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Usewear and phytoliths on bedrock grinding patches, Pilbara, north-western Australia

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Disciplines

Medicine and Health Sciences | Social and Behavioral Sciences

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and

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Abstract

Bedrock grinding patches were recorded in the Fortescue Metals Group Ltd Rail Corridor within the Wooodstock/Abydos Aboriginal Heritage Area 130 km south of Port Hedland, Western Australia. WA State Ministerial conditions required the salvage of representative samples, residue analysis and other detailed microscopic study to investigate the technology and function of grinding patches in the area. Following a pilot study and experimental work, we undertook microscopic study of 159 samples – including PVS (PolyVinyl Siloxane™) peels and water extractions – from 81 grinding patches, collected at six recorded sites. The worn stone surfaces are similar microscopically to traces found on experimental and Aboriginal stone artefacts used for grinding seeds, although the development of wear patterns is variable. The most common residues were phytoliths which indicate that grinding patches were utilised for grinding grasses of the Panicoid and Chloridoid sub-families, although the open nature of the sites means issues of taphonomy need to be considered. Spinifex phytoliths suggest seeds from this plant may also have been exploited. No traces of pigment or ochre were found. We suggest that the grinding patches are linked with food processing associated ceremonial gatherings and rock art.

Introduction

As part of a heritage mitigation strategy, Shaun Canning, ACHM (Australian Cultural Heritage Management) and Gavin Jackson (Gavin Jackson P/L) invited RF to salvage some granite grinding patches in the Pilbara, Western Australia (WA). WA State Ministerial conditions required the salvage of representative samples, residue analysis and other detailed microscopic study to investigate the technology and function of the grinding patches prior to their destruction. The bedrock grinding patches had been previously recorded in the FMG Rail Corridor within the Wooodstock/Abydos Aboriginal Heritage Area 130 km south of Port Hedland, WA (Jackson 2006). The area is

60-200 km south of Port Hedland in Karriyarra and Palyku Aboriginal lands. RF subsequently invited Alan Watchman to undertake geological investigations and to evaluate possibilities for dating organic accretions on the grinding patches. This fieldwork with RF, Alan Watchman, Gavin Jackson and Boone Law (ACHM) took place on Karriyarra country in December 2006 in the company of FMG personnel and Karriyarra community members (Bruce Bung and Andrew Gordon). A key objective was to sample 14 grinding patches from four Aboriginal sites in order to develop a viable recording and sampling methodology. Polyvinyl Siloxane (PVS) peels were taken from all worn grinding patches (from the smoothest looking surfaces) and from adjacent unworn surfaces. An aqueous sample was also removed using a pipette to suck any residues from the abundant cracks in the granite surface. Subsequent fieldwork by Gavin Jackson resulted in the application of this methodology to recover a further 159 PVS and aqueous residue samples from six more sites (n=81 grinding patches total). In this paper, we outline the recording methodology and summarise key findings of the microscopic study, suggesting that the grinding patches were most likely used for grinding seeds, including perhaps the tiny seeds of spinifex, for which there is only rare ethno-historical evidence.

Study Area

The study area is part of both Karriyarra and Palyku country, approximately 60-200 km south of Port Hedland, in the Pilbara region of WA (Figure 1). The landscape is essentially a stony desert with irregular and very low rainfall, 150-300 mm per year (BoM 2012). The vegetation is dominated by acacia and spinifex scrub (Figure 2).

Figure 1: Study area. [Source: FMG]

Figure 2: Spinifex and acacia species dominate the landscape around the granite domes and grinding patches. [Photo: Boone Law]

Watchman (2007:4) in his geological report noted that the study area generally lies

'between the Pilbara hinterland of iron-rich sediments and the coast, and essentially comprises low granite hills about 200 m in elevation. Various Archaean granitic rocks crop out in the area and these comprise the Yule Batholith (Hickman and Lipple 1978).'

Watchman (2007:4) described one typical site with unusual xenoliths (rocks that are enveloped in a larger rock during formation):

'At site KAR 06-02 this structural dome of granitoids is part of a migmatite suite of rocks consisting of fine to coarse-grained equigranular to porphyritic biotite adamellite and biotite granodiorite. Leucosomes of thin aplite dykes and pegmatites have intruded parallel to the foliation.

At site KAR 06-02 a narrow, even-grained aplite has intruded the porphyritic biotite adamellite, and it is on this equigranular intrusive rock that the grinding patch (#1) was made (Figure 3). The aplite dyke is approximately 55cm wide and contains pale, elongate xenoliths (near the colour scale in Figure 3). The dyke trends at 30° and although generally flat on top has a slight dip of approximately 10° to the northwest.'

The granite includes quartz that varies in grain size and is very hard. Hundreds if not thousands of grinding patches occur in this area and their function is thought to be either for pigment preparation or grinding plant foods (Jackson 2006).

Bedrock Grinding Patches

The granite commonly outcrops in the form of domes rising gently above the sandy plain. Hundreds of granite grinding patches were recorded by ACHM and Gavin Jackson in an area where the FMG rail was proposed (Jackson 2006). The sampled patches have macroscopic smoothing varying from about 30 cm x 15 cm in maximum dimensions up to about 300 cm x 150 cm. Grinding patch morphology mostly follows the flat to slightly convex topography of the granite domes. Some grinding patches have depressions worn from use, forming a concave cross-section. Some grinding patches are adjacent to stream beds or natural shallow depressions in the granite that have held water after rain (Figure 3 and Figure 4), though others are associated with no obvious source of water.

The granite grinding patches in the study area exhibit different degrees of grinding and some variation in the type of granite on which they occur. Some surfaces are very weathered, and modification by grinding shows up very clearly. Other granites have exfoliated and exposed relatively fresh surfaces, some of which have also been used for grinding.

Figure 3: Some grinding patches (on the edge of the granite slab, below the pink and black flagging tape) have shallow depressions and are located near stream beds. [Photo: Boone Law]

Figure 4: Some grinding patches are on low domes of granite but stream beds are less than a few hundred metres away. Left to right: Gavin Jackson, Bruce Bung, Andrew

Gordon, Alan Watchman, with RF crouching and pointing at the grinding patch. [Photo: Boone law]

Occasionally upper grinding stones or hand stones were found near the grinding patches. Hand stones are typically made of a hard dolerite (Figure 5).

Figure 5: An upper grinding stone or hand stone (dolerite) found near a bedrock grinding patch. [Photo: Boone Law]

Although we are aware of few tool-use experiments undertaken specifically on granite (but see below), many tool-use experiments have been undertaken utilising quartz, and it is the smoothing, polish, and striations on quartz-rich rocks that provide a key for interpreting the usewear patterns described below (e.g. Fullagar 1991, 2006).

Karriyarra community members Andrew Gordon and Bruce Bung involved with the fieldwork project suggested that grinding patches might have been used for grinding ochre for body paint. Consequently, the grinding patches are thought to be linked to body painting and men's ceremonies performed near adjacent Aboriginal rock engravings on dolerite outcrops, similar to the granophyre rock formations on the Burrup.

Experimental Archaeology

Two tool-use experiments were undertaken by RF in the field. Spinifex and Acacia seeds were harvested and were ground to flour in a period of about 30 minutes, using a dolerite hand stone and a granite slab (Figure 6). The main purpose of this experiment was to enable RF to observe the nature of grinding usewear on granite. It is likely that the main form of abrasive wear is a consequence of grinding hard stones together (as it is for sandstone seed grinding implements). However, the presence of siliceous particles (phytoliths) and other plant tissue also contributes to polish formation, as has been documented for a wide range of processed materials in numerous tool-use experiments (e.g. Hamon 2008).

Grinding experiments were also undertaken with red ochre (hematite) which leaves a distinctive, bright, extremely fine-grained residue that was extremely difficult to remove. In this instance the grinding process rapidly ceased to be effective because the ochre firmly filled all the depressions and cracks, creating a hard smooth film and clogging the hard sharp grains of the original rough granite surface. Because the stones were too large to fit on a microscope stage, polyvinyl siloxane (PVS) peels (see below) were taken to facilitate the study of the grinding surfaces at high magnification using a light microscope.

Polish development under these grinding conditions probably cannot extend beyond a stage when grains are plucked from the surface (see Figure 7). These plucked grains provide free abrasives that will constrain the extent of polish forming as the entire surface is gradually worn down (Kamminga 1979). More compacted, homogenous stones (such as quartzite) can sustain much more developed patches of polish, but the surface of the granite from this study area is constantly and rapidly

Figure 6: Experimental grinding tools used to grind Spinifex and Acacia seeds. Left: lower grinding stone (granite). Right: Hand stone (dolerite). Scale bar is in centimetres. [Photo: RF]

Polish development under these grinding conditions probably cannot extend beyond a stage when grains are plucked from the surface (see Figure 7).

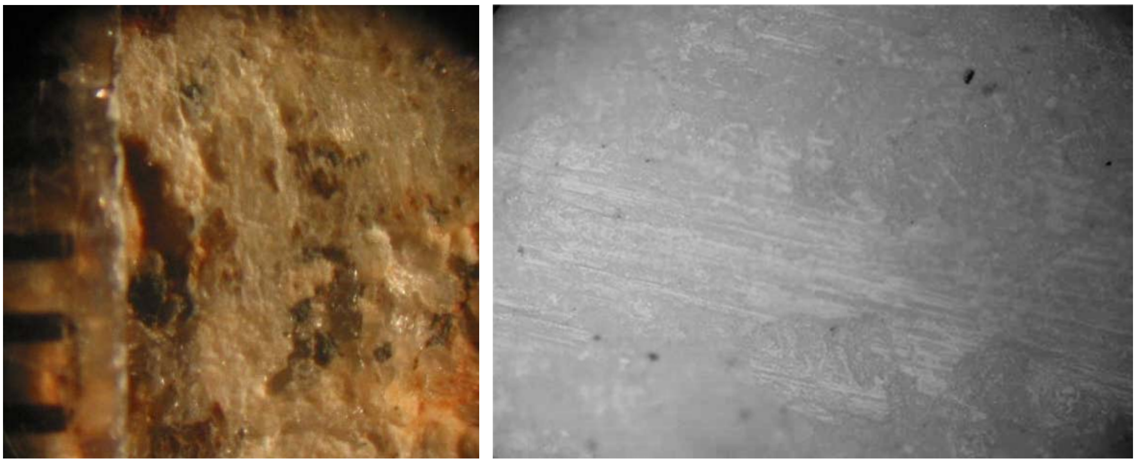


Figure 7: Usewear on experimental lower granite grinding stone (shown in Figure 6). Left: some broad striations and abrasive smoothing. Note the pits where grains have been plucked from the surface. Scale on left is in millimetres. Right: PVS peel of lower grinding stone showing fine striations, smoothing and polish (lighter coloured streaks). Scale: Diagonal is about 1mm. [Photo: RF]

being worn with use, in the same way (but perhaps less rapidly than) sandstone seed grinding tools commonly found in other parts of arid Australia.

Methodology: sampling grinding patches for usewear and residues

We used two techniques to gather samples for studying the function of bedrock grinding patches. First, the areas to be sampled (those deemed to be the 'most worn') were cleaned by wiping the surfaces vigorously with ethanol to remove loose surface residues. Then, a dental impression compound, polyvinyl siloxane (PVS) (see Mandikos 1998), was used to take a high resolution impression of the grinding surface and of the adjacent area with no grinding (Figure 8). Using this method quartz grains were replicated with excellent clarity such that natural fracture features were easily visible under a metallographic reflected light microscope at x200 magnification. Next we used a disposable nylon dropper to deliver purified water to the porous rock surface close to where the PVS samples were taken on the grinding patch (Figure 9). The water was agitated with the nylon tip and left to soak into cracks in the granite for a minute. The water and any residues it had 'sucked up' from the cracks and rock surface was removed with the dropper and transferred to sealed nylon tubes (Figure 10). Later examination revealed that a wide range of particles including phytoliths were clearly visible in these residue samples when viewed microscopically under a transmitted light microscope at x200.

In addition to the peels and residue samples, tiny flakes from the grinding surfaces were removed by Alan Watchmen so that I could examine the polished and unpolished surfaces microscopically; this was considered necessary because use-wear striations were not visible on the grinding patches at low magnification in the field.

Figure 8: RF delivering PVS (with mixing dispenser) to the grinding patch surface KAR 06-21 GP 16. [Photo: Boone Law]

Figure 9: RF taking a residue sample with the disposable nylon dropper. [Photo: Boone Law]

Figure 10: PVS (green peels) and residue (sealed tube) samples on and off a grinding patch. The red stain is formed by very fine sediment at the margin of depressions that fill with rain. The green PVS peels were removed and sealed in plastic bags. Larger PVS

peels (the size of standard microscope slides) were made for some grinding patches. [Photo: Boone Law]

Results: Use-wear observations

Using a stereoscopic microscope in the laboratory, with low angled point source of light, striations were noted to be very common on the small flaked rock samples removed from grinding patches (Figure 11). Additionally, the PVS peels from grinding patches provided a negative impression but with sufficient detail to see the same features. PVS peels on freshly fractured quartz grains indicate the excellent resolution achievable via this method (Figure 12).

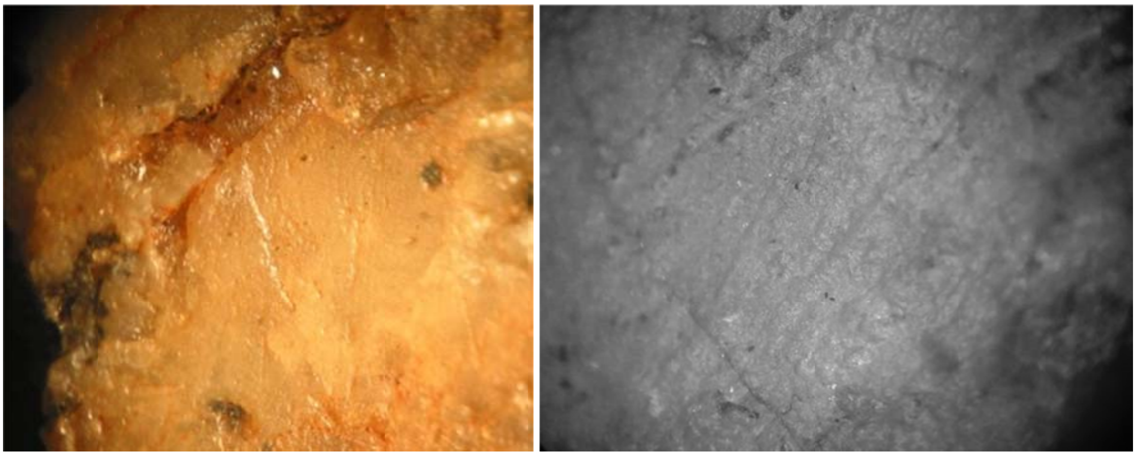


Figure 11: Striations visible on rock sample from grinding patch KAR 06 21 1A (4). Left: Width of field about 1cm. Right: Detail of usewear on rock sample. Diagonal is about 1mm. [Photo: RF]

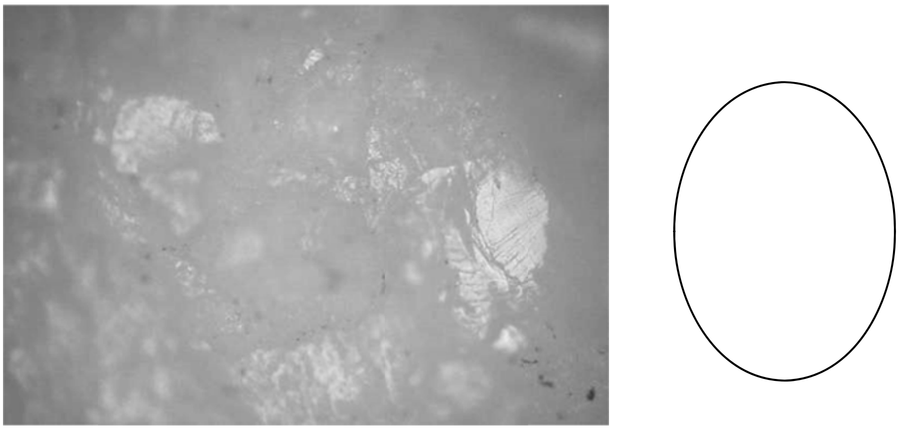


Figure 12: Impression of fresh fractures and stress lines on a quartz grain (circled) on PVS Sample 11 taken away from the most worn area at grinding patch KAR 06 21 GP38. The photo was taken at x100 magnification, and the maximum dimension (diagonal) is about 2 mm. [Photo: RF]

At higher magnification under a metallographic (reflected light) microscope, PVS peels from grinding patches show abundant fine striations indicating abrasive smoothing. Low points on the peel (i.e. high points on the grinding stone surface) are associated with hard grains of quartz that have more smoothing and appear to have been polished flat with fewer striations (Figure 13 and Figure 14).

The PVS impressions from each grinding patch and off-site controls were studied under a reflected light microscope. Two kinds of smoothing or polish were noted. Alignments of polish and striations were common on some grinding patches and rare or absent on others.

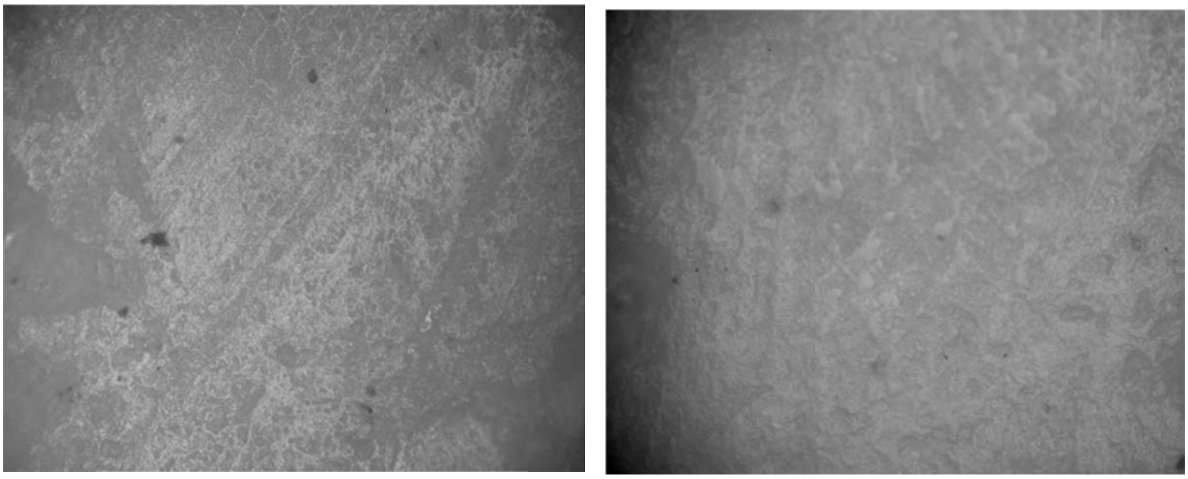


Figure 13: PVS peels from smooth polished surface of grinding patches. Left: KAR 06-21 GP 16. Note fine striations (slightly darker scratches) and alignments running top right-bottom left. Lighter patches with small depressions (darker patches) are polished. Right: KAR 06 01 GP1 Sample 2. Scale for both images: diagonal is about 1mm. [Photo: RF]

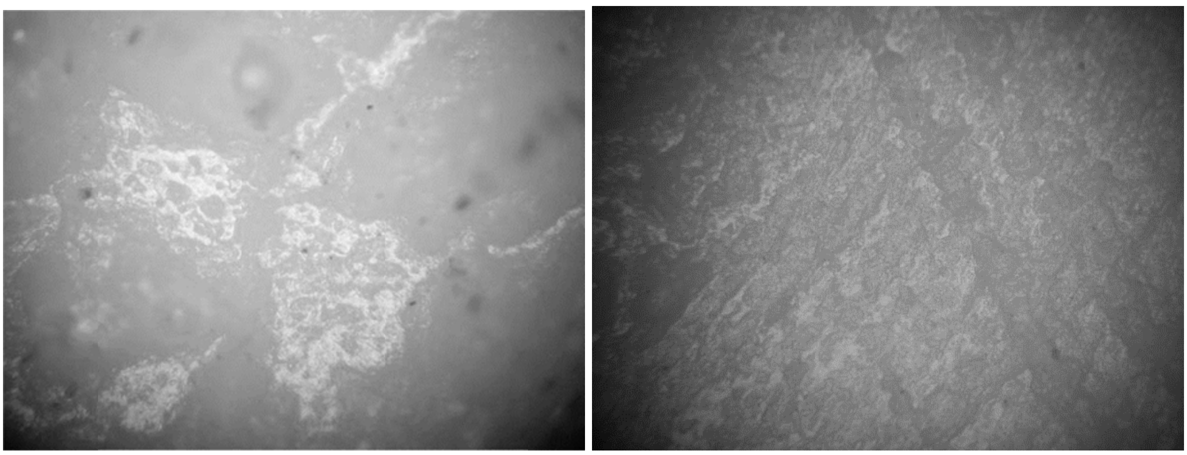


Figure 14: PVS peels from grinding patches. Left: PVS peel from KAR 06 19 GP 1, showing exceptionally well developed polish on high points (lighter areas) with darker patches indicating depressions on the stone itself. Right: PVS peel from PAL VII 06 02 GP35 showing much more abrasive conditions with striations oriented in at least two directions. Scale for both images: diagonal is about 1mm. [Photo: RF]

Nevertheless some surfaces were highly smoothed and flat; and had sustained bright polish which is presumably a consequence of the stone types and the material which was being ground.

Results: Phytoliths in residues

A total of 97 residue samples from 95 grinding patches at 10 sites were studied by LW. These samples were analysed by examination of the mounted residue on a glass slide using a transmitted light microscope. This revealed that the aqueous residue samples typically had abundant residues present, including phytoliths and starch grains (Figure 15). Phytoliths were recorded as belonging to one of 23 'distinctive' (ie recognisable) categories: sinuous edged rod, straight edged rod, spiny edged rod, blocky quadrilateral, hair cell ovoid, trichome, elongated hair cell, unilobe, bilobe with a limited waist, bilobe with a defined waist, spheroid [which typically indicate the presence of spinifex grasses], angular quadrilateral, Eriachne [bilobe on a base], Aristida [bilobe with a distinctive long shaft], polylobate, sphere, quadrilateral plate, sinuous edged plate, bulliform, Acacia [irregular amorphous form with surface ornamentation], stomata, Cyperaceae [plate with distinctive patterned nodes] and 'others'. Additionally, pieces of amorphous plate and amorphous fragments of thicker, irregularly shaped, non-repetitive morphologies were also noted; these latter categories were excluded from the total phytolith counts used both to compare the relative phytolith abundance in each sample and to construct the phytolith diagrams.

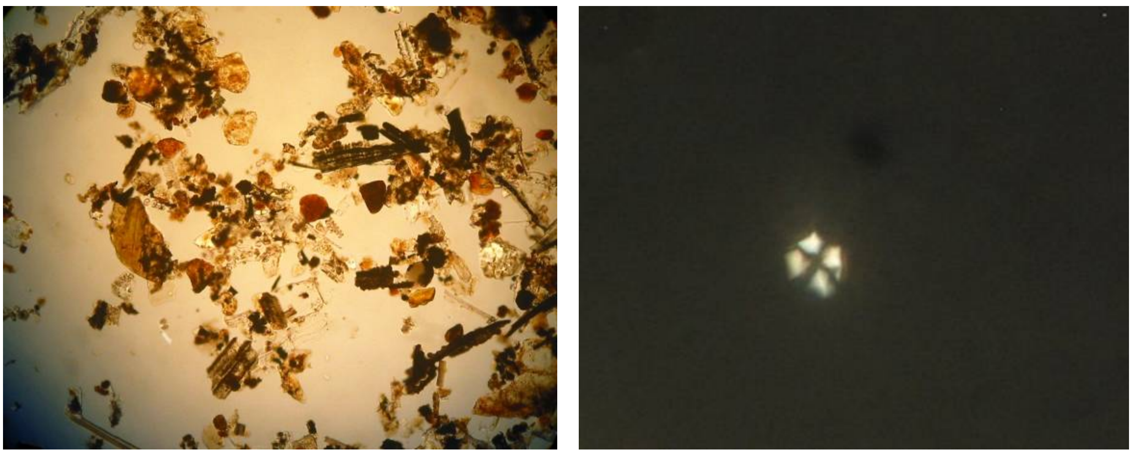


Figure 15: Left: Residue extraction from KAR 06 10 GP1 Sample 3, with phytoliths (some with serrate edges) Scale: diagonal is about 1mm. Right: Starch grain (diameter 18 microns – too large to be from grass) from KAR 06 01 GP1. Cross polarised light. [Photo: RF]

Analysis confirmed the ubiquitous presence of phytoliths in all samples examined. The abundance of phytoliths present in each sample varied considerably, most likely as a result of taphonomic factors rather than differences in original use patterns. Diagnostic phytolith types observed included those from Acacia, and Panicoid, Chloridoid and Spinifex grasses (Figure 16), and assemblages were dominated by morphological types produced by a variety of grasses, particularly members of the Chloridoid and Panicoid sub-families. Six of the sites are discussed here (Figure 17).

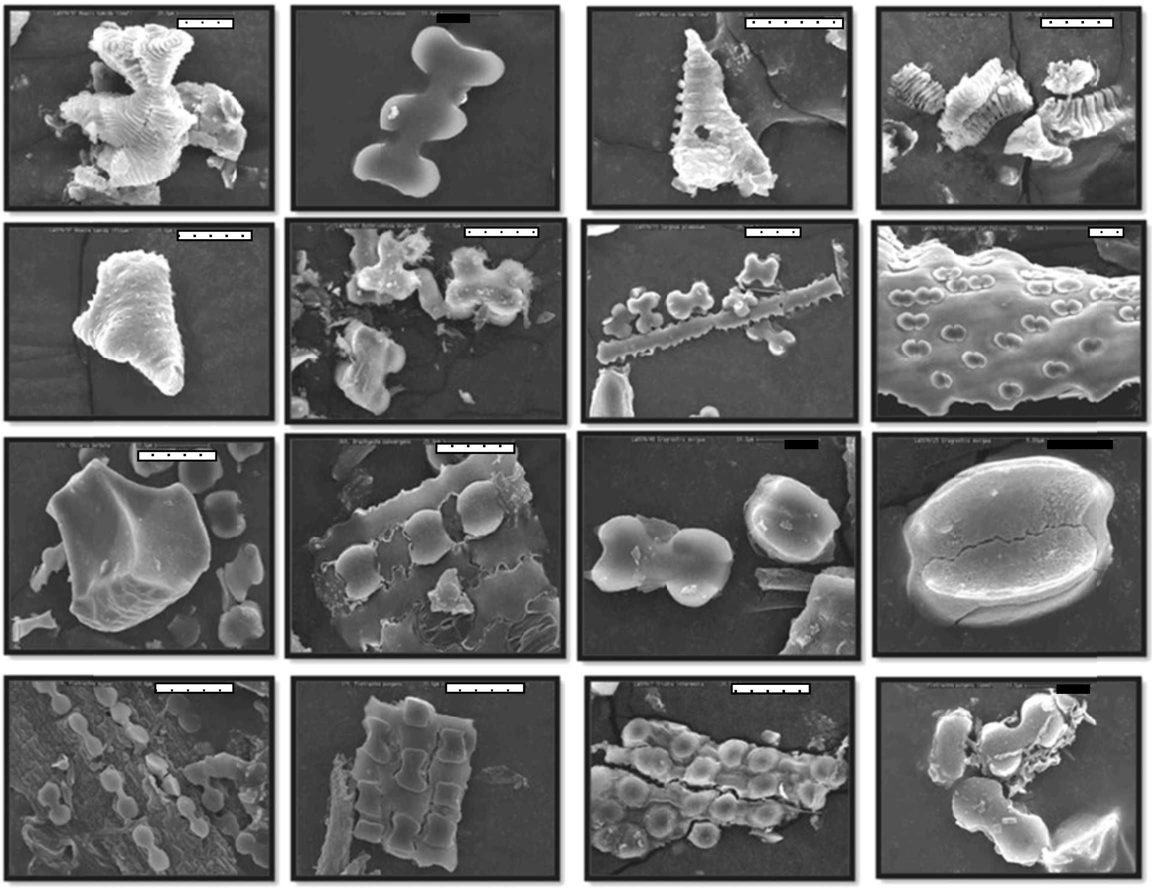
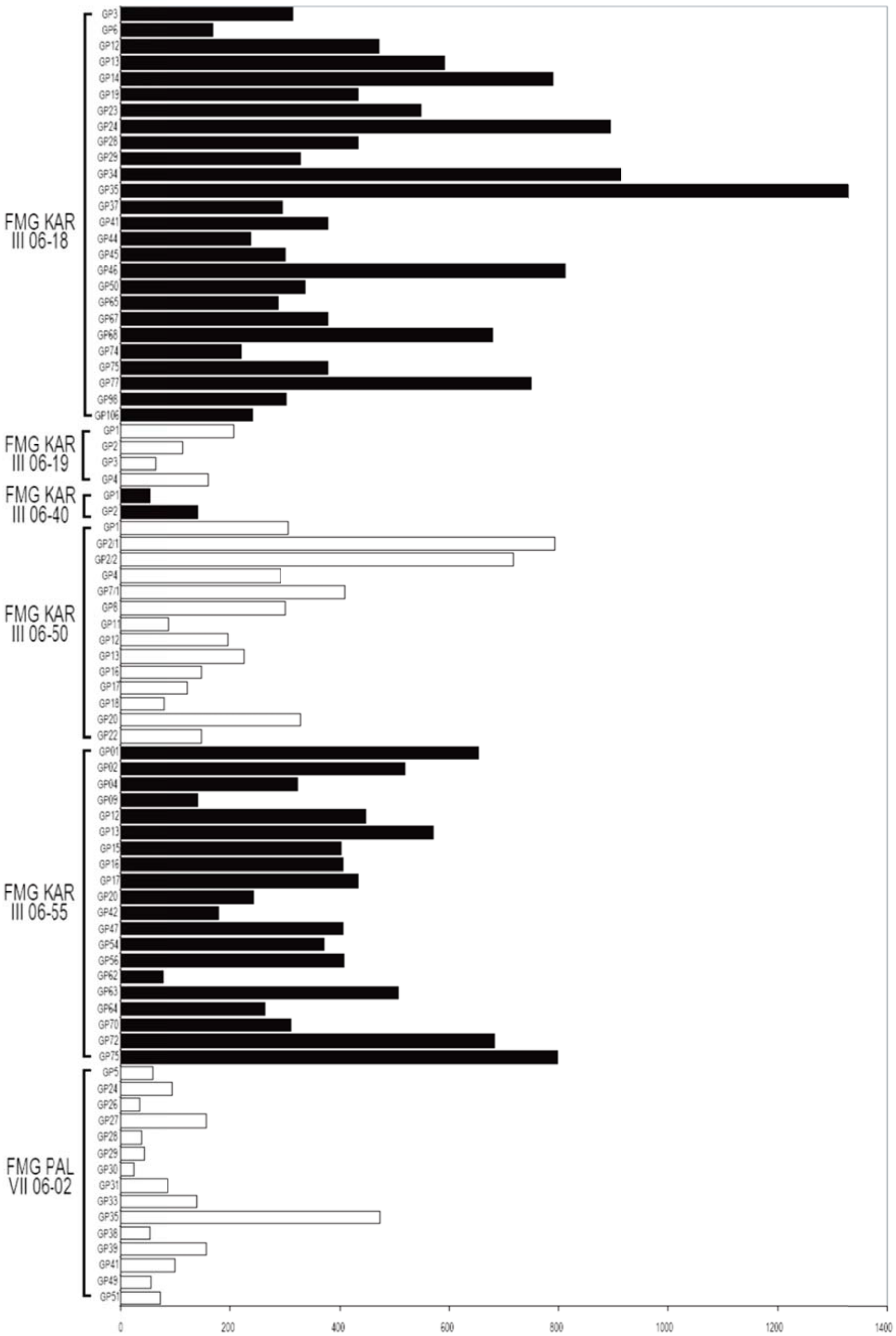


Figure 16: Some of the phytolith types observed in this study. SEM images. Top row: Acacia, second row down: Panicoideae grasses, third row down: chloridoideae grasses, bottom row: Spinifex (also in the Chloridoideae subfamily). Scale: White striped bars are 20 microns, Black bars are 5 microns. [Photo:LW]

Although it is not possible to be entirely certain that all of the residues were the result of grinding owing to the open nature of the sites sampled, phytolith analysis provides support for the proposition that in all cases the sampled grinding patch features were utilised for the grinding of plant materials, as opposed to ochre preparation. The phytolith analysis suggests that the plant material processed on the grinding patches was similar in each case, being typically grasses of the Panicoid and Chloridoid sub-families.



FMG KAR III 06-18
FMG KAR III 06-19
FMG KAR III 06-40
FMG KAR III 06-50
FMG KAR III 06-55
FMG PAL VII 06-02
0
200
400
600
800
1000
1200
1400

Figure 17: Graph showing the comparison between phytolith abundance in each residue sample (and across the six different sites), based on total numbers of distinctive phytoliths counted across ten transects. [Wallis 2008]

Of particular interest are the low incidence of Acacia and the variable presence of Spinifex on grinding patches within the same site complex (Table 1). Spheroids typical of spinifex are present at all sites but their presence varies at grinding patches within the sites. This suggests (but does not unequivocally demonstrate) that the presence of Spinifex and Acacia may not simply be related to their abundance in the landscape (which is very high) but rather to cultural selection at times in the past.

Table 1: Abundance of phytoliths at sites.

Site	Number of grinding patches at each site	Patches with Acacia present	Patches with Spinifex (spheroids) present	Chloridoid to Panicoid relative abundance
FMG KAR III 06-18	26	1	26	Even except GP46
FMG KAR III 06-19	4	1	4	High
FMG KAR III 06-40	2	0	2	High
FMG KAR III 06-50	14	2	13	Tending even
FMG KAR III 06-55	20	1	19	Even but variation in patches
FMG PAL VII 06-02	13	0	6	Variation in patches

Figure 18 shows a graphical representation of the distinctive phytoliths in residue samples from the KAR III 06-19 site.

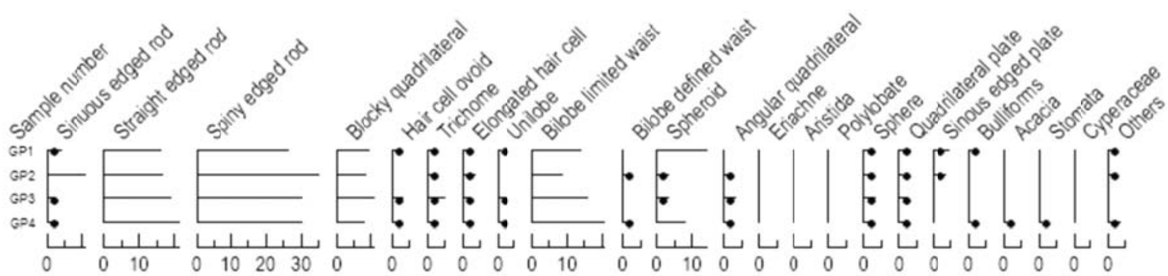


Figure 18: Phytolith diagram of residue samples from FMG KAR III 06-19. [Wallis 2008]

Although only four samples were examined from KAR III 06-19, they show relatively consistency in the presence of spinifex grasses (ie spheroid type phytoliths) and Chloridoid grasses, with very little input from Panicoid grasses. In contrast, distinctive phytoliths in residue samples from the FMG KAR III 06-50 site are all quite homogenous, with the various morphological types indicating a mixture of Panicoid and Chloridoid grasses, with only very limited input from spinifex grasses (Figure 19). The degree to which residue samples might be affected by local taphonomic conditions (water, wind and fire) is difficult to determine with this data set and it is thus not possible to demonstrate Aboriginal preference for particular grass taxa.

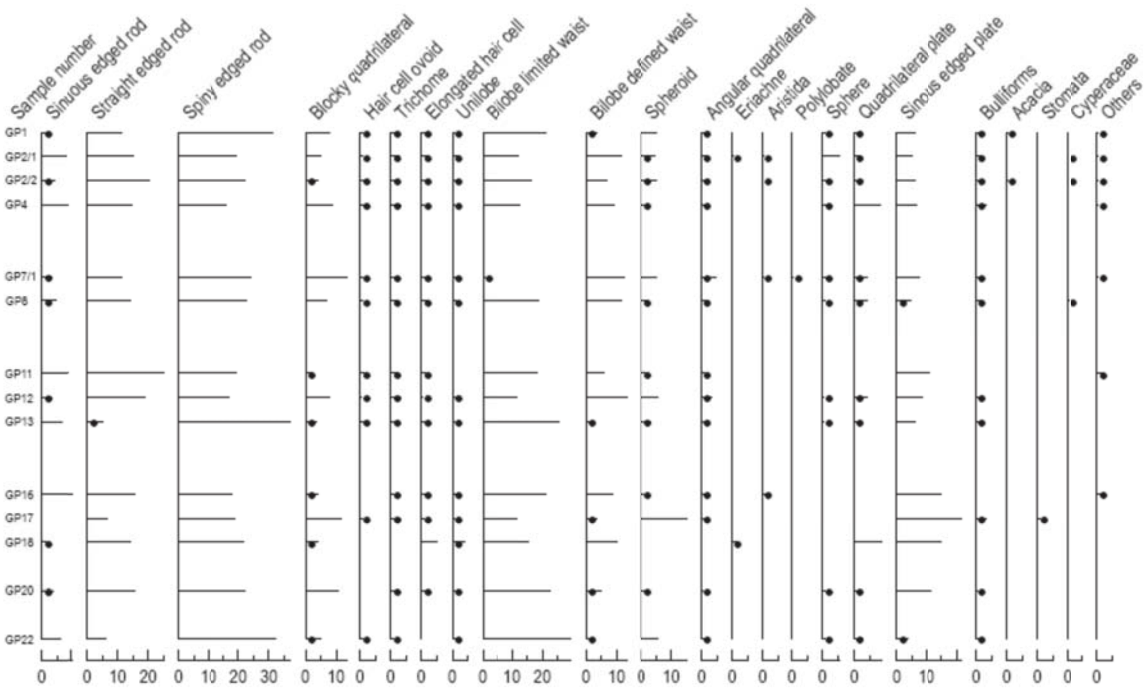


Figure 19: Phytolith diagram of residue samples from FMG KAR III 06-50. [Wallis 2008]

Unfortunately there is no easy way to distinguish between phytoliths that have been incorporated into a grinding patch residue as a result of human processing of plant material, as opposed to those that have settled on the surface fortuitously through wind action. While the presence of burnt (stained) phytoliths in a residue might indicate their presence was the result of wind rather than human agents (since people generally do not process burnt grasses), the fact that burning does not always cause staining does not mean it is always possible to assume unstained phytoliths are unburnt, and therefore more likely the result of deliberate plant processing activities (though see Parr 2006). Nevertheless, the examination of 'off-site' control samples (ie those collected from the rock surface adjacent but not on grinding patches) might allow elucidation of this issue.

Discussion

Taphonomic issues notwithstanding, the phytolith evidence provides support for the proposition that in all cases the sampled grinding patch features were utilised for the grinding of plant materials. Starch grains were very rare and not likely to survive open air conditions. No ochre stains or particles were observed, nor any other significant use-residues.

The phytolith analysis shows that the plant material processed on the grinding patches was similar in each case, being typically grasses of the Panicoid and Chloridoid sub-families. Moreover, usewear on the grinding patches is consistent with experimental wear patterns from grinding seeds.

Extensive bedrock grinding patches are known in Gulf country of western Queensland (Gorecki and Grant 1994). A grass seed grinding function for these Pilbara grinding patches (rather than ochre grinding) is not surprising particularly given the polished surfaces noted by previous researchers, and the extensive distribution and long time depth of grinding technology in Australia (Fullagar et al. 2008; Gorecki et al. 1997). Nor is it surprising to find phytoliths in abundance (see Hart and Wallis 2003). What is surprising is the evidence of spinifex phytoliths and a rare archaeological example of possible exploitation of spinifex seeds for food.

There are about 14 species of Triodia and Plechtrachne genera (commonly called spinifex) in central Australia and it is notoriously difficult to determine species (Latz 1995: 288). There are at least three species in the Pilbara: Triodia wiseana (hard spinifex), Triodia pungens (soft spinifex) and Triodia epactia (soft spinifex). Aboriginal people use Spinifex for an extraordinary range of things: food (seeds and internodes), medicine (i.e. resin impregnated anthills and smoke), shelter, bedding (!), glue (resin) for tools and ornaments, waterproofing of rafts, hunting hides, torches and firesticks, nets (hard spinifex clumps) and fibres (Gott 1992; Juluwarlu Aboriginal Corporation nd; Latz 1995). Pitman and Wallis (2012) list 11 main categories including reference to spinifex processing using stone to grind clumps of leaves (for fibre and string) and seeds (for food). The presence of spinifex phytoliths on grinding patches raises an interesting question about the use by Aboriginal people of spinifex seeds in the Pilbara and elsewhere in Australia. Beth Gott's database of Aboriginal use of plants (Gott 1992) documented few specific references to grinding spinifex seeds in semi-arid margins of the continent: in northern Flinders Ranges (Cleland and Johnston 1939) and northwestern NSW (Turner 1905).

In central Australia, Latz (1995: 291) noted that the 'Warlpiri are reputed to eat spinifex internodes in times of hardship but consider them a tasteless, inferior, stopgap food. ... Aboriginal people in this area deny any use of spinifex seeds for food'.

In northwestern Australia, in the Hamersley Plateau of the Pilbara, Juwularlu Aboriginal Corporation (nd:118) documented edible seeds including *Acacia inaequilatera*, *colei*, *pyrifolia*, *tumida*, *Panicum decompositum*, *Calandrina polyandra*, *Portulaca oleracea* and *Eucalyptus camaldulensis*; but no spinifex. However, Brehaut and Vitenbergs (2001: 146) document that edible seeds reported by the Guruma elders included hill spinifex (*Triodia* sp.) (Guruma name: paru). [This list of edible plants was compiled mostly by Peter Stevens and Nelson Hughes with identification assistance from Stephen van Leeuwen and Michael Hughes from Western Australia's Department of Conservation and Land Management.]

There is also indirect evidence that Spinifex seeds were ground for food in the Pilbara. Although Veth (1993) and Walsh (1987) noted no spinifex seeds in the Martu resource schedule, there is evidence from the Burrup. Bird and Hallam (2006:5) referred to Turner (1981) and reported that 'A study of the grinding patches recorded during the Dampier Archaeological Project in the early 1980s showed that they were most common in camping areas close to spinifex grasslands, suggesting that they were mainly used for grinding spinifex seeds into flour. Many grinding patches had clearly been used over long periods of time, from the amount of wear and the fact that their surfaces had often been rejuvenated and re-roughened through pecking or incising lines.' The Jaburara Heritage Trail brochure also says Aboriginal people harvested spinifex for seeds. It is likely that spinifex seeds were used for food in the Pilbara particularly when nothing else was available in the required quantity at particular times of the year.

Peter Veth (Veth et al. 1993 and in discussion) has suggested that the semi-arid margins around the arid core may have been harder to live in at certain times because they are less predictable (when and where rainfall happens); and large aggregations of people close to the grinding patches are suggested by the vast body of engravings, which is indeed the case in the Woodstock/Abydos study area. Following this argument, bedrock grinding patches on this huge scale are a signature of substantial food production (i.e. seed cakes or damper) to feed large gatherings, made possible by the peculiar configuration of social networks, seasonal resource availability (water and grass seeds), and rock formations (both granite domes for grinding patches and granophyre boulders for rock art.). Based on ethnography and oral tradition, it is likely that these large areas of intensive seed processing reflect women's activities, to feed families involved in ceremonies associated with the rock art. Domestic campsites are likely to be associated with these seed grinding activities.

Conclusions

Other than noting the presence of grinding patches and measuring their dimensions, research into Aboriginal grinding patches is typically minimal in Australia. In this study we present a methodology for recovering PVS peels of grinding stone usewear and aqueous solutions of phytolith residues in order to allow the further study of such features to assist in the determination of their possible function(s). Seed grinding experiments were undertaken with granite and dolerite to complement other tool-use experiments. Usewear study of 95 grinding patches at 10 site locations indicates that all were probably used for grinding seeds, although the incidence of striations and polish development is variable and may relate to different task conditions, or, alternatively other tasks such as the processing of spinifex leaves and stems for fibres.

Phytolith analysis of residues recovered from the surfaces of grinding patches indicates the dominance of grass phytoliths. Despite unresolved taphonomic conditions in open site settings with likely contamination from rain and wind, the grass phytolith assemblage supports the usewear study and suggests the use of Spinifex (Triodia and Plechtrachne genera) in the Pilbara for seeds. New micro-staining techniques developed by Birgitta Stephenson (2011) have high potential for reliable identification other grinding stone traces and further evaluating the function of these sites

A high frequency and extensive distribution of grinding stones (including bedrock grinding patches) are probably linked intimately with food production for large gatherings of Aboriginal people.

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Initial fieldwork for this study in December 2006 included Karriyarra community members Andrew Gordon and Bruce Bung, Alan Watchman, Boone Law, Richard Fullagar and Gavin Jackson (who undertook subsequent fieldwork).

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