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Lithic technologies from a stone hut and arrangement complex in Pitta Pitta Country Queensland, and the detection of social learning in archaeology

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ABSTRACT
Lithic assemblages associated with Indigenous Australian built structures are underexplored. The Hilary Creek Site 1 (HCS1) complex, western Queensland, comprising at least 16 stone-based hut structures and multiple stone arrangements, also contains a surface assemblage of thousands of flaked stone artefacts. Analysis of a sample of this assemblage provides novel insights into the technology and role of flaked stone artefacts at this site, revealing trends in production reminiscent of industries found elsewhere in arid Australia, including the highly standardised tula adze technology. The nature of the HCS1 complex, revealed through a combination of Indigenous knowledge, historical research and archaeology, facilitates exploration of theoretical models seeking to detect aspects of social learning amongst those making flaked stone artefacts. We offer social learning theory as a novel way to expand on the significance of lithic technology at this unique site – a Pitta Pitta place of teaching, learning, and youth initiation – and present new directions for theoretical modelling of flaked stone artefact variability in Australian archaeology.

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Indigenous archaeology; stone tools; teaching and learning; adze; tula; Queensland

Introduction
In recent years Australian archaeologists have increased attention on built structures – domestic, economic, and ritual – made by Indigenous people (e.g. Clarke 1991, 1994; McDonald and Berry 2017; McNiven et al. 2017; Memmott 2007; Wallis and Matthews 2016). Ceremonial stone arrangements are one such structure type found in western Queensland (e.g. Davidson 2008:129–130; Davidson et al. 1991:35, 46; Hill 1901:24; Kelly 2009:565), while another type comprises huts (also known as 'gunyahs') (e.g. Kelly 2009:563; Robins 1981; Simmons 2007:146). The latter are typically found in clusters that are sometimes referred to as 'villages' (cf. Pascoe 2014), and were often remarked upon in early ethnographical accounts (e.g. Hill 1901:25; Hodgkinson 1877:515, 519; Wells 1893:517). The most authoritative descriptions of such architecture in the western Queensland region are afforded by Roth (1897, 1910), who described several different types of built structures in Pitta Pitta country around Boulia. The simplest form was a wind break (Roth 1910:57), but a more substantial structure was the 'kurau-i', designed to withstand rain. For such a structure,

... Building operations are commenced with two naturally bent forked saplings which are fixed deep into the ground below – and made to interlock above; ... light bushes are laid and intertwined with their foliage down, these being followed by tussets of grass, then a coating of mud, and lastly by another layer of bushes ... The ground-space enclosed by the hut-wall is more or less circular in the smaller varieties, somewhat elliptical in the larger (Roth 1910:63–64).

The ultimate structure in the Boulia district, however, was the 'annakadyi',

... built on a similar scaffolding as the kuraui, but designed especially for warmth. A flat-bottomed hole is dug into the ground to a depth of about one and a half feet ... the bottom of the excavation

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Whether all such clusters of huts can be defined as villages sensu stricto, as some have done (e.g. Pascoe 2014:125; Westaway et al. 2018, 2019; cf. David and Weisler 2006 for villages in the Torres Strait) is peripheral to the main goals of this study but is an issue of substantive importance that will be addressed elsewhere.
constituting the future floor. The framework is next inserted. Wet grass is then collected and wedged into the spaces intervening and thick layers of mud covered on; the mud thus moistened soon becomes hardened and, by means of the grass, fixed in position; a ring of wet mud about a foot in width is finally smeared round the limits of the entrance for which it forms a sort of artificial door-frame. On completion, a big fire is kindled with the result that, by sun-down the place is warm enough to sleep in (Roth 1910:64).

Although not mentioned anywhere by Roth (1897, 1910)², a variation of the kurau-i and anna-kadyia, incorporating a circular base of stones, is relatively common along creeks in Pitta Pitta country, often in close proximity to ceremonial stone arrangements (Brien 2021; Davidson et al. 1989; Wallis et al. 2017, 2021, unpub. data). How and when Pita Pitta people used these hut site complexes (especially those associated with ceremonial stone arrangements) is unclear, but it was presumably at least in part seasonal, when inclement weather necessitated protection from the elements.

The challenge of interpreting such sites is complicated by an absence of detailed studies of the material culture associated with them; indeed, detailed stone artefact analysis is only rarely included as a component of built structure analysis anywhere in Australia. Further, the ability to investigate the nature of such sites using their most ubiquitous artefacts, flaked stone, is one without strong theoretical underpinnings in archaeology. The study we provide here presents morphological and reduction sequence analyses from a sample of the surface assemblage recovered alongside stone-based huts and stone arrangements at Hilary Creek Site 1 (HCS1), on Marion Downs station south of Boulia (Figures 1 and 2). The novel theoretical approach used to address this challenge seeks to link procedural units (Perreault et al. 2013) detected in standardised reduction sequences with possible cues for the teaching and learning of lithic technology by stone knappers in the past (Maloney 2019). The range of features and material culture at HCS1 make it well

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²By the time of Roth’s recording, traditional Aboriginal lifeways in this region had been disrupted by pastoralism and the violent actions of the Native Mounted Police. Furthermore, Pitta Pitta people today recount that Roth rarely ventured into the bush to talk with people, preferring the Australian Hotel and Boulia racecourse (Trevina Rogers pers. comm., July 2021). This may go some way to explaining his silence regarding these distinctive features.
suited to providing insights into a place of ritually controlled teaching and learning using stone artefacts. Indigenous colleagues’ oral histories and knowledge, as well as historical accounts from the wider study area, provide insights into possible social learning, a topic rarely explored in stone artefact analysis, although arguably important in understanding Indigenous Australian technologies and societies of the past (Maloney 2019, 2020a; Maloney and Street 2020). Comparison with reduction sequence models from other arid zone assemblages allows us to contextualise the HCS1 artefacts and then examine popular theoretical assumptions surrounding tula technology (e.g. Hiscock and Veth 1991; Maloney and Dilkes-Hall 2020; Veth et al. 2011), as well as explore other explanatory models proposed as being sensitive to social learning in the past (Maloney 2019). The biogeographical context, cultural significance and historical background of HCS1 (see below) encourages the application of this approach to lithic technology, which is argued to have possibly supported the widespread adoption of tula adze technology via the extensive trade networks of the region.

Background

The biogeographical region

The study area is on the northern margins of the ‘Channel Country’ biogeographic zone, characterised by braided rivers, and flood and alluval plains. The Georgina is the westernmost of three major rivers joining the Eyre River and flowing south into Kati Thanda (Lake Eyre). While Quaternary alluvial sediments feature along the waterways, the landscape is otherwise characterised by the silicified Tertiary Marion Formation overlying a truncated laterite profile on the Lower Cretaceous Wilgunya Formation (Paten 1964:12; Whitehouse 1948; Wilson 1990). Dissection and erosion of the Marion Formation has given rise to the stony ‘gibber’ plains that are characteristic of the region. Data collected at Marion Downs (BoM 2020; weather station No. 38014) indicate mean annual rainfall is just over 200 mm, most of which falls during summer, and overnight temperatures approaching freezing in winter (BoM 2020; weather station No. 38003). In drought years there is <40 mm of rain, with aridity exacerbated by high evaporation levels, although periodic extreme flooding events also occur (Phelps et al. 2003; Popic and Wardle 2012:101; Reynolds et al. 1961:7). As such, the region experiences regular ‘boom and bust’ cycles, with such conditions presumably less conducive to productive subsistence during the peak aridity of the late Holocene (e.g. Kemp et al. 2020; McGowan et al. 2008; Petherick et al. 2008:8). As there are no rockshelters or caves in the area, in which people can seek shelter during inclement weather, a distinct architectural tradition of stone hut construction exists to service the basic human need to seek cover from heavy rain.

An additional result of the unpredictable rainfall is that local vegetation is limited, dominated by hummock and tussock grasslands, with some patches of acacia shrublands and open woodlands, and eucalypt woodlands (Alexander n.d.). The main plants are Mitchell grasses, gidgee, mulga, turkey bush and spinifex, all of which can survive extended drought periods. A variety of native mammals, birds and reptiles live in the region (Strahan 1983), with major waterholes periodically supporting a range of freshwater aquatic species (e.g. Hodgkinson 1877:514, 518, 519; McKinlay 1861–1862:51, 69, 83, 91, 92, 107; Roth 1897:93).

Historical records

European incursions into the Channel Country began with Burke and Wills’ ill-fated 1860–61 expedition to the Gulf of Carpentaria (Anon. 1861; see also Wills 1861), followed shortly thereafter by
numerous rescue parties (e.g. McKinlay 1861–1862). Permanent European settlement followed the introduction of the Pastoral Leases Act 1869, which made financial investment in western Queensland more attractive than it otherwise had been (Pearson and Lennon 2010:99). Established in 1876, Marion Downs was the second pastoral run in the region. Goodwood (north of Boulia and the site of a Native Mounted Police [NMP] camp; see below) was taken up shortly thereafter, along with Buckingham Downs, Glenormiston, and Glengyle, and then Sandringham and Herbert Downs in 1877. With the introduction of artesian bores in the 1880s, such stations became even more attractive investments (Towner 1961–1962; see also Meston 1895), but the limited surface water and variable rainfall continued to present challenges for pastoralism, and continues today.

At approximately the same time as the first runs were being established, William (‘Billy’) Hodgkinson (1877) led a government-sponsored expedition through the region. He made many mentions of Aboriginal people in his diary, but provided no detail on stone artefact manufacturing processes or stone-based huts, generally limiting his observations to aspects of diet and material culture, such as weapons, snares and grinding stones (Hodgkinson 1877:515). Although Hodgkinson’s interactions were largely non-confrontational (apart from several occasions when he detained people against their will to serve as his guides), this was not the case with pastoralists. Despite the written record in this regard being limited, the concurrent arrival of the NMP in the district allows us to surmise that inter-racial violence in the wider region was occurring by this time. The first NMP camp in proximity to HCS1 was established in 1876 ~350 km to the east on the Diamantina River at Barracks Waterhole (Queenslander 1876:29), putting HCS1 at the very margins of that patrol district. This camp remained operational until early 1882 (Burke and Wallis 2019; Western Champion 1882:2). A second NMP detachment was established in November 1878 by Sub-Inspector Ernest Eglinton beside the Burke River on Goodwood, in an area known locally as Mucklandama (an important locale archaeologically in relation to a cache of tulas recovered there), about 90 km to the northeast of Marion Downs (Queenslander 1879:70). The NMP retained a presence at the Burke River camp until 1886, when the detachment was transferred ~260 km to the northwest.

Given their well-documented propensity for ‘dispersing’ Aboriginal people (see Richards 2008), the presence of the NMP at both Diamantina and Burke Rivers is a strong indication that violent confrontations were occurring locally in the 1870s and 1880s. While Burke and Wallis (2019) have not yet identified any specific violent interactions between Aboriginal people and Europeans in the immediate vicinity of Hilary Creek, there is certainly evidence of such events in the region generally (e.g. Brisbane Courier 16 February 1878:6; see Burke and Wallis 2019: Entry ID 39578, Entry ID 19339; see also Burke and Wallis 2019: Entry ID 51322, Entry ID 18481; Hodgkinson 1877:515). Further indications of violent interactions between the NMP and local people is revealed by an Aboriginal man’s reaction on 6 June 1876 to the arrival of Hodgkinson’s expedition, and specifically to Larry, an Aboriginal trooper accompanying the party. On seeing Larry’s NMP uniform, the man in question ‘bolted’ (Hodgkinson 1877:515). Government Medical Officer (later appointed Northern Protector of Aboriginals) turned anthropologist, Walter Roth (1897:41), used the term ‘annihilated’ to describe the local people upon his own arrival in the region just two decades later, providing further testimony to the region’s violent history.

There are scant details of technological and craft production in any of the accounts from this frontier warfare period. One exception, no doubt with interpretive flaws, is Roth’s (1904:16–17) description of tula adze technology, which he referred to as ‘potlids’ and ‘native gauge heads’, noting specific details of production and manufacture for these distinctive tools. Drawing upon these very descriptions and archaeological assemblages from Camooweal to the north, Moore (2004:62–70) created an empirical record of tula production that can be used to help formulate a sequence of procedural manufacturing elements, linked in this study with a process of social learning. Key manufacturing steps for tula production – presumably learnt by knappers across Pitta Pitta country at some point – can be elucidated from archaeological, historical and empirical records to provide novel archaeological theory with which to investigate the lithic technology at HCS1 and the nature of site activities.

Previous archaeological studies

Studies of surface lithic assemblages for western Queensland are sparse (but see Hiscock 1988a; Moore 2003a; Simmons 2007). Davidson and colleagues undertook work on Marion Downs in the 1980s (e.g. Davidson et al. 1989, 2004, 2005), focusing on Yulluna country to the northeast of Bouia (e.g. Davidson et al. 1993; Ridges 2003; Ross 1997) and occasionally elsewhere (e.g. Davidson 1983). While descriptions of near-intact gunyahs were occasionally reported from southwest Queensland,
including on Cooper’s Creek (Robins 1981), the Mulligan River and Sylvester Creek (Kelly 2009), and a cache of tulas north of Boulia was reported by Hiscock (1988b), relatively little attention has been devoted to the archaeology of Pitta Pitta country. One exception is a short report by Wallis et al. (2021) elaborating on Davidson et al.’s (1989) original report of stone huts near the Marion Downs homestead, and an as-yet-unpublished thesis on four similar hut complexes located elsewhere on the property (Brien 2021). Further to the east, Simmons (2007) carried out a landscape study in Diamantina National Park to test models about colonisation of riverine areas in the arid zone. He found that site patterning in the region was linked to settlement mobility strategies from desert adapted economies, related to risk minimisation and driven by the availability of water.

Most recently, Kemp and Westaway have begun a major research project with Mithaka people to the southwest of Pitta Pitta country (e.g. Franklin et al. 2021; Kemp et al. 2022; Westaway et al. 2018, 2019, 2021). Although their findings are only just beginning to appear, there are clear differences between the archaeological signatures in Mithaka and Pitta Pitta country. For instance, while Westaway and colleagues report large numbers of stone arrangements similar to those observed in Pitta Pitta country, they report vast numbers of sandstone quarries that are not present in Pitta Pitta country. They have not recognised any hut complexes similar to those seen in Pitta Pitta country (i.e. with stone bases), despite there being a similar availability of stone building material in both areas.

Hilary creek site 1 (HCS1)

The eponymous Hilary Creek flows during heavy rain events, but is otherwise ephemeral through the dry season. Accordingly, it would only have been suitable for occupation for short periods, under certain conditions. HCS1 itself is one of three ‘sites’ forming part of a larger site complex, including HCS2, comprised solely of stone arrangements, and HCS3, containing artefacts, huts and stone arrangements, as described in more detail by Wallis et al. (2021).

HCS1 contains at least 16 extant hut structures spread over a 0.12 ha area of gibber plain lying between the multiple channels of Hilary Creek (Figure 2(C)). All huts have central, stone-free circular interiors averaging 3.2 m², most with a C-shaped cobble base which once supported a timber-framed superstructure, the remnants of some of which survive in a collapsed form (Wallis et al. 2021). In addition to the hut structures, 20 diminutive stone arrangements dominated by small, filled circles (n = 11) and short linear features (n = 8) were recorded (Wallis et al. 2021). A single ~100 m linear feature of cobbles stretches west from the huts, connecting them to a quarried silcrete outcrop (Figure 3). Radiocarbon dating of wood samples from HCS1 huts by Wallis et al. (2021) included calibrated age estimates from interior hut surfaces of 149 cal BP (Wk-47444), 114 cal BP (Wk-47445), and 179 cal BP (Wk-47446), with excavated samples returning estimates of 285 cal BP (Wk-47449) and 278 cal BP (Wk-47450)³, suggesting occupation of HCS1 occurred immediately prior to, during, and after European incursion.

Wallis et al. (2021:16) argued that the cultural assemblage at HCS1 indicated ‘low-intensity activity by small groups of people for relatively brief periods’. Yulluna man Lance Sullivan recounted oral histories to authors Burke and Wallis, whereby the people occupying HCS1, known as Ringu Ringu – a Pitta Pitta dialect (Blake 1979) – observed major songlines and ceremony cycles related to young men’s initiation. The latter required an isolated camp to which young men travelled in the company of Elders, a journey which could take several months, with the camps generally being separated a

³Note that median ages are given rather than age ranges, owing to their falling in a poorly refined section of the calibration curve; detailed results are provided in Wallis et al. (2021:Table 1).
short distance from ceremonial grounds (e.g. Beck 2016; Davidson et al. 2004; Satterthwait and Heather 1987). The location and structure of the HSC1 site, coupled with Indigenous and historical knowledge, suggests that this complex was one such site (Wallis et al. 2021). This interpretation of the site underpins the lithic analysis and theoretical approach described herein, designed to better understand what technological activities were being undertaken in this particular site context, interpreted from morphological variability amongst a sample of the site’s extensive surface assemblage.

**Theory of social learning lithic technology**

Social learning is difficult to detect in the past, yet seems a quintessentially human behaviour, which presumably aided novice stone artefact makers in the inheritable nature of learning crafts (Shelley 1990:187). Evolutionary biologists hold social learning to be unique to humanity (Boyd and Richerson 1988; Richerson and Boyd 2005:9; Stereny 2012). Archaeologists have only recently begun developing theoretical models for detecting aspects of social learning amongst the most ubiquitous cultural residue of the past: flaked stone artefacts (Högberg and Lombard 2020; Mahaney 2014; Maloney 2019; Moore 2015; Moore and Perston 2016; Muller et al. 2017).

Many researchers agree that mastering the production of any complex flaked lithic technology requires years of practice, particularly given that it appears impossible to replicate through simple observation and imitation alone (Howe et al. 1998; Nunn 2006; Olausson 2008; Tehrani and Riede 2008). Complex technologies appear to require a longer time investment by individuals (both teachers and learners), as well as indirect investment by the social group to support social learning of manufacturing across society (Hiscock 2014; Shennan and Steele 1999). It is expected that complex technologies depend on some form of social learning, especially when the economic cost of experimentation is high (Bettinger and Eerkens 1997, 1999). Highly repetitive information, where the cost of experimentation is low, is more likely to result in the production of items with fewer errors/variability than items for which standardisation is less common (Eerkens and Lipo 2007:248; Sperber and Hirschfeld 2004; Stereny 2012:136), and, as such, would require less time invested in social learning.

Raw material availability in lithic analysis (Andrefsky 1994) has contributed to attempts at modelling innovation rates in the social learning of lithic technology (Maloney 2019), contrasted with familiar discussions of raw material ‘costs’. Other widely held assumptions include technological information being transmitted more accurately, and being considered more credible, when delivered by an expert in private social contexts (Maloney 2019, 2020b; Moore 2015; Sperber and Hirschfeld 2004; Stereny 2012:136). The premise of the existence of cues in learning complex stone artefact production finds further support from cognitive psychology, where the copying of craft behaviours is found to improve when a teacher uses social learning cues, likely to be a prerequisite for complex craft learning (Csibra and Gergely 2011:1153; Gergely and Csibra 2006:239). Similarly, Eerkens and Lipo (2007:248) found that verbal instruction alone results in higher error, while visual instruction alone results in slightly lower error; a combination of the two is the least error-prone method of knowledge transmission (see also Morgan et al. 2015).

It is from these theoretical underpinnings that archaeologists have sought to develop theory to model the role of social learning in the past from a study of standardised reduction sequences. Nevertheless, skill level, and simplicity manifested in individual stone artefacts, has proven a problematic pathway to identifying social learning (Finlay 2008:85; Maloney 2019:39), with Olausson (2008:34) raising doubts as to whether archaeology can reveal skill acquisition at all, and Flenniken and White (1985) confirming that simple flakes perform a myriad of technological roles. Circumventing these biases, Perreault (2013:398) proposed gauging technological complexity through the identification of procedural units of manufacture as a more realistic observation amongst lithic assemblages, and one that is capable of independent repetition amongst analysts. Maloney (2019) proposed that highly standardised stone tool reduction sequences could be used to explore time invested in social learning via the detection of procedural units, where regularly identified manufacturing steps manifest in archaeological data, historical accounts, and Indigenous knowledge. These procedural units were inferred as theoretical teaching and learning ‘cues’, some of which could be detected amongst case studies of pressure-flaked bifacial points (Maloney 2019), and where Indigenous knowledge, historical observation, and empirical records supported the validity of certain cues detected archaeologically. These latter records also held that these particular stone artefacts – Kimberley points in the case presented in that study – were part of socially restricted social learning and initiation rites conducted in private and isolated settings (Maloney 2020b; Moore 2015).

The ‘length of description of regularities’ (LODR), proposed by Gell-Mann and Lloyd (2003:307), was also incorporated by Maloney.
to provide a simple time investment contrast for each procedural unit, logically seeing more time invested in the social learning of more difficult cues than simple flake production cues, for example (Figure 4). Thus, where procedural units can be readily identified and independently repeated – as was the case for the initial bifacial point study (Maloney 2019, 2020b; Moore 2015) – these are theoretically linked to teaching and learning cues, each with some reasonable variation in LODR (Figure 4). Not all of these procedural units will necessarily manifest in archaeological assemblages, and their identification alone does not constitute direct evidence of social learning. Instead, where highly standardised reduction sequences can be identified, procedural units within these are theorised to represent likely cues for teaching and learning, which were presumably mastered by novice knappers via social learning. Archaeological sites where aspects of this might unfold are rare, although Indigenous Australian initiation sites provide an apt example of known cultural learning places. In the case of HCS1, this includes ritual stone arrangements adjacent to, and at short distances away from, stone-based huts, and a vast surface assemblage containing a type of highly standardised retouched artefact: the tula adze. Tula adzes are distinctive retouched flakes recognised by a prominent bulb of percussion, a relatively wide gull-wing platform, and characteristically steep distal retouch – a technology known for extreme levels of morphological standardisation, with remarkable consistency in production found across the Australian arid zone (Hiscock and Veth 1991:333–334; Maloney and Dilkes-Hall 2020:2–3; Moore 2004:66).

Given that Elders with knowledge are known to have taught cultural Law and lore to youth in the study area, standardised artefact production sequences will be explored at HCS1 using this theory (Maloney 2019), with the aim of first quantifying morphological variability (or lack thereof), detecting (common) procedural units among reduction sequences, and inferring some reasonable cases of teaching and learning cues among them. This is directly informed by the historical accounts of production phases by Roth (1904:20) and the empirical record produced by Moore (2004:69–70). While each of the identified cues may not have been directly used in teaching technology, their detection at HCS1 is theoretically linked to how these technological crafts may have been learnt in the past.

### Sampling and methods

Given the large size of the HSC1 lithic surface assemblage, estimated – at a minimum – to consist of at least 20,000 artefacts, it was not feasible or culturally desirable to collect the entire assemblage. A semi-random sampling strategy was adopted to examine how lithic manufacture changed across the extent of the site, with all surface artefacts collected from three 1 m² squares positioned between but outside huts (Squares 1, 2, and 3), one 1 m² square positioned a short distance west and half-way along the linear stone arrangement (Square 4), and another 0.5 m² (Square 5) situated in the silcrete quarry at the western extent of the complex (Figure 1(B)).

An initial count of all flaked lithic artefacts was performed according to raw material types, and included the minimum number of flakes (MNF) and total number of artefacts (TNA) (Hiscock 2002, 2007:204). The former equation tallies complete flakes, the greater number of either proximal or distal fragments, and left or right longitudinal cone split fragments. The TNA is a count of all unambiguous flaked stone artefacts, including flaked pieces and medial flake fragments. All complete flakes, retouched flakes and cores were selected for

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*Given the paucity of stone artefacts on the surface inside the hut bases (for example, XU1 of a 1 x 1 m test-pit inside Hut 1 contained only seven artefacts, although the pit had been positioned over the densest part of the surface assemblage, compared to 74 for a similarly sized test-pit outside Hut 5; Wallis et al. 2017), there was not seen to be any value in positioning sample squares inside the huts themselves, as their sample sizes would have been too small for statistically meaningful comparative purposes.*
morphological quantification, each susceptible to landmark morphological measures used in comparisons.

Several such measures were used to test morphological trends and allow comparisons between flaked artefacts. These included flake length (percussion and maximum), width (proximal, mid, maximum and distal), thickness (bulbar and mid), elongation (length/width), and platform width and thickness (Figure 5). The external platform angle (EPA) and retouched edge angle were measured using a goniometer, the latter averaged across retouched margins. The convexity index, a division of maximum width by maximum thickness, provided a measure of bulbar prominence (Moore 2004:69). The index of invasiveness (II) and percentage of perimeter retouched (%PRT) quantified retouch intensity, while the edge-curvature index quantified the convexity, and concaveness of retouched margins (Clarkson 2002a, 2002b). Linear measurements of platform surfaces on complete flakes were used to make morphological comparisons with platform measurements on retouched flakes, as a comparative link to their blank selection (Clarkson 2007; Maloney 2020a; Maloney and Dilkes-Hall 2020). Tula rotations were counted by the number of retouch scar initiation surfaces, from either ventral, dorsal or blank platform surfaces. Recognition of the latter scenario required retouch scars initiated from the blank platform to be superimposed over previous retouch scars initiated from margins, to distinguish them from platform preparation scars; thus, a tula could be rotated a minimum of two times. Qualitative observations include description of dorsal cortex, as well as number and direction of dorsal scars on flakes, differentiated by 30° or more.

Statistical tests were applied to assess the significance (p = 0.05) of morphological trends and comparisons using SPSS v27. Appropriate tests were selected based on Shapiro Wilk (SW) tests of data normality, whereby p values 0.05 or lower, determine non-normally distributed data and supported examinations with Wilcoxon signed-rank tests (Z) and Pearson’s Chi-Square (χ) for non-parametric data (Drennan 2009). SW values above 0.05 supported the use of T tests (t) for normally distributed data. All data are available in Supplementary Materials A and B.

Results

Summary and spatial variation

A total of 1,079 flaked stone artefacts were recovered from the five surface squares (Tables 1, 2). The majority are complete flakes (n = 416) and flaked pieces (n = 417), with a smaller proportion of flake fragments (n = 197) and cores (n = 13). Retouched flakes and fragments (n = 32) represent 2.9% of the assemblage.

Raw materials are predominantly silcrete (89%), with smaller quantities of chalcedony (7%), chert (3.5%), quartzite (0.25%) and rare, fine-grained volcanic (0.25%) (Figure 6). A flake of the latter was removed from an edge ground axe, as evident from striations and polish visible on the ground surface (Figure 7), with 34 grinding implements identified across the hut structures, but not analysed here (Stephenson 2022; Wallis et al. 2021). Raw material type did not affect, or have significant relationships with, flake length (SW = 0.898, p = 0.01 | χ = 12.11, p = 1), width (SW = 0.920, p = 0.01 | χ = 11.02, p = 1) or thickness (SW = 0.859, p = 0.01 | χ = 21.258, p = 1). The number of dorsal flake scars (SW = 0.881, p = 0.01 | χ = 278.45, p = 0.001) and number of dorsal flake scar directions (SW = 0.818, p = 0.01 | χ = 276, p = 0.001), however, did reveal significant differences between raw materials. In summary, these tests revealed a lack of difference in flake morphology across raw materials, suggesting the silcrete quarry produced flakes of broadly similar morphology to other raw materials, although dorsal surface observations do indicate different nodules were reduced with varied core reduction strategies.

Recovered cores were reduced from silcrete (n = 9), chalcedony (n = 1) and quartzite (n = 1), varying between 3.4 and 800 g, and 29–187 mm in maximum dimension. Unidirectional and multidirectional cores were reduced from these fine-grained
nodules, preserving traces of weathered angular (62%) and water rolled cortex (38%), suggesting erosion of the Marion formation metamorphic rock into the gibber plain provided an additional raw material source. Measures of core reduction intensity, such as the number of rotations ($SW = 0.921, p = 0.295 \mid t = 4.855, p = 0.001$) and the number of flake scars ($SW = 0.926, p = 0.323 \mid t = 10.460, p = 0.001$), revealed no significant difference between material types, with each being reduced fairly equally, despite their different masses and shapes.

Spatial distribution across the sample squares revealed other differences in technological diversity, as gauged by frequency of artefact types presented in Table 2 ($SW = 0.471, p = 0.01 \mid Z = -11.140, p = 0.001$), raw material diversity ($SW = 0.946, p = 0.709 \mid t = 4.618, p = 0.03$), and flake length ($SW = 0.898, p = 0.01 \mid Z = -14.936, p = 0.001$). TNA is also affected by sample location ($SW = 0.825, p = 0.01 \mid Z = -2.201, p = 0.028$), with most of the artefacts being recovered from Square 5 (Figure 6), where extensive silcrete quarrying produced many hundreds of flakes, and proportionately more flake fragments and flaked pieces, than those amidst the huts ($SW = 0.884, p = 0.289 \mid t = 3.8, p = 0.013$). These tests suggest that sample squares amongst the hut structures produced evidence for different manufacturing activities from those samples collected away from the huts.

**Retouched flakes**

Of 37 complete retouched flakes in the assemblage, 12 tula adzes (Figure 8) were recovered in varied states of reduction intensity (further adzes were observed elsewhere on the site outside of the sample squares). These were derived solely from Squares 1, 2, and 3 positioned among the hut structures, and were made exclusively of chert and chalcedony. While the frequency of tula adzes may appear low, HCS1 actually has more of these tools than 16 other sites with tula technology across Australia (see Maloney and Dilkes-Hall 2020:5, Table 1). Beyond the huts, 26 other retouched flakes were recovered, most lightly retouched (e.g. Figure 9(A)), with two bifaces identified (Figure 9(B)).

**Flakes**

Of 428 complete flakes, bipolar ($n = 4$), Kombewah ($n = 2$), a single ground-edge axe flake, and redirecting flakes ($n = 2$) were noted, although the majority are tertiary (62%) and secondary (35.5%) direct percussion flakes of wide morphological range. Comparing the wider pool of flakes with the remnant platform characteristics of complete retouched flakes reveals details of blank selection and the

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**Table 1.** Frequency of flaked stone tools across HCS1 according to raw material.

<table>
<thead>
<tr>
<th>SQ</th>
<th>Volcanic</th>
<th>Silcrete</th>
<th>Chalcedony</th>
<th>Chert</th>
<th>TNA</th>
<th>MNF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>116</td>
<td>17</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>102</td>
<td>50</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td>103</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>4</td>
<td>61</td>
<td>27</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>325</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Σ</td>
<td>707</td>
<td>77</td>
<td>38</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 2.** Frequency of flaked stone tool types across HCS1.

<table>
<thead>
<tr>
<th>SQ</th>
<th>Complete</th>
<th>Retouch</th>
<th>Fragments</th>
<th>Flaked Pieces</th>
<th>Cores</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>48</td>
<td>6</td>
<td>62</td>
<td>57</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>80</td>
<td>10</td>
<td>28</td>
<td>44</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>53</td>
<td>1</td>
<td>55</td>
<td>26</td>
<td>4</td>
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<tr>
<td>4</td>
<td>22</td>
<td>9</td>
<td>28</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>225</td>
<td>123</td>
<td>232</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Σ</td>
<td>428</td>
<td>249</td>
<td>416</td>
<td>11</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 6.** Raw material type according to surface sample square.

**Figure 7.** Volcanic ground edge axe flake.
nature of tool production across the site (see below).

**Blank selection**

Tula blanks at HCS1 conform to the highly standardised squat-shaped flake with prominent bulbs that characterise this artefact form. Tula platform morphology is significantly different from the other flakes in terms of platform width ($SW = 0.914$, $p = 0.01 | Z = -4.53$, $p = 0.001$), platform thickness ($SW = 0.825$, $p = 0.01 | Z = -3.689$, $p = 0.001$), and EPA ($SW = 0.976$, $p = 0.01 | Z = -2.2$, $p = 0.028$). Bulbar prominence is also significantly different from the wider pool of flakes (Proximal Thickness: $SW = 0.664$, $p = 0.01 | Z = -3.287$, $p = 0.001$ | Bulbar index: $SW = 0.951$, $p = 0.01 | Z = 205.837$, $p = 0.001$). Comparison of tulas with chert and chalcedony flakes, exclusively recovered amidst the huts, further supports this blank selection (Platform Width: $SW = 0.888$, $p = 0.01 | Z = -3.79$, $p = 0.01$ Platform thickness: $SW = 0.783$, $p = 0.01 | Z = -4.26$, $p = 0.01$), seeing only those finer grained materials with prominent bulbs and distinctive shape being reduced as tulas. All of these artefacts display platform preparation that is not prevalent on other flakes ($< 23%$). Many flakes retain two or three adjacent dorsal flake scars, orientated in the same direction (53%), therefore being qualitatively reminiscent of tula blanks produced at Camooweal (Moore 2004:69), although a lack of refitting cores makes this uncertain. These observations and tests are all indicative of highly standardised blank selection and core preparation, with a specialised tula morphology emphasising bulbar prominence and being morphologically different from hundreds of other flakes.

The other retouched flake blanks were selected from a much wider morphological range (Figure 10), lacking any significant difference from the wider population of unretouched flakes in terms of platform width ($SW = 0.914$, $p = 0.01 | Z = 10.17$, $df = 1$, $p = 1$) and thickness ($SW = 0.825$, $p = 0.01 | Z = 30.68$, $df = 1$, $p = 1$), and the same level of platform preparation, with less than 10% displaying overhang removal and faceting scars. The silcrete tool blanks were not highly selected and were seldom retouched beyond a few marginal scars ($II = <0.21$), with no strong marginal patterns of retouch distribution present.

By contrast, the tulas displayed multiple signals of a highly standardised reduction sequence, characteristic of this widespread technology. Several tests of tula morphology and reduction sequence trends
reveal qualities shared with those documented elsewhere across Australia, seeing increasing retouch intensity diminish tool length (II: \( z = -3.059, p = 0.002 \) | %RTP: \( z = -2.981, p = 0.003 \)). The same trend is not evident for proximal width (SW = 0.931, \( p = 0.01 | z = -1.380, p = 0.167 \)), platform width (SW = 0.914, \( p = 0.01 | z = -0.762, p = 0.446 \)) or bulb thickness (SW = 0.951, \( p = 0.01 | z = 156.00, p = 0.880 \)). The curvature of tula distal margins similarly follows expected trends of a convex to slightly concave retouched margins for the slug stage. As tula reduction increases, so too does the edge curvature index (%RTP: \( W = 0.877, p = 0.01 \) Z = -5.159, \( p = 0.01 \); II: SW = 0.882, \( p = 0.01 | z = -5.143, p = 0.01 \)). These tests provide evidence for a strictly maintained proximal morphology as tula reduction increases, despite drastic change to the working margins and gradual diminishing of artefact length through resharpening.

The average retouched edge angle is not affected by the spread of retouch around tula perimeters (SW = 0.963, \( p = 0.278 | %\text{RTP: } t = -3.299, p = 0.322 \)). Instead, the working edge was maintained with angles between 48° and 85° across all margins and throughout multiple resharpening stages, rotations, and presumably some rehafting. Despite our confidence that these artefacts were originally hafted for use, no traces of hafting mastics were macroscopically observed, typical of Australian surface finds. In terms of morphology and reduction, the HCS1 tulas can be said to conform to the highly standardised reduction sequences found throughout Australia (Maloney and Dilkes-Hall 2020:4–6), including those observed by Roth (1897, 1904), and replicated by Moore (2004).

The silcrete retouched flakes (\( n = 26 \)) also demonstrate diminishing length with increasing retouch intensity (%RTP: \( SW = 0.976, p = 0.822 | t = -4.438, p = 0.01 \)), while edge curvature spread with marginal retouch (\( SW = 0.917, p = 0.077 | t = 6.925, p = 0.01 \)), typically in concave scalar retouch concentrations. The average retouched edge angle, between 42° and 83°, is not significantly different from the tulas (SW = 0.926, \( p = -0.116 | t = -1.379, p = 0.183 \)), but, coupled with low retouch intensity values, and no strong patterns of concentration in marginal distribution, silcrete flakes could be reasonably described as comparatively expedient. In support of this, it is noted that less than 1% of silcrete flakes were modified after flake production. Thus, the dominance of silcrete flakes at HCS1 belies their effective complexity, with minimal evidence for high selectivity in blanks, and lack of morphological standardisation; the opposite is true for those tulas in the hut sample squares.

**Social learning as a new approach to understanding lithic technology**

Oral histories and other records document Indigenous trade routes throughout Queensland that include Pitta Pitta country as central to these networks (e.g. Duncan-Kemp 1961, 1964; Hiscock 2005; Keogh 2011; McBryde 1984; Mithaka Traditional Owners Story Map 2020; Roth 1897, 1904; Silcock et al. 2012; Tibbett 2002). Roth (1904:17) noted tula trade occurring ‘down the Georgina’, where the hafted tula never formed an article of exchange or barter: on the other hand, there was always a traffic going on with the ‘potlid’ … [tula flake blank] … in the prepared state. The archaeological evidence for trade in tulas at various states of reduction from both late Holocene and historical contexts across these vast networks demonstrates remarkable convergence, and what appears to be an extreme level of standardisation (Clarkson 2007:116–121; Cochrane and Doelman 2014:259–263; Hiscock 1988b; Hiscock and Veth 1991:334–335; Maloney and Dilkes-Hall 2020:13–14; McBryde 1987:260; Moore 2004:64–69). This standardisation is highly unlikely to have been mastered without social learning, given the theoretical notions behind the teaching and learning of complex crafts, including the manufacture of flaked lithic artefacts (Bamforth and Finlay 2008; Maloney 2019; Muller et al. 2017; Tehrani and Riede 2008).

The tula reduction sequence and silcrete quarrying documented at HCS1 can be used to infer the existence of standardised procedural units (Perreault 2013). To pursue this, reduction sequences were identified, with morphological evidence suggesting tulas at HCS1 followed trends of extreme standardisation found elsewhere across the arid zone, where retouch followed strict processes to facilitate raw material recycling and the continuous resharpening...
of artefacts. Tula blanks were demonstrably selected for their specific platform and bulbar characteristics, which are significantly different from the hundreds of other flakes sampled at HCS1. Further, they were also selected for raw material type, which was focussed entirely on utilising cherts and chalcedonies. The reduction sequence was also standardised, with retouch gradually spread across distal and lateral margins, and edge curvature following predictable patterns of convexity, straightness, and, finally, a concave working edge in the slug stage. Retouch followed a continual reduction or resharpining of the working margins, including rotation of tula slugs. These documented trends establish an emphasis for the HCSI tulas on extendibility, versatility, and maintainability (Hiscock 2006; Moore 2003a, 2003b; Nelson 1991) – all features reliant on mastery of the standardised reduction sequence of the tula technology. The exclusive presence of tulas amidst the huts, and the restricted range of materials on which they were made, further suggest that these lithic technologies were indeed focussed here; whether made, used or maintained, they are associated with a known place of social learning.

It has been documented that a range of technological knowledge in western Queensland was socially restricted, passed on through formal teaching and learning contexts in youth initiation ceremonies. This is evident in the accounts of Duncan-Kemp (1964:14), who noted: 'Both ... [male and female] ... had to go through various degrees in the adult making ceremonies and visited many ... tribes for the purpose'. Details of the specific teaching of stone artefact technologies, the element most likely to preserve archaeologically, are hard to find amongst this historical literature (but see Duncan-Kemp 1961, 1964; Roth 1904). It is highly likely that complex knowledge of stone artefact manufacture was learnt in formal teaching arrangements between Elders and youth – no one is born with great knapping skill; it must be learnt, with greater effective complexity needed for crafts requiring formal teaching (Bamforth and Finlay 2008; Shelley 1990:187; Sterenly 2012:136; Tehrani and Riede 2008:318). Consequently, socially learning the process of complex artefact manufacture would have followed teaching and learning cues, which Maloney (2019) proposed could be modelled on standardised artefact reduction sequences via the identification of procedural units.

Parsimoniously, Roth’s description of tula production in Queensland – probably assembled from observations, accounts, and some conjecture – provides a list of such units, conveniently replicated in empirical records of tula production by Moore (2004:69). Roth (1904:28) described some restricted social knowledge of crafts, such as using tulas to produce coolamons (1904:17), and noting multiple details of tula production, despite admitting to poor understanding of the process, and never directly witnessing the teaching and learning context at initiation sites (Roth 1904:16–17). He noted multiple percussion tools, multiple techniques of flaking orientation and other manufacturing criteria deemed essential to tula production. Taking these observations to be related to separate manufacturing ‘actions’ equates them with procedural units (Maloney 2019; Moore 2011.703–704; Perreault 2013), which can reasonably be inferred as teaching and learning cues for tula production. Table 3 lists eight such procedural units extrapolated from Roth’s (1904:20) observations, sketches and photographs, and further informed by experimental data (Moore 2004:69–70).

Following Maloney (2019), these procedural units are taken to represent at least some of the learning goals or cues taught by Elders to novices, that can be linked to archaeological data from HCS1 through

<table>
<thead>
<tr>
<th>Table 3. Roth’s (1904:17) observations organised into procedural units for the teaching and learning model.</th>
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<td>1</td>
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<td>7</td>
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<td>8</td>
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</table>
technological observations and morphological trends documenting standardised tula production sequences. For example, dorsal flake scar numbers and orientations were found to be different in the sample squares positioned amongst the huts compared to those squares away from huts, indicating varied reduction techniques were practised here using materials different from the wide range of flakes and fragments present at the quarry. Blank selection of tulas emphasised a highly standardised, squat-shaped flake with bulbar prominence, with emphasis on similarity in platform preparation and the generation of unique dorsal scar configurations, thereby producing artefacts with cues 1 and 2 (Table 3). These can reasonably be inferred as having a comparatively longer LODR in order to master production of the all-important standardised tula blank. All these features emphasise the regularity of the learned lithic technology production (e.g. Howe et al. 1998; Nunn 2006; Olausson 2008; Tehrani and Riede 2008). The demonstration of highly standardised retouch patterns, and maintenance of the tula proximal morphology throughout, is likely to have included different tool orientations and employment of hammer stones, as described in cues 3, 4 and 5 (Table 3). Strict maintenance of edge angles throughout reduction supports the highly predictable retouch patterns associated with the tula, probably achieved by the various and careful applications of different percussion tools across cues 6–8. It is this standardisation which appears to have been strictly adhered to across the much wider context of tula technology, and which required the more nuanced retouch applications across cues 4, 5, and 6.

By contrast, the extensive silcrete flaking at the quarry was found to have wide morphological variability, low levels of blank selectivity, expedient modification of margins, and lacked any strong morphological patterns. When present, retouch on these silcrete flakes was found to be similar in edge angle to tulas, although it lacked the standardisation, and strict morphological maintenance found amongst the stone artefacts (including tulas) at the huts. The silcrete flakes are thus theorised as having comparatively fewer procedural units – each likely to have shorter LODR – required for production (Figure 11). The raw material ‘cost’ of silcrete in terms of time invested into learning is theorised as less than that of chert and chalcedony, given the demonstration of morphological and reduction sequence differences between these materials across the site; with both of the latter materials being exclusively reserved for tula technology at HCS1. The analysis of procedural units in tools found amidst the huts identified eight procedural units, each with varied LODR, including those thought most difficult – with theoretically longer LODR – to convey different cues of the social learning process possibly enacted here.

Summarising these theoretical inferences for the HCS1 data, a simple east to west comparison of quarry-site versus stone hut-based activities has been identified, and it is argued that this represents a credible contrast of theorised elements of social learning (Maloney 2019), namely, effective complexity, the LODR, and the relative cost of raw material (Figure 11(C)). If there was indeed social learning associated with the lithic technology at this site – as Traditional Owners and historical records, along with archaeological analysis would suggest – then this spatial contrast supports a greater likelihood of formal social learning being conducted around the huts, where tulas were exclusively found, than at the quarry, where a diversity of expedient flakes were produced.

Discussion

Tula technology

Continently, the distribution of tula technology exhibits a clear spatial association with the arid zone (Maloney and Dilkes-Hall 2020:3), depicted in Figure 12, although data on how far east the tula was adopted are patchy (McNiven 1993; Moore 2003b:24–25). Temporally, the tula is considered a late Holocene innovation, with continuity into historical times. Veth et al. (2011:9) argued for a ‘sudden appearance’ and wide spread of the tula after 3,700 cal BP, with some variability in timing away from the arid zone (Maloney and Dilkes-Hall 2020; McNiven 1993). Many Aboriginal groups continued to manufacture and trade tula adzes well into the twentieth century (Akerman 2006; Gould 1971:152, 1978:82; Hayden 1977:182; Horne and Aiston 1924:106–107; McBryde 1987:260, 265), including across western Queensland (Duncan-Kemp 1964:14; Roth 1904).

The temporal overlap of historical records for the region provides some information on the context of HCS1 in a wider social network and the colonial frontier. We consider it most likely that use of the HCS1 site, and thus the majority of artefacts present at the locality, is likely to be associated with the last few hundred years, based on radiocarbon dating results (Wallis et al. 2021). Descriptions from the Lake Eyre region – south of, and linked by trade networks to, the study area – provide an apt context for the social role of tula production and trade in this region. McBryde (1986:265) encapsulated this role as follows:

... the siliceous stone required ... for ... adzes was available in abundance ... Yet ... certain
locations were regarded as having special qualities or were the property of specific groups. Quarrying, manufacture and distribution … were made to serve the social and ritual needs of small groups whose survival in a harsh environment often depended on good relations with their neighbours …

This context fits with popular arguments for trade and exchange playing a role in the innovation and spread of the tula, yet also hints at socially restricted access to lithic quarries, and links tula adzes to social and ritual practices in the study area – both concepts supported by Traditional Owner knowledge and theorised as contexts sensitive to social learning models by Maloney (2019, 2020a).

While spatial and temporal records of the tula reveal reasonably strong patterns across Australia, our understanding of the underlying causes driving their innovation and widespread adoption is evolving (Maloney and Dilkes-Hall 2020:16; Smith 2013:186). The broadly accepted argument is that late Holocene environmental change increased foraging risks – with tula technology one of many technological responses to altered economic conditions (Cochrane and Doelman 2014; Maloney and Dilkes-Hall 2020; Hiscock 1994, 2006:81; Hiscock and Veth 1991; Smith 2013:196; Veth et al. 2011). Tula technology’s standardisation is thought to have minimised the need for frequent tool replacement via an emphasis on extendibility and sustainability of raw material use (Hiscock 2006:81; Nelson 1991:70; Shott 1986:19). Several studies have argued that the tula developed to increase capacity for wooden craft production in trade and exchange systems, socially mitigating foraging risks through enhanced group interconnectedness (e.g. Cochrane and Doelman 2014; Hiscock 1988b; Hiscock and Maloney 2017; Maloney and Dilkes-Hall 2020). All these arguments theorise the highly standardised

Figure 11. Theoretical contrast of tula production and silcrete flakes in terms of inferred procedural units and LODR.
reduction sequence and extendibility of tula technology as supportive evidence of risk minimisation. We know little of how this technological adaptation was so successfully adopted across most of the continent, although we assume it was taught and learnt inter-generationally. The research reported in this paper supports this interpretation. None of the economic and social benefits theorised as driving this technology would have been possible without social learning of the production process.

**Conclusion**

The association of ceremonial stone arrangements with stone-based huts and a large surface assemblage of stone artefacts, suggests education about technologies was likely to have been part of broader initiation processes at sites like HCS1. One stone arrangement here physically links huts with a silcrete quarry, where manufacturing evidence was found with fewer artefact manufacturing procedural units compared to the manufacturing elements of tulas found at the huts. The tula adze remains a unique and endemic flaked stone artefact in Aboriginal Australian archaeology, with social learning providing a clue to the process of its standardisation, and purported sudden appearance and spread across Australia. Based on historical sources, Indigenous knowledge, and archaeological data, we have argued that tula technology contains observable procedural units in a remarkably standardised production sequence, which is inferred as being due to cues in the teaching and learning process (Maloney 2019). The location of tula technology, and its associated effective complexity, suggests that at least some stone-based structure complexes could have been physical locales for social learning of these crafts in the recent past, while quarrying activities focused on less complex technological activities that were less dependent on a formal teaching arrangement and less costly in terms of raw material. Rather than HCS1 being defined as a ‘village’ (cf. Pascoe 2014; Westaway et al. 2018, 2019), archaeological data, engaging with novel theory, suggests the hut structures were part of a socially restricted locale for teaching and learning lithic technology, amongst other cultural practices of ceremonial initiation.

The often-discussed changes and reconfigurations of lifeways in the late Holocene for Indigenous people represent diverse and dynamic adaptive abilities, yet all of the technological change evident in these popular explanatory theories had to be learnt by successive generations. This study investigated more than adaptive models from lithic technology, offering a way in which documented reduction sequences
can be modelled as part of a process of Elders passing on the teaching and learning cues of lithic technology. Without these teaching and learning processes, the adaptive benefits to mobility and trade from the tula’s highly standardised and extendible woodworking technology may not have been so prolific across the late Holocene and into the historical period.

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Western Champion (Blackall/Barcaldine) 1882 July 26th p.2.

