The following table gives a breakdown of the cultural components of the 2009 sites included in this analysis, and demonstrates that petroglyphs, while found at as many as 75.5% of the sites in some of the survey areas, occur at just over 50% of sites in the total sample.

A frequently observed feature is that shell food refuse and stone artefacts have fallen among the interstices of the tumbled boulders on which the art was made, which suggests that multiple activities took place at the art sites. Sometimes intentional caches of stone implements are also found. Among the artefacts, which include flakes and cores, are rounded waterworn pebbles that often show evidence of having been used as pounders. These may be associated with the process of making the petroglyphs and therefore deserve further study (Bednarik 1998: Fig. 1).

It is of especial interest that at many sites where upright stones have been wedged into position, senior Aboriginal informants looked for, and often located, water-worn pebbles. They maintained these were used to rub the standing stone in *thalu* or increase rituals (Daniel 1990). The standing stones (they are often in pairs designating male and female components) represent a particular commodity for which the *thalu* ritual is performed, and, according to the informants, the rubbing ‘makes it work’. Indeed, smooth abraded patches on the upright stones themselves were sometimes noted by the survey team once attention had been drawn to the rubbing practice.

While this paper focuses principally on the rock art, it is important to bear in mind that the petroglyphs are but part of a rich cultural complex that reflects many other aspects of the way of life of the people associated with the images. Conservation and protective measures must therefore include the whole range of evidence of the lifestyle and worldview of the former inhabitants of the region.

Petroglyphs	Open sites	Stone features	Shell accumulations	Stone sources	Grinding patches
554 (75.5%)	238 (33.1%)	134 (18.7%)	included with open sites	included with open sites	95 (13.2%)

Woodside 1980 Survey - 720 sites

Petroglyphs	Stone artefacts	Stone features	Shell accumulats	Stone sources	Grinding patches
156 (19.9%)	164 (20.9%)	302 (38.5%)	61 (7.8%)	47 (6%)	43(5.5%)

CALM 1993 Survey - 784 sites

119 (62.6%)	48 (25.3%)	43 (22.6%)	19 (10%)	15 (7.9%)	11 (5.8%)
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King Bay - Hearson Cove (DRD) 1997 - 190 sites (excluding sites in Woodside Survey)

³ This definition does not necessarily conform with site definitions used by other researchers, therefore care must be taken when making direct comparisons in site density or numbers with other areas.

79 (71%)	55 (61%)	9 (10%)	25 (28%)	25 (28%)	38 (42%)
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South-west Burrup Peninsula (DRD) 1997 - 111 sites

132 (64.6%)	67 (31.4%)	48 (21.7%)	39 (18.1%)	34 (15.9%)	55 (26.5%)
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West Intercourse Island (DRD) 1997 - 204 sites

Petroglyphs	Stone artefacts	Stone features	Shell accumulat's	Stone sources	Grinding patches
1040 (51.8%)	572 (28.5%)	436+ (21.7%)	144+ (7.2%)	121 (6%)	242 (12.5%)

Total sites in surveyed areas - 2009

Table 1. Frequency occurrence of cultural features. (Percentages are based on the number of sites in each survey, not on the total number of cultural traits. Since there are often multiple cultural traits at a given site, the percentages add up to more than 100%.)

Techniques used to make the petroglyphs

Techniques used to make the petroglyphs are varied, and judging from the evidence of the marks that were left, a wide range of tools was employed. Scored lines were made usually with a very fine instrument, while pecked marks reflect a variety of percussion points ranging from fine to coarse and from circular to angular. Abraded lines and indents were made by repeatedly rubbing a hard object backwards and forwards, while other images show no perceptible depth and appear to have been made simply by bruising the rock with a pounding action.

The colour contrast between the weathered dark reddish-brown rock exterior and the pale-coloured interior of the rock may range from clear contrast to no contrast whatsoever. Colour contrast is regulated by the thickness of the weathered rock cortex, the depth to which the image penetrates into the rock, and the length of time that has elapsed for the image to become weathered.

Pecked. The majority of motifs within the overall area are pecked⁴, with the sizes and shapes of pecked marks ranging from coarse (using a point of about 10 mm thick) to fine (using a point from 1–2 mm thick). The shape of the peck marks is usually roughly circular in shape, but may also be elongate (in the shape of a chisel head) or angular. The peck marks may follow the outline of the image only, or the interior of the image may be fully pecked to cover the entire form. While some of the pecked surfaces could have been produced by holding a pointed implement in the hand and hitting the rock directly, the finer and more accurately controlled work could only, in my opinion, have been achieved by the use of a chisel technique (cf. Bednarik 1998: 24). In this method, the point of the chisel would be placed exactly where the indentation was intended, and the other end of the implement hit with a hammer stone.

Scored. The scratched or scored method of producing an image is the only technique to which the term 'engraving' may accurately be applied. The image is made by dragging a sharp point or graver (burin) across the rock face. In some cases, only the outline of the motif has been scored, but more commonly the area is filled in with a series of near parallel or cross-hatched lines. Some of these lines are remarkably fine, and at times the scratched marks have barely penetrated the weathered cortex of the rock, thus producing minimal colour contrast. Since there is little or no depth to the score marks and therefore no shadow, these petroglyphs are often difficult to see.

Abraded. Abraded images are produced by rubbing the rock to form a smoothly polished surface, either in the form of a grooved outline or indented cupule, or by grinding away an entire shape. While it is often possible to detect peck marks underlying the abraded areas, pecking does not necessarily always precede abrasion.

Pounded. Some images have apparently been superficially pounded onto the rock surface, usually altering the rock texture and producing what could be described as a 'bruised' effect. These motifs have little or no depth and, depending on the thickness of the weathered cortex of the parent rock, the images may show minimal colour contrast and are therefore readily overlooked.

Composite techniques. A number of petroglyphs incorporate a combination of techniques, usually pecking, pounding and abrasion. Sometimes certain features of a pecked image, such as genitalia or eyes, have been enhanced by abrasion, or individually pecked marks have been joined into a line by rubbing.

Frequency of use of techniques

It is not possible to produce a simple table detailing the relative frequency of techniques used to produce all motifs recorded, because multiple techniques are often found together at individual sites, and multiple techniques may be used on a single motif. The site recording forms did not allow for detailed records to be made for each individual petroglyph. However, an estimate of bulk frequency in the combined survey areas indicates that pecked motifs are by far the most common, followed by composite engraved techniques, then scored, abraded and pounded in descending order of frequency (Vinnicombe 1997a: 62, Table 7; 1997b). This finding contrasts with the results of the 1993 CALM survey in which the scored technique was found to be the most frequent, followed by abraded and then pecked (Veth et al. 1993: 104, Table 8.6). The reason for this change in emphasis is yet to be determined and is a warning against making generalisations for the entire area. Since the CALM survey covered the more northerly region of the Burrup, a study of inter-site variability in relation to geographic, environmental and cultural considerations could highlight other significant differences.

⁴ In the CALM 1993 survey, scored motifs outnumber pecked motifs.

Motif size

Motif size is difficult to represent in tabular form because there is often a range of size categories at any one site and data were not recorded for individual motifs. However, estimates on bulk counts indicate that by far the majority of petroglyphs are less than 30 cm in size, with most of the remainder falling between 30 – 60 cm. Relatively few images are larger than 60 cm (Veth et al. 1993: 104, Table 8.5). There are occasional diminutive human figures, as well as turtles and at least one marsupial, that are less than 4 cm in length, while at the other end of the scale, some motifs, such as anthropomorphs, kangaroo, emu, whales and sharks, measure more than 150 cm.

Motif identification and subject preferences

At the outset, it is conceded that the identifications in the following preliminary analysis of motif content are based on subjective observations limited by a Eurocentric viewpoint. The results should therefore be assessed with due caution.⁵ The numerical breakdown does, however, provide an insight into some of the Aboriginal cultural and symbolic preferences expressed in this unique pictorial record of the past.

Information on subject identification is available on 3713 motifs. Of these, the tally for schematic representations (unidentifiable circular and meandering motifs, amorphous shapes, scratched and pecked marks etc.) is 1671, while those deemed to be naturalistic (including human and animal tracks) number 2042. There are a further 319 motifs listed as ‘other: naturalistic’ which include identifiable weapons.

While care was taken to identify the general category to which the art belonged and, in all but the CALM survey, to determine the faunal species represented (Tables 2, 3), some motifs did not readily fit the designated categories. For this reason, clearly recognisable motifs that were repeated at numerous sites (for example, arcs or boomerang shapes, indented spheres or shapes like whale or dugong tails), were somewhat arbitrarily relegated either to the ‘other’ naturalistic or ‘other’ schematic category. Some recorders erred more on the side of caution than others, which also led to variable designations. Nonetheless, with or without the sometimes ambiguous ‘other’ categories, ‘naturalistic’ motifs outnumber the ‘schematic’.

Geometric	Naturalistic			
Total	Human	Animal	Other	Total
34.9%	26.5%	25%	13.5%	65.1%

Motif content, Woodside survey. (For the purposes of the above table, the category classified as ‘unidentifiable’ is in the geometric column).

Geometric	Naturalistic			
Total	Human	Animal	Other	Total
40.5%	24.4%	35.1%	—	59.5%

Motif content, CALM survey. (For the purposes of the above table, patches, striations and unidentified motifs have been placed in the geometric column).

Geometric	Naturalistic			
Total	Human	Animal	Other	Total
45%	16.3%	30.1%	8.6%	55%

Motif content of 3713 petroglyphs, Maitland survey.

Geometric	Naturalistic			
Total	Human	Animal	Other	Total
48.6%	14.9%	32%	4.6%	51.4%

Motif content of 698 motifs, King Bay-Hearson Cove survey

Geometric	Naturalistic			
Total	Human	Animal	Other	Total
42.3%	23.9%	36.7%	15.6%	57.7%

Average of all surveys. Tracks are included in both the human and animal categories.

Table 2. *Relative proportion of geometric to naturalistic petroglyphs.*

Of the naturalistic or representational art, zoomorphs outnumber anthropomorphs (except in the Woodside survey), but if tracks are excluded, then the proportion between human and animal motifs is more or less equal (Tables 2, 3; Veth et al.1993: 103; Vinnicombe 1997b: 62). When tracks are included in the count, zoomorphs predominate

⁵ In order to alert readers to possible cultural bias, some researchers have advocated the use of exclamation marks or inverted commas when classifying subjects. In order to avoid a cumbersome presentation, I have not followed this convention.

significantly over anthropomorphs.

Among the faunal illustrations, the greatest emphasis is on marine species (21.3%), followed by terrestrial animals (6.4%, excluding tracks). This confirms the Burrup as an important marine resource, and establishes the resident Aborigines as specialists both in the exploitation and portrayal of the products of the sea. The data also suggest that particular regional emphases on subject matter are likely to be influenced by differences in ecology in the immediate environs of the petroglyph sites. For instance, fish are likely to be represented more frequently along the littoral zone near preferred netting and spearing localities, macropods in the boulder areas where hides provide shade during the heat of the day, and birds in preferred habitats for avifauna such as mangroves and mudflats (Green 1982a; Vinnicombe 1987a: 27). There are, of course, exceptions to this generalised distribution pattern, and examples of all subjects are found throughout the geomorphic zones. It must be remembered, however, that the divisions into geomorphic zones are somewhat arbitrary in the area under discussion, and the 'littoral zone' on the Burrup is nowhere further than an hour's walking distance from any given 'inland' point. In practical terms, therefore, the entire area is truly coastal (Vinnicombe 1997b: 34).

Of the animal species, turtles are most common in the overall count (12.3%), closely followed by fish (9%), with macropods (2% excluding tracks), birds (2% excluding tracks) and reptiles (2%) more or less equally represented (Vinnicombe 1987a: 62; Veth et al. 1993: 103; see Table 3). There is clearly a general patterning in motif selection that is repeated throughout the Dampier Archipelago, but with particular emphasis on selected subjects at certain sites and/or ecological zones. A great deal more detailed analysis, including inter-site and inter-area comparison, together with further ethnographic inquiry, is necessary to gain a deeper insight into the significance of this prolific pictorial record.

Motif	N.W. Intercourse Is. Mid West Intercourse S.W. Burrup	King Bay / Hearson Cove	Total
Human	557 (27.4%)	104 (29%)	661 (27.53%)
Human tracks	49 (2.3%)	14 (3.9%)	63 (2.62%)
Turtle	259 (12.7%)	37 (10.3%)	296 (12.33%)
Turtle eggs	161 (7.9%)	7 (1.9%)	168 (7.0%)
Fish	160 (7.8%)	55 (15.3%)	215 (8.95%)
Macropod	31 (1.5%)	19 (5.3%)	50 (2.1%)
tracks	177 (8.7%)	21 (5.8%)	198 (8.2%)
Bird	39 (1.9)	12 (3.3%)	51 (2.12%)
Bird tracks	248 (12.1%)	47 (13.1%)	295 (12.29%)
Reptile	42 (2.1%)	11 (3.0%)	53 (2.2%)
Other	319 (15.6%)	32 (8.9%)	351 (14.6%)
Total	2042	359	2401 (100%)

Table 3. Motif content, naturalistic petroglyphs.

Human or anthropomorphous figures

Anthropomorphous figures exhibit a high level of variety and individuality, although simple stick figures (body, arms and legs all the same width) are more commonly represented than in-filled figures in which the bodies are proportionately wider than limbs (Green 1982a). Other recognisable 'styles' include fat-bodied figures with short arms and legs, figures with detached blob-like heads, in-filled humanoid figures sometimes with abraded cupules to represent the eyes, and 'faces' (often but not always without bodies) with internal bas-relief patterning.

Most human figures are represented in a standing frontal position, and the majority of those that can be sexed are male. Particular anatomical details such as genitalia may be singled out for attention, often in exaggerated proportions. For instance, the penis is often as long as, or almost as long as, the legs, giving the impression of a body propped on a 'trident'. When the central line is longer than the legs on either side, it is often indistinguishable from a tail, and may therefore represent a stylised reptile such as a goanna or lizard rather than a human. Female figures are typically shown in a squatting posture, with legs apart and bent at the knee. The pronounced breasts protrude sideways and labia in the form of two protruding lines from the perineal region are often exaggerated. Coupled figures schematically representing intercourse are not uncommon.

The majority of human figures occur singly or in pairs, but are sometimes represented in linear groups with joined hands. These suggest gatherings of people for the performance of dances or rituals.

Figures in side elevation frequently have robust rather than linear bodies. On the Burrup, an unusual style of figure in side elevation, with arms raised and knees bent, is repeated over a wide area. A repeated convention is that the heads of these figures are represented as blobs not attached to the body. Some of these figures are associated with lines along or up which they appear to be either suspended or climbing (see illustrations in Flood 1997: 243; Sale 1992).

There are some large human figures (up to 1.5 m high) that often display compound techniques in their execution. Outlines are usually abraded, or the whole figure is fully pecked. Eyes, when shown, are often deeply gouged and abraded to form cup-like depressions, while other details, such as genitalia, may be similarly abraded.

Other unusual motifs that occur at selected sites throughout the Burrup are humanoid faces with large owl-like eyes usually shown as concentric circles. Similar petroglyphs have been found in the Cleland Hills in central Australia and in the Durba Hills along the Canning Stock Route in Western Australia (Edwards 1968; Dix 1977). As yet unpublished 'faces' have been also found in the Calvert Range in Western Australia (pers. comm. P. Kendrick and P. Veth), demonstrating that this particular genre, usually deeply pecked and with features represented in bas-relief, has a wide distribution.

Although the great majority of human figures show no adornment, occasional motifs depict presumed headdresses or body-belts, and some are associated with weapons such as 'boomerangs' and 'sticks'. A proportion of the latter may be spears, but spear heads as such are not singled out for illustration. The small oval spear-throwers and oval shields typical of the Pilbara area are sometimes illustrated, often patterned with designs. They are usually shown independently of human figures, that is, they are seldom held in the hand.

Stick figures may sometimes hold boomerangs, but more commonly the boomerangs are represented in a pair, symbolically placed one on each side of the body and not held directly in the hand. Aboriginal informants were all agreed that these boomerangs represent clapping sticks associated with music and ceremony rather than with activities such as hunting or fighting.

Radiating lines from the head are linked with ceremonial headdresses by the Roebourne Aboriginal people and may therefore be viewed only by initiated males. Elders have requested that examples of such headdresses should not be illustrated in reports and publications. Also included in the restricted category are internally decorated oval designs representing sacred objects which, in appearance, are not unlike the shields and spear throwers described above.

Human hand prints are sometimes portrayed, either in outline or fully pecked. Normally, they are not directly associated with human figures. Human footprints, some larger than life-sized and occasionally bearing six toes, are far more common than hands and are found throughout the region. They may be shown as a single footprint or in pairs, and sometimes appear in a line suggesting a track. At least one such track, in the Pistol Range, leads up a steep boulder slope to a fully pecked anthropomorphous figure standing in a commanding position on a vertical rock face. The footprints almost certainly represent ancestral tracks relating to the mythological period of creation rather than to prints left by ordinary mortals.

Fauna

Faunal species depicted in the art will be discussed in the order of frequency in which they occur (see Table 3).

Marine species

Marine species form 21.3% of the 'naturalistic' motifs, with turtles (12.3%) predominating over fish (8.95%) in the overall count. The images may be outlined or in-filled, or may show internal patterning in the form of stripes, chevrons or spots. Turtles are often associated with aggregations of pecked cupules that probably represent turtle eggs that were collected by the Aboriginal people during summer. The trails left in the sand by female turtles when they go ashore to lay their eggs may also be featured. Males and females mating are usually shown as a single oval body, but with two heads and additional flippers instead of the usual four. It is of note that in a survey of North-west and Mid-west Intercourse Islands, where turtle nesting beaches are located, turtles (12.7%) outnumbered fish (7.8%) by a considerable margin (Vinnicombe 1997a), while in the King Bay/Hearson Cove survey, fish (15.3%) predominated over turtles (10.3%). Ecological and environmental factors, as well as subsistence patterns, clearly affect motif distribution.

Pisciform motifs seem sometimes identifiable to family if not species, for example, stingrays, flounder, groper, angel fish, sharks, unicorn fish and dolphins (Green 1982a: 143; Turner 1981: Appendix 1; Rhoads and Green in DAS 1984b: 15; Vinnicombe 1997b).

Marine mammals, particularly whales and dugong, are also part of the repertoire, with some 'whales' represented over 2 m in length. Dugong seem readily identifiable by the typical down-turned snout. Another motif encountered throughout the Burrup has been referred to as 'whale tails' in reports and publications, but although the general shape is evocative of a whale tail, the shapes are far more likely to represent dugong tails, if indeed the form is based on nature rather than an abstract sign. Although whales habitually frequent the Dampier Archipelago during their seasonal migrations and would have provided windfall meals when they became stranded on shore, they were not habitually hunted. Dugong, on the other hand, were a highly prized source of food, and would have been hunted, in season, by spearing from mangrove rafts. Once wounded, Dugong are captured in the water and held fast by a rope tied around the narrow 'waist' where the tail joins the body (Akerman 1985). The characteristic shape of the dugong tail is therefore essential to hunting technology and is more likely to have been illustrated than the less commonly encountered whale tail.

Though not commonly depicted, Crustacea are represented by crabs, and less frequently, crayfish. Remnants of both species have been identified in middens (Baynes 1981; Bradshaw 1994).

Avifauna

Birds, as distinct from bird tracks, constitute 2% of recognisable fauna in the art repertoire, and may be portrayed with long or short legs, long or short beaks and long or short necks. Some seem identifiable as to species, but have not been the subject of detailed study. Those with long legs and long curved beaks are likely to be marine feeders. Indeed, some are shown with fish suspended in their beaks, and some with what appear to be snakes. The few examples of

unmistakably terrestrial birds include 'eagles' depicted in the frontal position with wings extended. Some fat-bodied birds with short legs were identified by Aboriginal informants as a species that lives among mangroves and that feature in social mythology. Similarly, eagles play a significant role in many important myths.

It is of note that bird tracks (12.3%) are significantly more numerous than the birds themselves (2%), and are more frequently depicted than kangaroo tracks (8.2%). Both three-toed and four-toed birds are represented, and the tracks may be found singly, in pairs, or placed one in front of another to form a trail. The methods used to reproduce the tracks cover the full range of techniques, but many are true engravings consisting of multiple shallow incisions scratched into the dark brown rock.

Representations of emu, often large images on imposing rock faces, are found at selected sites throughout the Burrup. They are, however, anomalous in that emu are not part of the faunal suite currently found on the islands. They are therefore unlikely to have been among the fauna habitually seen by the Aboriginal people who lived on the Burrup after the rise in sea level 6000–7000 years ago. However, emu would certainly have been familiar to the island dwellers, since close ties with the Ngarluma on the mainland were maintained. It is nevertheless probable that the origin of the emu represented on the Burrup derives from symbolic mythology rather than literal representations from the immediate environment. It is also possible that the depictions of emu date back to before the rise in sea level.

Emu footprints, often fully pecked and deeply abraded, are commonly represented on the Burrup, and can sometimes be traced following in the same direction over extensive areas. On occasion, tracks lead towards images of large anthropomorphous images or giant kangaroos, and it is of note that both emu and kangaroo are closely associated with Aboriginal law and ceremony on the mainland.

Marsupials

The most common marsupial pictured in the art is the large euro kangaroo (2%). Some are portrayed even larger than life size, with bodies well over 150 cm, while others are quite diminutive (8 cm). The images may be outlined or fully pecked. While some are remarkably naturalistic, others are more generalised kangaroo shapes, and are always shown in lateral elevation. Twisted perspective is sometimes suggested by the incorporation of two eyes, usually deeply pecked and sometimes abraded to form cupules. The male genitalia are often conspicuous, but females are also shown, with young joeys protruding from the pouch. Occasionally there may be lines across the neck or the base of the tail, possibly representing cuts of meat for sharing, and some show 'spears' protruding from the body.

Again, kangaroo tracks (8.2%) are more commonly represented than kangaroos themselves (2%). The tracks are often shown in pairs, one next to the other, and may sometimes include the front as well as the hind paws, with a central mark to represent the indentation left by the tail. Some of these tracks, like those of the emu, are deeply abraded and highly polished. Kangaroo tracks may sometimes follow extensive trails, leaping, as it were, from one boulder to another. Mapping the direction taken by these trails in order to establish whether there is consistent patterning would be an interesting study. The kangaroo is the main carrier of the Law in the Aboriginal belief system, and the prints may well indicate tracks associated with mythology as well as actual routes of trade and exchange.

Dog-like creatures with legs of equal length and sharply pointed ears are occasionally shown. Some of these have stripes across the body, and may depict the Thylacine. It is, however, often difficult to assign this identification with certainty, although a large and imposing juxtaposition of male and female images on Angel Island, with striped bodies and upturned tails thickened at the base, are undeniable contenders to the 'Thylacine' claim.

Echidna are among the current faunal population on the Burrup and provide a popular source of food for Aboriginal people. They are, however, rarely represented in the art. Only two examples have been noted in reports (Rhoads and Green in DAS 1984b: 19; Mulvaney and Veth in DAS 1984: 37).

Reptiles

'Reptiles' (2%) are usually schematically represented, but distinguishing between a goanna, a lizard or a human male with exaggerated penis is often problematic. Snakes, though uncommon in the general repertoire, are sometimes clearly represented, but more usually the serpentine lines show no diagnostic feature such as head or tail. This is somewhat surprising since snakes are commonly found on the Burrup and also feature strongly in the mythology of the mainland Ngarluma people.

Non-representational or schematic art

A high proportion (45%) of the rock art of the Burrup is considered as schematic or non-representational, although the division between naturalistic and schematic is admittedly both arbitrary and Eurocentric. However, for the convenience of comparison and discussion, the division is retained.

The most common shapes repeated over and over again are ovals and circles, sometimes with intersecting bars or with protruding appendages. There are also numerous parallel scratched or cross-hatched lines, and complex patterns of intersecting lines, curves and circles.

Among the motifs recorded as 'schematic' are particular shapes repeated over and over again that almost certainly represented objects known to the makers of the art. Among these are motifs the survey teams termed 'dumb-bells'. These are essentially two rounded forms linked with a narrow bar that may be represented in outline only, or may be filled in with peck marks. These shapes are repeated throughout the Burrup and associated Archipelago, but Aboriginal informants have shed no light on their possible interpretation.

Other often repeated motifs are indented ovals or kidney shapes, which again may be depicted in outline or in-filled. Similar shapes have been interpreted as stingray livers in Arnhem Land, but there is as yet no corroborating evidence from Western Australia.

Groups of curved lines or arcs, similar in shape to boomerangs stacked one within the other, are also distributed over a wide area. Since they are not directly associated with human figures, they are unlikely to represent weapons.

Post-contact subjects

Although post-contact subjects in the rock art of the Burrup have been reported in the popular press, there is only one representational engraving (on Dolphin Island and apparently incised with a metal tool), that has been authenticated. This represents a sailing ship and is associated with incised numbers and letters of the alphabet. The rock on which the sailing ship occurs is on the beach at which European-owned vessels landed to obtain freshwater during the early pearling and whaling period (MacIlroy 1979). The authorship of the engravings is therefore open to question.

Compositions and panels

In addition to individual motifs as described above, there are impressive composite panels that often show indisputable evidence of having been added to over a considerable period of time. Some of the compositions illustrate linear connections between motifs that are difficult to interpret without the associated mythology and value system that clearly underlie their portrayal. One such composition is the celebrated 'Climbing Men' panel that has been illustrated in several publications (Vinnicombe 1988; Flood 1997; Sale 1992). Another impressive panel showing superimpositions and variable degrees of patination was located on North-west Intercourse Island as a result of the survey in the area proposed for the siting of the Maitland Industrial Estate (Vinnicombe 1997a: Fig. 10).

Natural features

The shape of the rock on which images were placed, as well as natural features already present on the rock surface, often have considerable influence on the composition, outline or content of the final art form. Many compositions or even individual figures are so placed that the shape of the background rock acts as a frame or forms a natural recess into which the motifs are fitted. In other instances, images have been intentionally placed so that natural protuberances or cavities in the rock surface serve as features such as eyes, umbilicus, stomach or vulva. The back or tail of a kangaroo may follow a natural ridge or recess, and one example was noted of a turtle placed so that a naturally patterned bulge on the rock formed the carapace.

Most of the major art sites, especially those that are associated with rock pools in deeply dissected gullies, are set in impressive locations associated with a particular ambience that is essentially 'The Burrup'. The setting, in association with the profusion of art motifs that adorn every aspect of the tumbled boulders, or which overlook the scene from an imposing vantage point, leaves a profound impact on the senses. These irreplaceable natural surroundings are an essential element of the rock art of the Burrup and associated Dampier Archipelago, but it is these elements that are progressively becoming neutralised and impacted by development.

Patination, rock varnish and dating of petroglyphs

Apart from the undisputed date of greater than 3800 radio carbon years obtained for petroglyphs covered by a shell midden deposit at Skew Valley (Lorblanchet and Jones 1980), attempts to determine relative ages for the rock art of the Burrup have been based on superimposed sequences and stylistic chronologies (Lorblanchet 1983). Such studies are, however, beset with problems. It is difficult to ascertain to what extent different styles are dictated not so much by chronology as by the thickness of the rock crust and by the differing techniques required to penetrate the crust. In addition, as would be expected in an environment subject to highly variable and sometimes intense erosion, degrees of repatination on worked surfaces differ even on the same image (Rhoads and Green. in DAS 1984b: 15).

So-called 'desert varnish', a dark glossy patina thought to have accumulated in arid conditions 17 000 years ago (Clarke 1978) is another indicator with potential for dating, but there is a considerable body of conflicting literature on this subject (Dorn and Whitley 1983; Dorn et al. 1986; Dragovich 1984a, 1984b). Indeed, there is doubt as to whether the glossy coat which can be seen adhering to some rock surfaces on the Burrup is a true desert varnish. More correctly, it should simply be termed 'rock' varnish (Bednarik 2002). Chemical analyses showed the composition of samples from the King Bay area to be similar to that of the parent rock. This suggests that the varnish is derivative and not necessarily the result of external climatic factors. Indeed, it could be forming under present climatic conditions and need not be related to former arid phases (Green 1982a: 177–81).

No firm conclusions can be drawn concerning the time span over which the art was made, although there are indications that some Pilbara art, at least, may be of considerable antiquity (Bednarik 2002). However, the strong accent on marine fauna in the repertoire supports a date not older than the stabilisation of recent sea levels when there would have been a concomitant accent on marine exploitation by the Aboriginal inhabitants. This suggests a date of not more than approximately 6000–7000 years for the marine component of the petroglyphs which, as already noted, forms the bulk of the representational art.

Research potential

The Burrup is clearly an outstanding research resource, and the CALM report identified ten major research

directions (Veth et al. 1993: 81, 114–7). These include the inter-relationship between topography, resources and site distribution; the temporal and demographic occupation of the Burrup in relation to the last marine transgression; the distribution, comparative content and inter-site variability of rock art elements; the stylistic and scientific dating of rock art; the relationship between archaeological sequences from the Burrup Peninsula and the adjacent Hamersley Plateau; the seasonal usage of the Burrup and associated Archipelago; and the intensity and residential permanency of occupation. Further investigation along these lines would contribute to understanding changing patterns of regional occupation and to an appreciation of the processes that created the art.

Essentially, questions relating to recognisable and consistent art sequences over the whole area remain untested, as do questions relating to element composition, spatial arrangement and the inter-related influences of rational economy and a belief in the supernatural.

It is an astonishing oversight that the major art sites associated with seasonal rock pools, which may be surrounded by glyphs ranging in number from 1000 to 10 000 or more motifs, have not as yet been the focus of purposive and systematic investigation. Only two such sites, Gum Tree Valley where there are 1300 motifs (Lorblanchet 1983, 1984, 1985) and Little Gully with 1177 motifs (Green and Rhoads in DAS 1984b: 18), have been recorded in any detail. While the CALM project identified several major site complexes of outstanding significance, the transect sampling strategy with linear boundaries followed during that survey meant that parts of sites often fell outside the study area. Other as yet unrecorded site complexes of major significance are located in the Pistol Range. Clearly, a complete record, analysis and cross comparison of data should be made of at least a selection of these major sites, as would certainly be done if the localities were in Europe. Indeed, factor analysis and cross-correlation of observed criteria should also be applied to a representative sample of all localities and site types in addition to the major concentrations of petroglyphs, both in relation to comparing motifs within sites and to a comparison between sites. The task of recording, analysing and protecting is immense, but the richness and variety of this unique heritage urgently deserves detailed and scientifically directed attention.

The current dilemma

The current dilemma is who or what organisation or instrumentality is taking responsibility for assessing priorities and future action with reference to the planning, management and study of the cultural heritage in the face of rapidly accelerating development proposals? Already, well over 400 sites have been ‘utilised’ in the interests of industrialisation, over 1760 engraved boulders have been relocated to a salvage yard, and much of the natural environment has been altered out of all recognition. Hills have been flattened, valleys filled in and bitumenised access roads constructed with all the unsightly associations of service corridors, water and gas pipelines, communication lines and electric pylons.

The short-term industrial boom will, however, fade—minerals are a non-renewable resource and the gas fields have a finite life span. In fifty years time, visitors and Aboriginal descendants who come to inspect what remains of the indigenous culture will be impinged upon by unsightly remains inimical to the natural grandeur of the Burrup. The rock art will be viewed along with a re-constituted landscape: ground levelled for foundations, unsightly dumps of unwanted material, quarries dug for fill, and cuttings made for roads. The potential for educational and cultural tourism on the Burrup Peninsula and associated islands of the Dampier Archipelago is unlimited, but the future will be marred by the short-sighted irresponsibility of the present.

According to recommendations made for the land designated Conservation, Heritage and Recreation under the land use plan adopted by Government (O’Brien 1996: Fig. 2), there should be a Management Committee for the Burrup Peninsula, but no such committee is currently operative (March 2002). Large tracts of land have already been designated Industrial Areas by the government, and in addition, there are currently leases held by Dampier Salt and Hamersley Iron in which important Aboriginal site complexes are located. Plans are already going ahead to establish industries utilising the by-products of gas: fertiliser, syntroleum, ammonia and seawater desalination plants, with the most recent addition being the relocation of a proposed methanol plant initially planned for Darwin. All these industrial complexes will be located on the flats immediately north of the Pistol Range in which some of the most outstanding Aboriginal heritage sites are located. The population of Karratha, the town that services the Burrup area, will escalate dramatically, and with the concomitant increase in four-wheel-drive vehicles and ocean-going boats, the art sites will become more accessible and more vulnerable to damage. The longer the delays in getting an overall plan of management established and operational, the more the natural and cultural values of this unique area are incrementally impinged upon.

The former Aboriginal Sites Department, which had responsibility for carrying out the provisions of the Western Australian *Aboriginal Heritage Act 1972*, has now been transferred from the administration of the Western Australian Museum to the Department of Indigenous Affairs and has become an agency directly controlled by government, and therefore obliged to act in accordance with government policies and priorities. The *Aboriginal Cultural and Material Committee (ACMC)* is charged with the responsibility of making recommendations to the Minister regarding applications to use land on which Aboriginal sites are located. This committee currently comprises three *ex officio* members, three specialists (anthropology, archaeology and history) and up to fourteen regional Aboriginal representatives. It is now the preferred policy of the ACMC not to make unilateral decisions regarding the use of land on which Aboriginal sites occur, but to insist that the views of Aboriginal people are sought before a recommendation is made to the Minister. Since the developers pay for these consultancies, the way is open for bargains to be driven and it

may be in the financial interests of the Aboriginal spokespersons to condone development. An added complication is that there are now multiple Aboriginal claimants to the land and the associated rights to make decisions about that land, and each competing Aboriginal group employs its own set of lawyers and consultants who may be dismissed at any time and new advisers appointed. This fluidity and lack of continuity is exacerbated by the fact that funding is ephemeral, and the Aboriginal groups may themselves regroup and reformulate interests and priorities. The developers, who have substantial investments and potential profits at stake, are by comparison well-established professional organisations prepared to pay considerable sums of money as compensation for the use of the land, and by implication, the Aboriginal heritage sites that are on that land. Commercial advantage thus appears to be the regulating factor in negotiations and settlements, not, regrettably, the cultural and scientific future of the Aboriginal heritage.

At the present time, heritage surveys on the Burrup are financed either by government or by the developers who pay for an archaeologist, an anthropologist and members of the Aboriginal community to carry out the ground inspection and conduct ethnographic inquiries. While care is taken not to contravene the *Aboriginal Heritage Act*, the reports are not public documents and, at Aboriginal request, the location of the sites together with associated descriptions may be withheld from the State catalogue. In the final negotiations regarding implementation of the Aboriginal Heritage Act, as much bureaucratic and on-the-ground effort may be put into avoiding a few grinding patches or a shell scatter, as avoiding sites that have greater cultural significance or scientific potential. Because there is no operative plan of management, there is no prioritisation of importance.

Even in the event of a recommendation being made that a site is too significant to be disturbed, the Minister to whom this recommendation is made has the right to overturn the decision if it is considered in the public interest to sacrifice the site. Public or community interest is usually interpreted as opportunities for investment and employment. Outside the immediate environs of the Burrup and the personnel intimately involved with heritage issues (developers, lawyers, consultants and Aboriginal representatives), no-one knows what is going on. There is no neutral agency to act as referee, and no authority to assess the broader picture and make informed provision for the future.

Meanwhile, active measures are being taken by government to promote the sale of natural gas abroad. For example, in October 1997 the Premier of Western Australia visited China with a view to persuading the Chinese government to buy natural gas from the North-West Shelf. At the same time, a delegation from the United Nations was visiting Kakadu National Park in the Northern Territory to ascertain whether or not proposed uranium mining will affect the integrity of the very significant Aboriginal cultural heritage and famed rock art in that area. They did not visit Western Australia; Kakadu National Park is listed as a World Heritage area, while the Burrup Peninsula and Dampier Archipelago are not, despite being world renowned for their unique natural and cultural resources.

The intention of this paper then, is to bring to the attention of a wider and informed audience both the merit and the vulnerability of the Aboriginal heritage on the Burrup Peninsula. It also makes a plea for constructive action that will support the formulation and implementation of a comprehensive plan of management. This plan should not only acknowledge the aspirations of the Aboriginal land claimants, but also contribute to an all-encompassing vision for the future viability of the Dampier Archipelago as a continuing source of inspiration and reflection for all humankind.

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Résumé. *Le présent article poursuit deux buts; d'une part, attirer l'attention sur l'abondance des pétroglyphes, et des sites archéologiques qui leur sont associés, dans la presqu'île de Burrup et dans l'archipel de Dampier limitrophe, au N.-O. de l'Australie-Occidentale; d'autre part, retracer la succession d'événements qui a abouti au dramatique impact de l'industrialisation sur cette région. Le développement industriel y a systématiquement ignoré les valeurs liées au patrimoine aborigène. Un appel est ici lancé pour la mise en place urgente d'un plan de mesures efficaces concernant les traditions culturelles encore vivantes dans cette aire remarquable.*

Zusammenfassung. *Der Zweck dieses Artikels ist zweifach: um Aufmerksamkeit auf die reichlichen Petroglyphen und assoziierten archäologischen Fundstellen der Burrup Halbinsel und des benachbarten Dampier Archipels im Nordwesten von Westaustralien zu lenken, und um die Abfolge der Ereignisse, die zu den Auswirkungen der Industrialisierung dieses Gebietes führten, zu umreißen. Australide Erbgut-Werte sind konsequent übersehen worden zugunsten industrieller Entwicklung. Ein Aufruf wird für die dringende Implementierung eines wirksamen Verwaltungsplanes für die überlebenden kulturellen Traditionen dieses hervorragenden Bezirkes gemacht.*

Resumen. *El propósito de este artículo es doble: llamar la atención sobre los prolíficos petroglifos y los sitios arqueológicos que les están vinculados en la Península Burrup y en el adyacente Archipiélago Dampier en el Nor Oeste de Australia Occidental, y de subrayar la secuencia de eventos que condujeron al impacto de la industrialización en ésta área. Los valores del patrimonio Aborigen han sido continuamente ignorados favoreciéndose el desarrollo industrial. Se hace una petición para la urgente implementación de un efectivo plan de administración para las tradiciones sobrevivientes de esta sobresaliente región.*

REFERENCES

- AKERMAN, K. 1985. *People of the Ocean – tide riders of the Dampierland Peninsula*. WAIT, Perth.
- Australia, Department of Northern Development and Department of Industrial Development, W.A. 1974. *The Pilbara study: report on the industrial development of the Pilbara during 1974*. Australian Government Publishing Services, Canberra.
- BAYNES, A. 1981. Faunal identifications from Burrup Peninsula excavations. Unpubl. MS, Department of Aboriginal Sites (DAS), Western Australian Museum, Perth.
- BEDNARIK, R. G. 1977. A survey of prehistoric sites in the Tom Price region, north western Australia. *Archaeology and Physical Anthropology in Oceania* 12: 51–76.
- BEDNARIK, R. G. 1979. The potential of rock patination analysis in Australian archaeology – part 1. *The Artefact* 4: 14–38.
- BEDNARIK, R. G. 1991. Standardisation in rock art terminology. In C. Pearson and B. K. Swartz (eds), *Rock art and posterity: conserving, managing and recording rock art*, pp. 116–118. Occasional AURA Publication 4, Australian Rock Art Research Association, Melbourne.
- BEDNARIK, R. G. 1998. The technology of petroglyphs. *Rock Art Research* 15: 23–35.
- BEDNARIK, R. G. 2002. About the age of Pilbara rock art. *Anthropos* 97: 201–15.
- BEVACQUA, R. 1974. The Skew Valley midden site: an Aboriginal shell mound on Dampier Island, Western Australia. Unpubl. report, DAS, W.A. Museum, Perth.
- BINDON, P. 1978. A survey for Aboriginal sites, Dampier Salt Ltd, western leases. Unpubl. report, DAS, W.A. Museum, Perth.
- BOLTON, M. A. 1980. Recording an Aboriginal rock art site: an individual research project for Anthropology 3400. Unpubl. report, Anthropology study unit. Nedlands College of Advanced Education, Perth.
- BRADSHAW, E. 1994. A report on archaeological work in the coastal Pilbara, Western Australia. Final unpubl. report for AIATSIS, Canberra, and Heritage Council of Western Australia, Perth.
- BRADSHAW, E. 1995. Dates from archaeological excavations on the Pilbara coastline and islands of the Dampier Archipelago, Western Australia. *Australian Archaeology* 41: 37–8.
- BROWN, S. 1979. Dampier to Perth natural gas pipeline route: a survey for Aboriginal sites. Unpubl. report prepared for State Energy Commission. Department of Aboriginal Sites, W.A. Museum, Perth.
- BUTLER, W. H. and M. A. BUTLER 1984. An assessment of third party effects of the natural environment of the Burrup Peninsula at the end of Domgas construction, North West Shelf Project. Unpubl. conservation consultant report, on behalf of Woodside Off-shore Petroleum Pty Ltd.
- CALM 1990. Dampier Archipelago Natural Reserves: management plan 1990–2000. Management Plan No. 18.
- CLARKE, J. 1978. Rock patination and the age of Aboriginal engravings at Dampier, W.A. In *Rock art conservation: a review of a research project December 1973 to December 1978*. Unpubl. report, DAS, W.A. Museum, Perth.
- Clough/Soros-Longworth and McKenzie (SLAM) 1980. Land and port planning of the Burrup Peninsula. For Dept of Industrial Development, Perth.
- CRAWFORD, I. M. 1964. *The engravings of Depuch Island*. In W. D. L. Ride and A. Neumann (eds.), *Depuch Island*. W.A. Museum Special Publication 2, Perth.
- CURR, E. M. 1886 (ed.). *The Australian race*. Vol. 1: 296–301. Government Printer, Melbourne.
- DANIEL, D. 1990. Thalu sites of the West Pilbara. Department of Aboriginal Sites, Perth.
- Department of Aboriginal Sites, W.A. Museum (DAS) 1974 (B. J. Wright). Dampier Archipelago Aboriginal sites. Unpubl. report for incorporation into the Pilbara Study Report, W.A. Museum, Perth.
- DAS 1979a (B. J. Wright). Dampier Archaeological Liquefied Natural Gas Project: a survey for Aboriginal sites. Unpubl. report, W.A. Museum, Perth.
- DAS 1979b (V. Novak). Dampier Archaeological Liquefied Natural Gas Project: a survey for Aboriginal sites: King Bay area. Unpubl. report, W.A. Museum, Perth.
- DAS 1979c (J. Clarke). Dampier Archaeological Liquefied Natural Gas project: a survey for Aboriginal sites: quarry, communications station and access roads. Unpubl. report, W.A. Museum, Perth.
- DAS 1980a (B. J. Wright). A proposal for the archaeological investigation of, and preservation of, Aboriginal sites in the Dampier Archipelago. Unpubl. report, W.A. Museum, Perth.
- DAS 1980b (J. Clarke). Dampier Archipelago Liquefied Natural Gas Project. A survey for Aboriginal sites in the vicinity of a proposed access road Dampier to King Bay, W.A. Unpubl. report, W.A. Museum, Perth.
- DAS 1980c (J. Clarke et al.). Dampier Archipelago Liquefied Natural Gas Project. Supplementary report II: survey for Aboriginal sites in the vicinity of proposed borrow pits, granite quarry and lay down areas. Burrup Peninsula, Western Australia. Unpubl. report, W.A. Museum, Perth.
- DAS 1981 (B. J. Wright). The recording and protection of Aboriginal prehistoric places on the Dampier Archipelago. Press release, June 1981. W.A. Museum, Perth.
- DAS 1982a (B. J. Wright). A proposal for the archaeological investigation of and preservation of Aboriginal sites in the Dampier Archipelago. Unpubl. report, W.A. Museum, Perth.
- DAS 1984a. Dampier archaeological project: survey and salvage of Aboriginal sites on portion of the Burrup peninsula for Woodside Off-Shore Petroleum Pty Ltd. Map folio. Dept of Aboriginal Sites, W.A. Museum, Perth.
- DAS 1984b (Rhoads et al.). Dampier archaeological project: survey and salvage of Aboriginal sites on portion of the Burrup peninsula for Woodside Petroleum Pty Ltd. Catchment areas, geomorphic zones and tabulations. Unpubl. report, Dept of Aboriginal Sites, W.A. Museum, Perth.
- DIX, W. 1970. Field note book I. DAS, W.A. Museum, Perth.
- DIX, W. 1973. Field note book II, Dampier Archipelago. DAS, W.A. Museum, Perth.
- DIX, W. 1977. Facial representations in Pilbara rock engravings. In P. J. Ucko (ed.), *Form in indigenous art: schematisation in the art of Aboriginal Australia and prehistoric Europe*, pp. 227–285. AIAS, Canberra.
- DIXON, C. 1982. Photogrammetric analysis of petroglyphs. General project for Bachelor of Applied Science. Unpubl. report. WAIT, Perth.
- DORN, R. I. and D. S. WHITLEY 1983. Cation-ratio of petroglyphs from the Western Great Basin, North America. *Nature* 302: 816–8.
- DORN, R. I., D. B. FAMFORTH, T. A. CAHILL, J. C. DOHRENEWEND, B. D. TURRIN, D. J. DONNAHUE, A. J. T. JULL, A. LONG, M. E. MACKO, E. B. WEIL, D. S. WHITLEY and T. H. ZABEL 1986. Cation-ratio and accelerator radiocarbon dating of rock varnish on Mohave artefacts and landforms. *Science* 231: 773–896.
- DRAGOVICH, D. 1984a. Varnished engravings and rock weathering near Broken Hill, western NSW. *Australian Archaeology* 18: 55–62.
- DRAGOVICH, D. 1984b. Minimum age for desert varnish in the Broken Hill area, NSW: a preliminary estimate. *Search* 15: 113–5.
- EDWARDS, R. 1968. Prehistoric rock engravings at Thomas Reservoir, Cleland Hills, Western Central Australia. *Records of the South Australian Museum* 15: 647–70.
- FLOOD, J. 1997. *Rock art of the Dreamtime*. Harper Collins, Australia.
- GARA, T. J. 1983. The Flying Foam Massacre: an incident on the north-west frontier, Western Australia. In M. Smith (ed.) *Archaeology at ANZAAS 1983*. W.A. Museum, Perth.
- GARA, T. J. 1984. The Aborigines of the Dampier Archipelago: an ethnohistory of the Yaburarra. Unpubl. paper, W.A. Museum, Perth.
- GARA, T. J. 1993. 'Orphan country no more': Aboriginal associations with the Burrup Peninsula. A report to the Ngurin Aboriginal Corporation, Roebourne. Environmental Protection Authority (EPA) 1979. North-west shelf development project: report and conclusions by the EPA Bull. 69,

- Dept Conservation and Environment, Perth.
- GORDON, R. 1996. Sources of rock armour on the Burrup Peninsula. Unpubl. report for Woodside Offshore Petroleum Pty Ltd. Gordon Geological Consultants, Perth.
- Government Gazette 1984a. Order in Council, Protected Area, Dampier Climbing Men. 2/11/83, p. 3507.
- Government Gazette 1984b. Order in Council, Protected Area, Burrup Peninsula–North. 2/11/83, p. 3503.
- GREEN, N. 1982a. They draw rude figures on stone: engravings at King Bay. Unpubl. MA thesis, Department of Anthropology and Prehistory, Australian National University, Canberra.
- GREEN, N. 1982b. The archaeology of the Burrup Peninsula. W.A. Unpubl. report for Heritage Australia, Australian Heritage Commission, Canberra.
- GREEN, N. and J. TURNER 1982a. Proposed fieldwork for Aboriginal site documentation in the Dampier Archipelago 1982. Unpubl. report, DAS, W.A. Museum, Perth.
- GREEN, N. and J. TURNER 1982b. Preliminary report to the Registrar of Yindjibarndi sites associated with the Harding River Dam. Unpubl. report, DAS, W.A. Museum, Perth.
- GREEN, N. and J. TURNER 1982c. Report to the Western Australian Heritage Committee and the Australian Heritage Commission for the quarter ending September 30, 1982. Unpubl. report, DAS, W.A. Museum, Perth.
- GREEN, N. and J. TURNER 1983. Karratha West access road. Unpubl. report to the W.A. Main Roads Department. W.A. Museum, Perth.
- GREGORY, A. C. and F. T. GREGORY 1884. *Journals of Australian explorations*. Government Printer, Brisbane.
- HALL, H. A. 1971. *A partial vocabulary of the Ngaloona Aboriginal tribe* (ed. by C. G. von Brandenstein). AIAS, Canberra.
- HARRIS, J. 1988. An excavation report of Georges Valley shell midden, Burrup Peninsula. Unpubl. BA hon's thesis Dept of Archaeology, University of Western Australia, Perth.
- JESTRIBEK, K. 2000. Pilbara petroglyphs: research in progress. Unpubl. report, Dept. of Archaeology, University of Western Australia, Perth.
- KEENE, L. 1981. Mapping of Aboriginal archaeological sites of the Burrup Peninsula. General project for Bachelor of Applied Science WAIT, Perth.
- KING, P. P. 1827. *Narrative of a survey of the intertropical and western coasts of Australia, 1818–1822* (2 vols.). John Murray, London (1969 Facsimile edition, Libraries Board of S.A., Adelaide).
- LANTZKE, D., L. SHIPLEY, A. M. MURPHY and S. CAMPBELL-SMITH 1994. A report of a preliminary Aboriginal heritage survey for the proposed Karratha Heavy Industry project, Western Australia. Unpubl. report prepared for DRD by McDonald Hales and Associates, Perth.
- LORBLANCHET, M. 1977. Summary report of fieldwork, Dampier, WA. *Newsletter*, New series No. 7. AIAS, Canberra.
- LORBLANCHET, M. 1978. Skew Valley, Dampier, W.A. Shell middens and rock engravings. Unpubl. MS, AIAS, Canberra.
- LORBLANCHET, M. 1983. Chronology of the rock engravings of Gum Tree Valley and Skew Valley near Dampier, WA. In M. Smith (ed.). *Archaeology at ANZAAS 1983*. W.A. Museum, Perth.
- LORBLANCHET, M. 1984. Summary of fieldwork carried out from May to July 1984 at Dampier (Western Australia). Unpubl. report held by the Aboriginal Affairs Department, formerly Department of Aboriginal Sites, W.A. Museum.
- LORBLANCHET, M. 1985. The engravings of the top of Gum Tree Valley, Dampier, W.A. Unpubl. report, AIAS, Canberra.
- LORBLANCHET, M. and R. JONES 1980. Les premieres fouilles a Dampier (Australie de l'Ouest) et leur place dans l'ensemble Australien. In J. Garanger (ed.). *La prehistoire de l'Océanie*. Paris.
- MACILROY, J. 1979. Dampier Archipelago historic sites survey. Report for the Australian Heritage Commission. Unpubl. report. W.A. Museum, Perth.
- MCCARTHY, F. D. 1961. The rock engravings of Depuch Island, north-west Australia. *Records of the Australian Museum* 25: 121–48.
- MASEFIELD, J. (ed.) 1906. *Dampier's voyages, by Captain William Dampier*. Grant Richards, London.
- MATTNER, C. J. 1989. Simulation of regional sampling designs on the Burrup Peninsula, W.A. Unpubl. B.Sc. hon's thesis, Dept of Archaeology, University of Western Australia, Perth.
- MURPHY, A., K. EDWARDS and S. CAMPBELL-SMITH 1994. Desk top review and preliminary field investigations of Aboriginal heritage issues associated with the proposed Karratha and Port Hedland Heavy Industry Estates. Unpubl. report prepared for AGC Woodward Clyde Pty Ltd by McDonald Hales and Associates, Perth.
- O'BRIEN PLANNING CONSULTANTS 1994. Burrup Peninsula draft land use and management plan. Prepared for the Burrup Peninsula Management Advisory Board by O'Brien Planning Consultants, Perth.
- O'BRIEN PLANNING CONSULTANTS 1996. Burrup Peninsula land use plan and management strategy. Burrup Peninsula. Prepared for the Management Advisory Board by O'Brien Planning Consultants, Perth.
- O'CONNOR, R. 1983. Report of an ethnographic survey of the proposed Dampier–Cape Lambert Gas Pipeline Route. Unpubl. report, W.A. Museum, Perth.
- O'CONNOR, R. and G. QUARTERMAINE 1988. Report of a survey of Aboriginal sites in the vicinity of the Karratha Heritage Trail. Unpubl. report, Karratha Rotary Club.
- PALMER, K. 1977. Myth, ritual and rock art. *Archaeology and Physical Anthropology in Oceania* 12: 38–50.
- PER (Public Environmental Review) 1994. Maitland heavy industry estate, Karratha. Unpubl. report prepared for Landcorp and DRD by AGC Woodward-Clyde Pty Ltd., Perth.
- PICKERING, M. 1982a. An archaeological survey of the Dampier to Perth natural gas pipeline route: section 1, Burrup Peninsula to Yannarie River. Unpubl. report, DAS, W.A. Museum, Perth.
- PICKERING, M. 1982b. An archaeological survey of the Dampier to Perth natural gas pipeline route: section 1, Burrup Peninsula to Yannarie River. Supplementary report 1: access roads and construction sites. Unpubl. report, DAS, W.A. Museum, Perth.
- Pilbara 21, 1992. A land use strategy for the Burrup Peninsula. A discussion paper. W.A. Government, Perth.
- RANDOLPH, P. 1973. Field note book I. DAS, W.A. Museum, Perth.
- RICHARDSON, A. K. 1886. The Nickel Bay tribe. In E. M. Curr (ed.), *The Australian race*, Vol. 1: 296–301. Government Printer, Melbourne.
- RIDE, W. D. L., I. M. CRAWFORD, G. M. STORR, R. M. BERNDT, R. D. ROYCE and A. F. TRENDALL 1964. *Report on the Aboriginal engravings and flora and fauna of Depuch Island, Western Australia*. W.A. Museum Special Publication 2.
- ROBINSON, M. V., A. MURPHY and D. LANTZKE 1996. Report of an Aboriginal Heritage survey undertaken at the proposed methanol plant area, Burrup Peninsula. Unpubl. report prepared for the Nanga-Ngoona Moora-Joorga Land Council, Roebourne, by Michael V. Robinson and Associates, Perth, and McDonald, Hales and Associates, Perth.
- SALE, K. 1992. Ascent to the sky; a shamanic initiatory engraving from the Burrup Peninsula, north-west Western Australia. *Archaeology in Oceania* 27: 22–36.
- SEAMAN, P. 1984. The Aboriginal land inquiry. Unpubl. report to the Minister with the Special Responsibility for Aboriginal Affairs, Perth.
- STOW, J. P. 1881. *The voyage of the Forlorn Hope from Escape Cliffs to Champion Bay 1865*. Sullivan's Cove, Adelaide.
- TURNER, J. 1981. Murujuga: a spatial analysis of the engraved rock of Withnell Bay. Unpubl. BA hon's thesis, Department of Anthropology, University of Western Australia, Perth.
- VETH, P. 1982. Testing the behavioral model: the use of open site data. Unpubl. BA hon's thesis, Department of Anthropology, University of Western Australia, Perth.
- VETH, P., E. BRADSHAW, T. GARA, N. HALL, P. HAYDOCK and P. KENDRICK 1993. Burrup Peninsula Aboriginal heritage project. Unpubl. report to the Department of Conservation and Land Management.
- VETH, P., T. GARA and P. KENDRICK 1994. The Aboriginal face of rock art on the Burrup Peninsula. In M. Sullivan, S. Brockwell and A. Webb (eds),

- Archaeology of the north. Proceedings of the Archaeological Association Conference 1993*, pp. 213–226. North Australian Research Unit, Darwin.
- VINNICOMBE, P. 1987a. Dampier archaeological project: resource document, survey and salvage of Aboriginal sites, Burrup Peninsula, Western Australia. Unpubl. report, DAS, W.A. Museum: Perth.
- VINNICOMBE, P. 1987b. Burrup Peninsula: notes towards a plan of management of the Aboriginal heritage. Unpubl. report, W.A. Museum, Perth.
- VINNICOMBE, P. 1987c. Field note book, CALM survey, Dampier Archipelago. DAS, W.A. Museum, Perth.
- VINNICOMBE, P. 1988. Salvage archaeology of the Burrup Peninsula. *Australian Archaeology* 25: 53–78.
- VINNICOMBE, P. 1997a. Maitland Heavy Industry Estate: Aboriginal heritage survey 1997. Unpubl. report for Department of Resources Development/LandCorps, presented by West Pilbara Land Council.
- VINNICOMBE, P. 1997b. King Bay – Hearson Cove, Aboriginal Heritage survey. Unpubl. report for Department of Resources Development/Land Corps, presented by West Pilbara Land Council.
- VIRILI, F. L. 1974. A preliminary report on the Aboriginal sites and the rock art of the Dampier Archipelago, W.A. Unpubl. report held by Dampier Salt, Karratha.
- VIRILI, F. L. 1977. Aboriginal sites and rock art of the Dampier Archipelago. In P. J. Ucko (ed), *Form in indigenous art: schematisation in the art of Aboriginal and prehistoric Europe*, pp. 439–451. AIAS, Canberra.
- VON BRANDENSTEIN, C. G. 1970. *Narratives from the north-west of Western Australia in the Ngarluma and Jindiparndi languages*. AIAS, Canberra.
- Western Australia Planning and Co-ordinating Authority 1979. Nickol Bay region recreation study, unpubl. report, October 1979. Dept Resources Development, Perth.
- WITHNELL, J. 1901. *The customs and traditions of the Aboriginal natives of Western Australia*. Private printing, Roebourne.
- Woodside Petroleum Development Pty Ltd (WPD) 1979. Draft environmental impact statement and environmental review and management program. Woodside, Perth.
- WRIGHT, B. J. 1968. *Rock art of the Pilbara region, north-west Australia*. Occasional Papers in Aboriginal Studies 11, Australian Institute of Aboriginal Studies, Canberra.
- WRIGHT, B. J. 1979. Dampier Archaeological liquefied natural gas project: a survey for Aboriginal sites. Unpubl. report, DAS, WA Museum, Perth.