Technological Provisioning and Assemblage Variability in the Eastern Victoria River Region, Northern Australia: A Darwinian Approach

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Nimji (Ingaladdi) Rockshelter, West Section of 1963 "W" Trench

Key
- Rock
- Gradational Change
- Sharp Break
- Stratigraphic Layer

Not Excavated

Below Surface

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200

0 1 2 3 4 5 6 7 8

Drip Line

Sandstone Bedrock

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- # = Lower peak in artefact deposition, c.7,294BP
- $ = Inferred basal age
Figure 9.2: Method of interdigitation for each pit and each square for Nuni and Gamawa 2.

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<td>16x5500</td>
<td>6000</td>
<td>16</td>
<td>%</td>
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</table>

% = Glass flakes and beads, 0BP
* = Upper peak in artefact deposition, c.1,500BP
Cal = Calibrated radiocarbon date
x = First bifacial point, c.3,000BP
# = Lower peak in artefact deposition, c.7,294BP
$ = Inferred basal age
Figure 9.3: Changes in stone artefact discard and occupational intensity over the last 15,000 years. A: Raw stone artefact numbers per spit for each site, and B: complete artefacts, bone weights from Gordol-ya, charcoal and burnt earth overlayed over total artefacts deposited over time.
Figure 9.4: Three measures of artefact reduction plotted against peaks in artefact discard. A: Numbers of core rotations, B: maximum retouch, and C: percent late stage flake platforms.
Figure 9.5: Changes in core morphology over time. Changes in morphology are closely tuned to fluctuations in the mean number of core rotations.
Figure 9.6: Changes in flake morphology over time.
Figure 9.7: Temporal modes in the discard of various types of pointed flakes.
Figure 9.8: Frequency of reduction sequences through time, as well as changing technological diversity for the region over time.
Figure 9.9: Frequency of artefact reuse as a possible indicator of the use of situational gear. A: Frequency of retouched broken edges, and B: reuse of flakes with old weathered surfaces.
Figure 9.10: Changes in raw material richness over time. A: Nimji, B: Garnawala 2, and C: Gordol-ya.
Figure 9.11: Changes in the proportions of local vs exotic raw materials. A: Nimji, and B: Garnawala 2.
Figure 9.12: Changes in the size and abundance of cores transported over varying distances to Nimji. A: Number of cores, and B: mean weight of cores.
Figure 9.13: Evidence of heritable continuity in stone artefact manufacturing technologies over the last 14,000 years.
Figure 9.14: Changes in variation and central tendency in four measures of retouched implement shape.
Figure 9.15: Changes in mean and standard error for several measures of retouched implement size.
Figure 9.16: Changes in variation and central tendency for two measures of flake retouching. A: the invasiveness of retouch scars, and B: the number of bifacially retouched segments.
Glossary

Anvil
A stone with impact pitting on one or more flat surfaces, sometimes forming a distinct depression.

Biface
A core with two distinct faces that has had alternate blows directed around its circumference onto each face, creating a characteristically sinuous platform edge.

Bifacial Point
A retouched flake (or biface) whose lateral margins are retouched to a point, with a low thickness to length ratio, and showing retouch on both the dorsal and ventral surfaces.

Bipolar Technique
Bipolar artefacts were created through the application of compressive forces between hammerstone and anvil. Crushing of the platform edge, together with a flattish fracture surface and a battered distal end are the usual criteria employed to identify bipolar flakes, although not all flakes removed from bipolar cores possess these features (Cotterell and Kamminga 1977), and some possess platform features at both ends, or crushing in addition to fully formed Hertzian initiations. Negative scars can sometimes also appear on the ventral surfaces of bipolar flakes directed from either end as a result of the crushing blow. Bipolar flakes also are not easily separated from bipolar cores, but the presence of a single flat scar on one face may serve as a guide, whereas bipolar cores will tend to exhibit a number of scars on all faces.

Burin
A flake from which elongate spalls have been detached along one or more lateral margins. The number of burin spall scars, the direction of removal and location of platform, the length and width of each scar, and the termination type for each spall were all recorded for burins.
<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td>A core is a nucleus from which a flake has been detached, as indicated by the presence of negative flake scar and no positive flake scar.</td>
</tr>
<tr>
<td>Cortex</td>
<td>Cortex is the weathered exterior of rocks formed by long periods of exposure to chemical and physical weathering. The percentage of cortex remaining on either the dorsal (if limited to the dorsal), the platform (if limited to the platform) or both dorsal and platform (if occurring on both) is recorded in 10% increments. On flaked pieces, cortex is recorded as an estimation of the total surface area covered.</td>
</tr>
<tr>
<td>Cortex Type</td>
<td>Cortex type varies according to the environment in which it formed and the subsequent processes by which it came to be transported to its current position. Three types of cortex are recorded for all artefacts preserving a cortical remnant. These are angular, rounded and irregular.</td>
</tr>
<tr>
<td>Double Side Scraper</td>
<td>A flake that has been dorsally retouched on two lateral margins that is not a point, burren or tula.</td>
</tr>
<tr>
<td>Double End Scraper</td>
<td>A flake that has been dorsally retouched on the distal margin, but is not a point, burren or tula.</td>
</tr>
<tr>
<td>Double Side and Double End Scraper</td>
<td>A flake that has been dorsally retouched on all margins that is not a point, burren or tula.</td>
</tr>
<tr>
<td>Distal Width</td>
<td>Width taken at the distal end of complete flakes, perpendicular to the percussion axis. Recorded to the nearest millimetre.</td>
</tr>
</tbody>
</table>
**Edge Curvature**
Index of the degree to which the retouched edge is convex or concave. The index is calculated by dividing the diameter of retouch by the depth of retouch. Convex edges return positive results while convex edges return negative ones.

![Diagram of Edge Curvature](image)

**Edge-Damage**
The presence on a flake of numerous flake scars deriving from the lateral margins that are no longer than 2mm.

**Edge Ground Axe**
Implement shaped on at least one margin by grinding against another surface. Such implements are often shaped by flaking, pecking, flaking and pecking or grinding and/or burnishing around much of their exterior. Also known as an edge ground hatchet. Edge ground axes may be made from bifaces, large flakes or large retouched flakes.

**Edge Ground Axe Flake**
Rejuvenation flake from an edge ground axe that preserves a portion of the ground surface or edge on its dorsal surface or platform.

**Edge Rounding**
Rounding of on or more portions of the lateral margins through heavy use on a yielding material or weathering.

**End Scraper**
A flake with a flat ventral surface and a retouched distal end that is not a point, burren or tula.

**End and Side Scraper**
A flake retouched dorsally along the distal end and one lateral margin that is not a point, burren or tula.

**Faceting**
Faceting looks much like overhang removal, but is oriented in the reverse direction, with smallish flake scars initiated from the dorsal surface onto the platform surface of cores and flakes. The cut off between faceting scars and 'struck flakes' is arbitrarily set at 15mm.
Flake

Any piece of stone detached from a nucleus, be it a core or another flake, that possesses one or a combination of the following: ring crack, platform, errailure scar, positive bulb of force, or clearly discernable dorsal and ventral surfaces.

Flaked Piece

Any piece of rock clearly created by human fracture (including heat shatter), but for which no attributes exist to identify it as a core, a flake or any other identifiable technological category.

Hammerstone

Piece of stone used to strike flakes from a core or to retouch flakes. Identified by the presence of impact pitting and/or cracking on one or more ends.

Hammerstone and Anvil

A hammerstone that also shows anvil pitting on the flat faces in between the pitted ends.

ID#

Each artefact in the assemblage is assigned an individual identifying number. This number is recorded on each artefact bag.
**Index of Fragmentation** Calculation of the intactness of an assemblage. This statistic is calculated by dividing the total number of flake fragments, by the number of complete flakes larger than 2cm.

**Index of Invasiveness** A measure of the invasiveness of retouch (recorded as a value of 1 or 0.5) for retouch scars spread across the 16 segments of a flake (8 per face – divided into proximal end, left proximal, right proximal, left medial, right medial, left distal, right distal and distal end). The sum of invasiveness scores is divided by the number of segments present (see Clarkson (2002) for measurement and calculation procedures). Recorded for all retouched flakes.

\[
\text{Index} = \frac{\text{Total Segment Scores} (1 + 0.5 + 0.5)}{\text{Total Segments} (16)} = 0.093
\]

**Geometric Index of Unifacial Reduction (GIUR)** A measure of the thickness of retouch relative to the total medial thickness of a flake. The measure is effective for quantifying retouch located on the dorsal surface of the lateral margins only (see Kuhn (1990) for measurement procedures). Recorded for all dorsally retouched flakes.
Grindstone

A large stone with surface/s that have been worn away through abrasive grinding, sometimes forming large flat to convex depressions. Fine parallel or concentric striations (sometimes microscopic) aligned in the direction of the grinding motion are sometimes present, and these may blur pre-existing fracture (or other surface) features or polish high points on the surface of the artefact. Lengthwise grinding may cause long depressions in the surface of the artefact, while concentric actions typically create a worn circular surface with rounded edges.

Lancet

An elongate unretouched flake less than 10cm in length, with tapering margins that meet at a point at the distal end, possess one or more arises, have low thickness to length ratios, and are roughly symmetrical over their length.

Leilira

A lancet-like flake that is greater 10cm in length.

Length

Length is measured as the distance between the ring crack and the distal termination parallel to the plane of force. Recorded to the nearest millimetre.
Length of Retouch  The total perimeter of retouch scars around the margins of a flake. Recorded to the nearest millimetre.

Location of Retouch  The surface from which retouch originates (e.g. the dorsal or ventral surfaces) or the order of scar superimposition. Retouch was recorded as dorsal only, ventral only, dorsal first, ventral first, alternating or dorsal-ventral dorsal (DVD), ventral-dorsal-ventral (VDV), dorsal last, ventral last, or bifacial.

Longitudinal Ridges  Longitudinal ridges (or arises) are protruding ridges running most of the length of the dorsal surface, formed by flake removals subsequent to the creation of the ventral surface.

Marginal Angle  A measure of the degree to which flakes expand or contract along their percussion axis. Negative angles indicate expansion of the lateral margins along the percussion axis away from the platform. Positive angles indicate that the flake tapers along its axis. A value of $0^\circ$ indicates that the lateral margins are parallel. The angle of the lateral margins was calculated by employing the following formula:
\[
\theta = \frac{\text{proximal width - distal width}}{2 \times \text{length}}
\]

And hence angle of the lateral margins \((\theta) = 2 \tan^{-1} \left(\frac{\text{proximal width - distal width}}{2 \times \text{length}}\right)\)

**Maximum Dimension**  
The maximum length of an artefact in any plane. Recorded to the nearest millimetre.

**Maximum Face Length**  
The maximum face length is recorded for all cores in the assemblage. This measure is defined as the length in millimetres of the longest face showing evidence of flake scarring, perpendicular to the platform. Recorded to the nearest millimetre.

**Minimum Number of Flakes (MNF)**  
A measure of the number of flakes present in an assemblage reconstructed from frequencies of uniquely occurring flake fragments. MNF is calculated by adding the number of complete flakes to whichever is the greater number of proximal or distal fragments, plus the greater number of left or right fragments, plus the greater number of left or right proximal or distal
fragments. For a full description of this method see Hiscock (2002).

**Multidirectional Bipolar Core**

Bipolar core that has been rotated such that flaking has taken place along more than one axis.

**Multiplatform Core**

Core with more than one platform, or truncated scars originating from more than one direction, resulting from a change in the orientation of the direction of applied force.

**Number of Aberrant Terminations**

The number of flake scars on cores showing terminations other than feather terminations (i.e. step, hinge or outrépasse).

**Number of Rotations**

The number of times that the orientation of blows to a core has changed. The number of rotations is arrived at by subtracting one from the total number of flaking reorientations. Recorded on all cores.

**Number of Segments**

The number of segments out of a total of 16 (8 per face – divided into proximal end, left proximal, right proximal, left medial, right medial, left distal, right distal and distal end) that are present on a flake or flake fragment.

**Overhang Removal**

Overhang removal is performed by rubbing or gently tapping the edge of the core to remove the lip remaining after previous flake removals to strengthen the platform for subsequent blows. Overhang removal can be identified by the presence of a series of smallish scars initiated from the platform surface onto the
dorsal surface of flakes or the face of cores. The cut off between faceting scars and 'struck flakes' is arbitrarily set at 15mm.

**Platform Quadrants**

The number of quadrants on the last platform of a core that show signs of flaking. The measurement is taken by situating the starting point of the first quadrant to the left of the last scar removed from the core and working in an anti-clockwise direction. Recorded on all cores.

**Platform Thickness**

Platform thickness is measured as the distance between the ring crack and the outer platform edge, perpendicular to the ventral surface. Recorded to the nearest millimetre.

**Platform Type**

Platform type records whether the platform is comprised of a single conchoidal scar, multiple conchoidal scars, cortex, cortex and conchoidal scars or whether it is crushed or focalised. Focalised platforms are defined as those with a total area less than or equal to twice that of the ring crack.

**Platform Width**

Platform width is taken as the distance between the two points at which the lateral margins meet with the platform. Recorded to the nearest millimetre.
**Proximal Width**

Width taken at the proximal end perpendicular to the percussion axis. Recorded to the nearest millimetre.

**Raw Material Type**

Raw material type records the common geological category into which an artefact falls (e.g. chert, rhyolite etc). No attempt has been made to identify stone type beyond these broad categories (e.g. the various types of volcanic stone, or varieties of chert).

**Redirecting Flake**

A flake that preserves a former platform edge on its dorsal surface. This type of flake represents the removal of an old edge by rotating the orientation of force application to the core.

**Reduction Sequence**

A conceptual model of the time-ordering of manufacturing actions involved in the reduction of a single nucleus of stone. The recurrent use of particular reduction sequences likely
represents a tradition. The reduction sequence need not be a normative or unilinear depiction of manufacturing sequences aimed at producing a particular end-product. The term can also refer to a set of contingent and variable procedures resulting in branching reduction pathways. In this case, the reduction sequence constitutes all of the branches that can be traced back to a single starting point (i.e. the trunk of the reduction flow chart). Multiple starting points represent different reduction sequences.

Retouch
The presence on a flake of scars deriving from the lateral margins that are longer than 2mm in maximum length.

Retouched Flaked Piece
A flaked piece that has one of its lateral margins retouched.

Retouched Segments
The number out of a total of 16 segments (8 per face) that have retouch.

Side Scraper
A flake that has been dorsally retouched on one lateral margin only, and is not a point, burren or tula.

Single Platform Core
Core with a single cortical or unflaked platform and flake scars aligned along a single plane of force application.

Termination
The termination is the distal extremity of the ventral surface created as force leaves the core. One of four termination types is recorded: feather, hinge, step and outrépasse terminations. Also recorded for the last four scars found on cores.

Feather
Step
Hinge
Plunging (Outrépasse)

Thickness
Thickness is measured as the maximum distance between the dorsal and ventral surfaces, halfway between the ring crack and the distal termination. Recorded to the nearest millimetre.
Topstone (Muller) A flattish to rounded stone with one or more surfaces clearly ground to form faceted surfaces with striations, polish and rounded surface features. Topstones tend to be much smaller and thinner than grindstones.

Tradition An evolutionary lineage in stone-working procedures.

Transformation The recycling of a flake via the removal of the margins through burination, by retouching a break, or by removing fresh flakes from an older, weathered surface.

Tula A retouched flake with a pronounced bulb of percussion, dorsal bulbar trimming, and a high thickness to length ratio. Tulas are characteristically resharpened until a slug form is reached. Tulas tend to be distally retouched only, such that length is reduced without much loss to width. Tulas were ethnographically observed in use throughout the arid and some semi-arid regions as heavily curated hafted tools used to work hard wood among other things (Gould 1980; Tindale 1965).

Tula Slug The worked down remnant of a tula. Tula slugs are defined as tulas with a length to width ration of greater than 3:1. Tula slugs often exhibit heavily stepped edges, and may be turned 180 degrees in the haft, such that the platform is use and completely removed through retouching.

Unifacial Point Retouched flake where the distal retouch forms a well defined point, thickness to length ratios are low, and the artefact is more or less symmetrical along its length.
**Unidirectional Bipolar Core**

Bipolar core that has been flaked along one axis only.

**Weight**

Weight was recorded for all artefacts to the nearest 0.1g.

**Width**

The distance between the right and left margins, taken perpendicular to and half-way along the percussion axis. Recorded to the nearest millimetre.