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Food or fibercraft? Grinding stones and Aboriginal use of *Triodia* grass (spinifex)

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ABSTRACT

Plant tissue and wooden objects are rare in the Australian archaeological record but distinctive stone tools such as grinding stones and ground-edge hatchets are relatively common, and they provide strong indirect evidence for plant food processing and woodworking, respectively. Ethnohistorical references to the Aboriginal use of stone tools for technologies related to fibercraft, basketry, hafting adhesives and fixative sealants (with gum, wax and resin) are also rare but all these tasks were probably more common than records indicate. Here we consider ethnohistorical evidence for stones in fibercraft and the processing of *Triodia* grass (spinifex) as a case study. We compare functional traces on experimental stones with traces on a museum specimen (CMAA 1926.591), which was collected ethnohistorically and reportedly used for 'grinding spinifex leaves'. Residues and other traces on the museum specimen are consistent with both fiber-processing and seed grinding. We suggest that it may be difficult for usewear and residue analysis to determine if grinding stones were used to target *Triodia* spinifex for fiber, food or another particular plant product. Further experimental research is needed to refine criteria for identifying archaeological fiber-processing tools. However, we propose that the combination of traces previously interpreted as seed processing on bedrock grinding patches and portable grinding stones may also indicate the processing of *Triodia* spinifex for fiber.

1. Introduction

Lithic microwear and experimental studies provide a key source for identifying plant processing and craft activities, particularly in the absence of direct evidence (e.g. Hurcombe, 1994, 2008a, 2008b; Guan et al., 2014; Clemente-Conte et al., 2015; Pawlik and Thissen, 2015; Terradillos-Bernal et al., 2015; Vaz et al., 2016; Decaix et al., 2016; Lucarini et al., 2016; Reynen and Morse, 2016). Although direct archaeological evidence of fibercraft is relatively rare, except under unusual preservation conditions, we know that the use of animal and plant fiber for string was a technology that probably developed prior to the emergence of modern humans (e.g. Nadel et al., 1994; Hardy, 2008; Hardy et al., 2013; Terradillos-Bernal et al., 2015). Much better preservation is generally restricted to the Holocene (see Hurcombe, 2008a, 2014; Kramell et al., 2014; Piqué et al., 2016; Vaz et al., 2016).

The indirect evidence for fibercraft in many parts of the world is not so rare and includes a variety of artefacts (e.g., beads, bow and arrows, maritime technologies, ceramic impressions or cordage, basketry and textiles, skeuomorphs, needles and net weights) that imply use of fibers or string (Hurley, 1979; Gilligan, 2007, 2008; Hardy, 2008; Hurcombe, 2008a, 2014; Lombard and Haidle, 2012; Balme, 2013; Arrighi et al., 2015; Song et al., 2016; Zhang et al., 2016).

Usewear traces on Palaeolithic stone tools at the site of Balancino, Italy, have also been interpreted as evidence for plant processing (specifically *Typha* sp.) to make cordage (Aranguren and Revedin, 2001; Aranguren et al., 2015). Similarly, usewear and residue evidence from stone tools from Hinds Cave in southwestern Texas, USA, have indicated the processing of yucca, agave and sotol fibres, commonly used for basketry, sandals and textiles (Sobolik, 1996). Other flaked-stone tools with wear traces interpreted as plant processing traces may have been created from craft related (rather than substance) activities (see Hurcombe, 2008a, 2008b,

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2014). Our interest here is in evidence for the use of grinding/pounding stones to extract or process fibres and why such tools are rarely documented archaeologically. We present a case study from Australia that suggests it may be difficult to discriminate the traces of use on some food and fiber-processing tools.

In Australia, string and fiber rarely survive in archaeological sites except under unusual circumstances, e.g. caches and burials (L'Oste-Brown et al., 2002). Tindale and Mountford (1936) described strips of fishing net (1–2.5 cm in length) in a burial recovered from Kongarati Cave, South Australia. At Fromms Landing on the Lower Murray Darling River, Sheard (1927) found a string bag (mesh of ~8 cm) in association with a stone point (Tindale, 1951, p. 258). Indirect evidence for the Aboriginal use of threads and fibercraft is more common in the archaeological record and includes beads with worn holes and edges, caused by the stringing medium. Early Australian examples include shell beads at 32 ka at Mandu Mandu, WA (Balme and Morse, 2006) and bone beads at 12–19 ka from Devil's Lair, WA (Dortch, 1979).

Aboriginal men and women have maintained a vast knowledge of plants and the technologies to extract food, craft and other materials for many purposes (e.g. Golson, 1971; Gott, 2008; Nash, 2012; Clarke, 2015). Ethnohistorical records include references to many utilised plant species in Australia (e.g. Maiden, 1889), and recently compiled botanical databases (e.g. Gott, 2002) permit more reliable identification of the plants documented by early European observers. Nevertheless, detailed records for some traditional technologies are sparse and the low frequency of records for a particular task may not necessarily reflect the significance or frequency of that task performance in the past.

Fullagar and Wallis (2012) proposed that stone tools used for preparation of fibers and seed grinding might have overlapping wear and residue traces. Consequently, a possible reason why *Triodia* spinifex fiber-processing stones have not been recognised previously is that the implements used for beating clumps were sometimes similar if not the same as those used for processing seeds. Our aim is to further investigate this proposition. First, we review ethnohistorical evidence for fiber-processing. Second, we report experiments to document wear and residues from processing *Triodia* spinifex. Third, to present the results of a residue and usewear analyses on the only known museum specimen whose function was catalogued as 'grinding spinifex leaves' (see below). Finally, we discuss the potential of usewear and residue analysis to discriminate tools used for processing *Triodia* spinifex to extract fiber, food, hafting adhesive and other plant products.

We argue that Aboriginal exploitation of *Triodia* spinifex for fiber was probably more common than previously thought, and that key to its exploitation and archaeological identification are reassessment of grinding/pounding stones, including handstones, hatchet heads, mortars, lower grinding dishes and bedrock grinding patches. We suggest that previous identifications of spinifex processing to grind seeds for food may be an error.

2. Ethnohistorical evidence

Ethnohistorical accounts often refer to production of string and rope from plant fiber, animal hair and sinew—mostly by women but also by men—and two processes were common to most parts of Australia: fiber extraction and cord manufacture (Clarke, 2012, pp. 169–202).

Clarke (2012) collected data for over 40 family taxa that variously provisioned Aboriginal people with what is generally soft bast fiber from bark and harder leaf fiber. Some families like Fabaceae included many utilised genera, including *Acacia* (wattle) and *Crotolaria* (pea). Several families provided natural cord, with no need for processing (e.g. Araceae, Convolvulaceae, Ophioglossaceae and Lygodiaceae). We are particularly interested here in whether traces of fibrous plants might occur on durable archaeological remains such as stone artifacts (Table 1).

Table 1
Records of Aboriginal fiber processing with, or probably with, stone.

Tools	Action	Fiber	Product	Taxonomic family	Common name	Location	Reference
Stone	Pound	Bark	Fiber	Sterculiaceae Moraceae	Kurrajong Fig	Top End, NT Arnhem Land	Hodgson, 1988, p. 41
Rocks	Pound	Bark	Twine	Proteaceae	Geebung	Sydney Region	Tench, 1961, p. 264
No record	Pound	Inner bark	Fiber	Moraceae	Aerial roots of Banyan fig	Yirrkala, NT Arnhem Land	Hutcherson, 1998, p. 11–12
No record	Pound	Bark	Fiber	Moraceae	Aerial roots of Banyan fig	Maningrida, NT Arnhem Land	Glasgow, 1994, p. 202
No record	Beat	Stems	Fiber	Malvaceae	Austral hollyhock	Victoria	Zola and Gott, 1992, p. 57
No record	Pound	Bark	Fiber	Moraceae	Bark cloth tree	Milingimbi, NT Arnhem Land	Smith, 1991, p. 10
No record	Pound	Inner Bark	Fiber	Sterculiaceae	Kurrajong	Arnhem Land NT	Smith, 1991, p. 12; Smith et al., 1993, p. 10, 12
No record	Pound	Stems	Fiber, Rope	Menispermaceae	Snake vine	Arnhem Land NT	Smith, 1991, p. 58; Smith et al., 1993, p. 46
No record	Pound	Inner bark	String	Sterculiaceae Sterculiaceae Moraceae	Peanut tree Kurrrajong White fig	Top End, NT Arnhem Land	Chaloupka and Giuliani, 1984, p. 62
Sticks or stones	Beat	Bark	Fiber	Thymelaeaceae	Pimelia	Southern Tablelands, NSW	Helms, 1895, p. 396
No record	Beat	Root	String	Moraceae	Bush fig	Aurukun, QLD	Adams, 1986, p. 5
No record	Pound	Bark	String	Moraceae	Anatiaris	Milingimbi, NT	Wightman and Smith, 1989, p. 10

NT Northern Territory, NSW New South Wales, QLD Queensland.

2.1. Fiber extraction

Clarke (2012, pp. 170–172) reviews the methods of plant fiber extraction (by baking, hammering, beating, pounding, chewing, soaking and steaming) and cord making (by hand-rolling on their thighs or their feet and sometimes with wooden spindles). Ochre could be utilised as a thigh lubricant and as a dye for colour, and the fibers and string were sometimes treated with wax, gum, oil and tanning agents as a fixative protection against weathering. Most references to the extraction of fibers from bark and leaves refer to pounding, beating and hammering or similar percussive action but do not explicitly mention stone implements, although from context the use of stone seems most likely (Table 1). For example, Smith (1991) refers to pounding the inner bark of *Antiaris toxicaria* R. Br (Smith, 1991, p. 10) and kurrajong *Brachychiton diversifloria* R.Br (Smith, 1991, p. 12); and the stems of snake vine *Tinospora smilacina*

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