Axe grinding grooves in central and northwest Queensland, with a case study from Rocks Crossing

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Executive Summary

The Rocks Crossing axe grinding groove site, approximately 120 km north of the township of Richmond in northwest Queensland (Qld), comprises a minimum of 423 axe grinding grooves made by Aboriginal people. Such grooves are abrasions in the surface of rock caused by the process of grinding stone edges to be made into axes. This report is an investigation of the nature of these archaeological features, within the context of Qld’s central, north-western sandstone belt and in relation to the edge ground axes produced.

Emerging from the study of the dimensions of the grooves at Rocks Crossing, this study finds a pattern of consistency which supports the existence of standardised axe manufacture and that northern Qld was a major base for production. It also finds that this is consistent with current views about the routes of an axe trade beginning in northern Qld and extending southwest to the Lake Eyre Basin and south into New South Wales and most likely Victoria. It demonstrates that the Rocks Crossing grooves are consistent with typical characteristics of grooves used for axe grinding, rather than other purposes, and suggests that valuable future research could occur exploring the extent, if any, to which smaller grooves reflect resharpening of axes rather than original manufacture of differently sized ones. This could extend current understandings about the nature and routes of the axe trade.
Introduction

This project is an investigation of the nature of axe grinding grooves in the sandstone belt of central and northwest Queensland (Qld). It examines their morphology and distribution so as to provide information about the behaviour of past Aboriginal people. In doing so, it also briefly considers edge ground axes, as the shaping of these distinctive stone artefacts is the process by which grooves are formed.

A case study is used to explore these issues: a site known as Rocks Crossing on Middle Park Station, northwest Qld (Figure 1). Containing 423 axe grinding grooves, Rocks Crossing is located approximately 120 km north of the Richmond township (Figure 2).

This project was undertaken with the aid of Industry Partner, Wallis Heritage Consulting.

Figure 1 Map showing the boundaries of Middle Park Station, on which the Rocks Crossing Site occurs (image courtesy of Lynley Wallis).

Figure 2 The northwest Queensland study area.
Literature Review

As yet, no specific studies have been undertaken of the Rocks Crossing site and a relatively insubstantial amount of research has been directed to axe grinding grooves in Qld and across Australia. This is perhaps due to their ubiquity and because they 'are well known relics of Aboriginal material culture which are easily identified, have simple structure and undisputed function' (Dickson 1981:39). Nevertheless, an examination of what is currently known about such grooves in central and northwest Qld provides a valuable basis for comparisons with the Rocks Crossing site. Complementing an investigation of the general material about axe grinding grooves, available literature pertaining to northwest and central Qld informs about the axe grinding grooves’ form, function, distribution and age.

The Form and Function of Axe Grinding Grooves

Axe grinding grooves are depressions in sedimentary rock that are the result of a material, usually flaked stone, being ground on it. As such the characteristics of the ground material influence the morphology of the grooves (Dickson 1981:43), such as where particularly hard stone may require more grinding, resulting in deeper grooves, or where a thicker piece of raw material may result in a wider groove. Such differences can be seen, despite the overall consistent characteristics of Rocks Crossing grooves, in Figures 3 and 6. The function of axe grinding grooves is to aid in the sharpening of stone for axes. Grooves form after what is normally a 'highly controlled' (Dickson 1981:42) grinding motion where 'the preferred action is a succession of forward strokes with the blank under pressure and return strokes without pressure, always along the same line' (Dickson 1981:42).

The majority of axe grinding grooves in Qld (and in many other areas) occur in sandstone (Hiscock and Mitchell 1993:43; McBryde 1974:158–162). Sandstone is particularly conducive because of its relative softness. Grant (1992:81), in her study of sites on Esmeralda Station, also in northwest Qld, found that 'all the 1040 axe grinding grooves found were on fine-grained sandstone'.

Axe grinding grooves are:

... located on horizontal or near horizontal rock surfaces ... the grooves are typically elongated, deepest in the middle of the long axis (length) and rising to the surface at either end of the long axis. The long axis of a groove is invariably straight and is longer than the width. The depth to which the groove has been abraded is smaller than either the length or width. (Hiscock and Mitchell 1993:6).
Axe grinding grooves ‘commonly occur in clusters, but can occur individually or in hundreds’ (Hiscock and Mitchell 1993:64). Dickson, drawing on his personal experiments over 15 years (Dickson 1981:39), found that certain dimensions of grooves reflected axe grinding whereas others resulted from activities such as seed grinding and the processing of ochre for pigment production. He found axe grinding grooves to be ‘typically 25 to 50 cm long … commonly 5 to 8 cm (wide) … and the depth is about 2 to 4 cm at mid length’ (1981:43). He indicated that grooves ‘less than 25 cm long, 2.5 cm to 3 cm wide with deep V shaped sections … were unsuitable for grinding axes and that they were possibly used for grinding spears’ (Hiscock and Mitchell 1993:31), while grooves ‘broad and shallow with no definite shape … were the result of natural phenomena’ (Hiscock and Mitchell 1993:31). Grant’s results fit closely with Dickson’s measurements: ‘the overall average for the Esmeralda axe grinding groove is 26.30 cm (L) x 9.81 cm (W) x 2.24 cm (D)’ (Grant 1992:81).

Morphologically axe grinding grooves can still differ somewhat. Dickson’s length dimensions, for instance, involve a 25 cm range. Normally differences occur across different materials. After their 1993 study of axe grinding groove sites which included more rarely used materials such as conglomerate, ironstone and the highly ineffective granite (Hiscock and Mitchell 1993:31), Hiscock and Mitchell (1993:43) revealed that ‘on average, sandstone grooves are the longest and widest’. As in Grant’s study (1992), all axe grinding grooves from Rocks Crossing occurred on sandstone.
Axe grinding grooves were used for both making and resharpening axes but it is not yet clearly known how to use their morphology to determine which of these uses applied in each case (Hiscock and Mitchell 1993:32).

**Edge Ground Axes**

To more fully appreciate the nature of axe grinding grooves some consideration of the existing literature around edge ground axes themselves is warranted.

In making an axe, it is vital to source a hard and tough raw material, with basalt being one of the best (Burke and Smith 2004:212; Corkill 2005:44; Dickson 1980:162). The stone must be flaked into a desirable shape, for grinding to then occur (Hiscock and Mitchell 1993:6–7). Examples of finished shapes can be seen in Figure 4. Hand axes were often used but also common was the method of hafting the ground stone to a wooden handle (Burke and Smith 2004:212).

Axe grinding groove sites are often associated with stone artefact concentrations, including at Rocks Crossing, where Wallis and colleagues (2004:47) found that 'approximately half of the axe grinding groove sites are associated with stone artefact scatters'. Edge ground axes and fragments thereof are also often found among other stone artefacts, such as with Morwood's (1990:16, 18, 21, 28) excavations of axes among artefacts such as backed blades, adzes and scrapers from Qld's Mickey Springs rockshelter and Quippenburra Cave.

![Figure 4 A selection of edge ground axes from northwest Queensland (images courtesy of Lynley Wallis).](image)

Edge ground axes are known to have been widely distributed via extensive trade systems across the majority of Australia (Dickson 1981:17) and axe manufacture sometimes occurred significant distances from their raw material sources and points of trade (eg. Dickson 1976:35, 1981:15–17). Roth's (1897) seminal ethnographical work among Aboriginal people in north Queensland revealed much about the north to south nature of this axe trade (along with numerous other items), which several subsequent researchers have supported. McBryde (1987:252–73) outlined how axe parts from Mount Isa were
traded to Lake Eyre and McCarthy (1977:253) also supported the trade’s having occurred from various Qld regions to Lake Eyre. Tibbett (2002), in his study of axe exchange in the Lake Eyre Basin, identified significant trade from Qld’s Mt Isa to further regions southwest of there, including the townships of Glenormiston, Boulia and Gason. He concluded that, based on the changing sizes of stone axes from larger in northern areas to smaller in regions further south (particularly from Mt Isa to Gason in his study), ‘directional exchange is occurring from north to south’ (Tibbett 2002:27).

While there is still lots to learn about the precise methods of axe production (Hiscock 2005:287), there appears to have been a large degree of standardisation of manufacture. Hiscock (2005:287) in particular noted this in his examination of Mt Isa and of another particular quarry further north named Lake Moondarral, which contained basalt (Tibbett 2006:26). Tibbett (2006:30) concluded that axes at Lake Moondarral were produced for trade and Hiscock suggested that the apparent degree of standardisation was perhaps ‘stimulated by the requirements of large-scale exchange’ (Hiscock 2005:287).

In 2005 northern Australian axes were regarded as being ‘at least 20000 years’ old (Davidson et al. 2005:104) but more recently, from Arnhem Land, ‘the earliest securely-dated fragment of ground-edge axe from Australia ... (was) dated at 35,500 cal. bp’ (Geneste et al. 2012:1). The length of time over which edge ground axes have been traded is less clear and ‘the axe trade ... may be no older than 1000 years in central Queensland’ (Davidson et al. 2005:125).

**The Distribution of Axe Grinding Grooves**

In 1993 a total 129 axe grinding groove sites had been recorded in all of Qld (Hiscock and Mitchell 1993:34). Currently on the Aboriginal Cultural Heritage database (maintained by the Heritage Branch within the Department of Aboriginal and Torres Strait Islander and Multicultural Affairs) there are 220 sites that contain reference to axe grinding grooves. If future finds and research confirm the contention of Wallis et al. (2004:45) that axe grinding grooves are common in northwest Queensland this would provide further support for the notion that this area was significant for axe manufacture. There has also been found a concentration of axe grinding grooves in areas where much survey work has been carried out, in southeastern regions and mining areas including Western Downs and the Bowen Basin (DATSIMA 2013). As work occurs in new regions, more will likely be found.

Wallis et al. (2004) found axe grinding grooves when conducting an archaeological survey in the foothills of the Gregory Ranges on Middle Park Station in inland northwest Queensland and Grant’s (1992) findings at Esmeralda Station were about 150 km northwest of Middle Park. On Middle Park Station, axe grinding grooves were found at both open sites and in rockshelters and in either case were always in close proximity to water (Wallis et al. 2004:47), an essential lubricant in the grinding process. Wallis also
found axe grinding grooves around the Norman River, Black Spring and Woolgar River (Wallis 2003:58–68, 132–146). Hiscock and Mitchell in their 1993 analysis of selected Qld axe grinding groove sites (Hiscock and Mitchell 1993:43–45) also noted the proximity of grooves to water and found that open sites near water contained a significantly greater average number of axe grinding grooves than were found in rockshelters, possibly due to 'the lack of readily available water in rockshelters' (Hiscock and Mitchell 1993:44).

Interestingly, however, in Wallis' and colleagues’ survey area, neither axes nor volcanic quarries were found (Wallis et al. 2004:48). Although the precise route is uncertain this suggests that axes being shaped there were traded. Mt Isa, with its large quarry areas, and axes made from there being traded both locally and over long distances (Davidson et al. 2005:106–107), is one of Queensland’s main areas of axe grinding sites, inclusive of axe grinding grooves (Hiscock and Mitchell 1993:65).

Figure 5. Some locations mentioned in the text regarding axes and axe grinding grooves’ distribution.
The Antiquity of Axe Grinding Grooves

Axe grinding grooves have at present been unable to be dated (Dickson in 1981:43; Hiscock and Mitchell 1993:69). Essentially this is because the rocks on which the grooves occur can not themselves be dated so the only other potential means of dating would be by association. This would require the grooves to have been covered by sediment, the sand or carbon in which could then be dated to provide a minimum age. This did not occur at Rocks Crossing. Given, however, that axe making results in grooves it seems reasonable to argue that axe grinding grooves are at least as old as the edge ground axes as described above.

Methodology

Statistical Description and Analysis

Statistical summary of the Rocks Crossing axe grinding grooves initially involved determining the averages, minimums and maximums of all grooves in total and of each section’s grooves. Comparisons were then easily made between sections and even between aspects mentioned in the literature, such as with Dickson’s axe grinding groove dimensions. These comparisons were aided by continual cross-checking with the site plans, such as with these plans demonstrating that the grooves commonly occurred in clusters. Statistics were examined to one decimal point in each case so as to be consistent with their recording from the field. The exception was orientations, which were rounded to the nearest degree in each case, given that one degree itself is such a small distance in this context and as such tenths of degrees were highly unlikely to provide further useful information.

For ease of interpretation I then tabulated the Rocks Crossing dimensions. In graphing of average dimensions (Figure 7), given that the total numbers of grooves in each section ranged from 2 to 94 and that grouping them in lots of 20 would involve six sections in the first group and only one section in each of categories 61–80 and 81–100, I thought it more informative in terms of revealing any patterns to group grooves into lots of 10. In a further effort to extract any possible patterns I further categorised orientations, which had all been measured from the mid-point of the longitudinal plane, into 90° quadrants (Figure 9). While generally difficult to draw conclusions based on orientations it is hoped that if future case studies are done these categories may prove useful for comparison.

Site Plan Digitisation and Drawing
Manually compiling the Rocks Crossing site plans was highly valuable for gaining an understanding of the grooves’ contexts. Plans consisted of sections labelled “A” to “N” plus insets, with each section and inset drawn on a separate A3 sheet. When physically cutting and adjoining sections, examining landscape features and recorded compass readings were vital for determining how each section would accurately adjoin the next. Differing degrees of detail existing in each plan meant that occasional educated judgement was required, but in all cases this was limited to minor factors such as anticipating the continuation of an erosion line separated only by a handful of millimetres when adjacent sections were adjoined.

Using Adobe Illustrator then allowed computerisation of the insets. Using the scanned plans as templates the pencil tool was highly effective for drawing features such as the outline of the sandstone, and ellipses were most conducive for representing the axe grinding grooves. Also useful was creating separate “layers” for different features, such as axe grinding grooves, scales and rock.

**Results**

An overall statistical summary of the 423 axe grinding grooves at Rocks Crossing is shown in Table 1. Interestingly, average length and depth fits into Dickson’s “typical” dimensions but the average width here is slightly greater. The maximum width of 55 cm is somewhat unusual, the next widest groove being 24 cm.

<table>
<thead>
<tr>
<th>Total no of Grooves</th>
<th>Length (cm)</th>
<th>Width (cm)</th>
<th>Depth (cm)</th>
<th>Orientation(°)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ave  Min  Max</td>
<td>Ave  Min  Max</td>
<td>Ave  Min  Max</td>
<td>Ave</td>
</tr>
<tr>
<td>423</td>
<td>28.8  4   49</td>
<td>11.2  2.5  55</td>
<td>3.2   0   8.5</td>
<td>192</td>
</tr>
</tbody>
</table>

Table 1  Statistical summary of dimensions of all axe grinding grooves at Rocks Crossing, Queensland.

An examination, presented in Table 2, of average dimensions for each section of the Rocks Crossing site, reveals a considerable degree of consistency. Length, width and depth averages in sections K and L are significantly smaller but this involves only a total of 12 grooves. Section A has a more substantial, but not large number of 25 grooves, which are, on average, shorter, narrower and shallower than the overall Rocks Crossing average.

<table>
<thead>
<tr>
<th>Section</th>
<th>No of Grooves</th>
<th>Ave Length (cm)</th>
<th>Ave Width (cm)</th>
<th>Ave Depth (cm)</th>
<th>Ave Orientation (°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>25</td>
<td>22.7</td>
<td>7.8</td>
<td>1.7</td>
<td>193</td>
</tr>
</tbody>
</table>
Table 2  Rocks Crossing axe grinding grooves’ dimensions in each section

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>45</td>
<td>31.3</td>
<td>11.7</td>
<td>2.9</td>
</tr>
<tr>
<td>C</td>
<td>39</td>
<td>26</td>
<td>10.4</td>
<td>2.9</td>
</tr>
<tr>
<td>D</td>
<td>3</td>
<td>34.8</td>
<td>10.7</td>
<td>4.3</td>
</tr>
<tr>
<td>E</td>
<td>94</td>
<td>30.5</td>
<td>11.8</td>
<td>4</td>
</tr>
<tr>
<td>F</td>
<td>48</td>
<td>30.8</td>
<td>12</td>
<td>3.4</td>
</tr>
<tr>
<td>H</td>
<td>65</td>
<td>28.1</td>
<td>11.4</td>
<td>2.9</td>
</tr>
<tr>
<td>I</td>
<td>27</td>
<td>28.4</td>
<td>11.6</td>
<td>3</td>
</tr>
<tr>
<td>J</td>
<td>41</td>
<td>30.2</td>
<td>12.6</td>
<td>3.2</td>
</tr>
<tr>
<td>K</td>
<td>10</td>
<td>23.3</td>
<td>6.8</td>
<td>2</td>
</tr>
<tr>
<td>L</td>
<td>2</td>
<td>23.3</td>
<td>6.3</td>
<td>1.8</td>
</tr>
<tr>
<td>M</td>
<td>7</td>
<td>26.6</td>
<td>9.2</td>
<td>2.6</td>
</tr>
<tr>
<td>N</td>
<td>17</td>
<td>26.9</td>
<td>10.2</td>
<td>3.2</td>
</tr>
</tbody>
</table>

The vast majority of axe grinding grooves occurred in clusters with little overlapping and some of the longest and deepest grooves can be seen in Figure 6.

![Figure 6](image-url)  View of Section D at Rocks Crossing (image courtesy of Lynley Wallis).

Further analysis, from a different perspective as shown in Figure 7, sought the existence of any patterns by obtaining the average lengths, widths and depths for sections that contained numbers of grooves within multiples of ten. Sections D, K and M, for instance, contained 3, 10 and 7 grooves, respectively, so these are the sections represented in Figure 7’s 1-10 column.
Figure 7. Average lengths, widths and depths of axe grinding grooves at Rocks Crossing, presented in combined sections where the total groove numbers are examined in groups of 10, e.g. sections D, K and M each had less than 10 grooves and the first category of 1-10 represents combined averages of these three sections.
The orientations of individual grooves from the Rocks Crossing site can be seen in Figure 8, where north is represented by 0°/360°. A number of exact groove orientations occurred more than once but usually between 0 and 5 occasions. No groove orientation was the same more than 10 times. Orientations of all grooves as they occur in 90° quadrants can be seen in Figure 9.

Figure 8 Orientations of all axe grinding grooves in the Rock's Crossing site.
Figure 9 Rocks Crossing axe grinding grooves orientations as they occur in quadrants of 90°.

Discussion

Differences in axe grinding grooves’ lengths may be the results of a number of factors. Length can generally be inferred to be related in part to the arm lengths of the people grinding the axes (Dickson 1981:43) while sitting. It can not be precluded, however, that their makers may have at times during the process stood, perhaps intentionally in order to lengthen the range, or knelt when they grew tired or if it was more practical. Both postures would have impacted on the grooves’ lengths. Future detailed studies may be able to analyse data like arm length, height and weight of modern day axe grinders to see if inferences could be made, with reference to Rocks Crossing’s and other grooves, about who among past Indigenous groups may have been the main axe grinders. It may become clear, for instance, that it was generally the task of certain adults.

At Rocks Crossing among sections of at least ten grooves a reasonable difference exists between the shortest and longest average lengths: sections A (22.7 cm) and B (31.3 cm), respectively. This may suggest that taller people made section B’s grooves or that section A’s makers adopted a more restrictive posture. The two groups of people may even have
had different ideas about the best manufacturing methods. They could even have been made by the same group of people trying different methods. There is also a possibility that differences in axe sizes themselves resulted in corresponding groove length differences. This would be interesting given the notion of the region’s standardised axe manufacture, although even within standardisation some natural variation would not surprise, particularly over as large a number as Rocks Crossing’s 423 axe grinding grooves. Also, while sections A and B represent the greatest difference, they are not overwhelming departures from Rock’s Crossing’s overall average length of 28.8 cm, which is similar to Grant’s average of 26.3 cm.

Width variations in axe grinding grooves are more attributable to the type of axe material being ground. Sections K and L had the greatest diversions (being smaller) from the overall average width but totalled only 14 grooves, and overall Rocks Crossing widths varied little.

Axe grinding grooves’ depths are related to the hardness of both the rock in which the grooves are made and of the stone being ground. Degrees of force and care being applied would also impact but these are difficult to quantify. Sections A and D differ most, with average respective depths of 1.7 cm and 4 cm, but section D totalled only three grooves. Any depth differences that do exist may also be attributable to axes requiring different amounts of grinding due to variations in the form of the raw material after it had been flaked.

Dimensions of grooves in different sections at Rocks Crossing also generally correspond with each other. Most grooves occur on the western side of the creek bed and where grooves are longer, they are normally also wider and deeper. Orientation averages of each Rocks Crossing section are in excess of 100° but concluding much from this would be contentious and Figure 8 demonstrates that there is still a wide range of orientations overall. Inferring, for example, preferred positions while grinding is problematic and without the ability to determine factors such as the exact times of the day that grooves were made, any comparisons such as regarding comfort of body positioning and the position of the sun, as well as the impact of any natural shelters, would be unwise. Figure 9 demonstrates that grooves occurred between 271° and 360°/0° more than in any other 90° quadrant. Potential understandings from this and other factors related to orientations may be more robust after further similar studies provide results conducive to comparison.

Rocks Crossing’s axe grinding grooves’ characteristics were highly consistent, as revealed by a further examination in Figure 7. This supports the notion of standardisation of axe manufacture and that this was done for the purpose of trade. This standardisation is further reflected by the average dimensions of all sections that contained 39 or more grooves. This accounts for the vast majority of the total number of grooves (i.e. 332 or 78%). With an average length of 29.4 cm, width of 11.7 cm and depth of 3.2 cm, this corresponds almost exactly with the overall average and demonstrates that where greater
variations from the overall average occurred, it was in sections which contained relatively few grooves and as such are less significant in this context.

While the exact trade routes of edge ground axes is not uniformly agreed it is most likely, as mentioned above, that it took a north to south route (Roth 1897) and that axes being produced further north would have been somewhat larger than those originating from there but found further south, given a reasonable likelihood of usage along trade journeys which may have resulted in their becoming smaller. The extent to which this may be reflected by axe grinding grooves is difficult to finitely determine given the relative paucity of research focus across a greater area of distribution. As such it is particularly important for future research to explore whether grooves were consistently smaller when used for resharpening rather than for the original manufacture of different sized axes. If this emerges as being the case, clearer patterns of axe grinding grooves reflecting resharpening of axes would exist to then lend greater support to arguments for the specific locations and extents of trade networks. This would complement information provided by the axes’ raw materials and quarry sites, such as when axes are found hundreds of kilometres from the nearest location of their raw materials.

Conclusion

Analysis of axe grinding grooves, through the case study of those at Rocks Crossing, reveals a pattern of consistency in dimensions when examined from a variety of perspectives. While more research needs to occur to confirm the precise relation between axe grinding groove dimensions and those of axes themselves, this analysis supports the existing literature’s notions that northern Qld was a major area of axe production, that there existed standardised axe manufacture and that this was most likely for trade purposes. This met this study’s aim of seeking such patterns.

Other valuable findings also helped to demonstrate the nature of axe grinding grooves in the region. Their known distribution currently extends to 220 sites in Qld and will likely further expand. The axe grinding grooves recorded at Rocks Crossing are consistent with dimensions that existing research asserts are reflective of axe grinding rather than other purposes and they occurred in clusters near water and in sandstone.

Future experimental research may demonstrate valuable patterns of smaller groove dimensions when created by resharpening rather than original manufacture of differently sized axes. Should this be the case, smaller grooves found in NSW, Vic. and along routes from Mt Isa to the Lake Eyre Basin may confirm existing views about the trade of edge ground axes along these routes. It is hoped that this Rocks Crossing study may be of value to such future studies and in particular that it may provide helpful information to the region’s Indigenous people.
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