Backed tools in Middle Pleistocene central Africa and their evolutionary significance

The fashioning of stone inserts for composite tools by blunting flakes and blades is a technique usually associated with Late Pleistocene modern humans. Recent reports from two sites in south central Africa (Twin Rivers and Kalambo Falls) suggest that this backed tool technology originated in the later Middle Pleistocene with early or “archaic” Homo sapiens. This paper investigates these claims critically from the perspective of the potential mixing of Middle and Later Stone Age deposits at the two sites and the possible creation of misleading assemblages. The review shows that backed tools form a statistically minor, but technologically significant feature of the early Middle Stone Age of south central Africa. They first appear in the Lupemban industry at approximately 300 ka and remain an element of the Middle Stone Age technological repertoire of the region. Comparisons are made with early backed tool assemblages of east Africa and with the much younger Howiesons Poort industry of southern Africa. The paper concludes that Lupemban tools lack the standardization of the Howiesons Poort backed pieces, but form part of a regionally distinctive and diverse assemblage of heavy and light duty tools. Some modern-like behaviours appear to have emerged by the later Middle Pleistocene in south central Africa.

Introduction

It has recently been claimed that backed stone tool technology is present in the Middle Pleistocene archaeological record of south-central Africa (Barham, 2000, 2001; Clark, 2001; Clark & Brown, 2001). Blunted, truncated and snapped flakes and blades have been reported from the Zambian sites of Twin Rivers and Kalambo Falls, and are attributed to the later Lupemban industry of the Middle Stone Age. At Twin Rivers they account for up to 15% of the retouched tool assemblage (Barham, 2000:206), and are bracketed by TIMS U-series dates of between >400 and 140 ka with a probable median age of 260 ka. The Lupemban at Kalambo Falls is presumed to be of a similar age range (Clark, 2001). The presence of backed tools in the Lupemban predates the appearance of this technology in east Africa at ~130 ka (Mehlman, 1989) and in southern Africa at ~75 ka with the Howiesons Poort industry (Grün & Beaumont, 2001). The backed tools of the Howiesons Poort have been interpreted as evidence of behavioural modernity having been developed by OIS4 based on their similarity to Later Stone Age backed artefacts of the mid-Holocene (H. J. Deacon, 1992). The similarities include the standardization of size and shape for hafting, the use of nonlocal raw materials and the relatively brief duration of the backed component of each industry. The arbitrary change in tool design represented by the appearance and disappearance of the Howiesons Poort is considered by some to represent not just technological adjustments to changing resources, but also evidence of
material culture embedded in social discourse. Backed tools are culturally determined conventions or mental templates indicative of modern symbol-based behaviours (Wurz, 1999). If such an interpretation can be extended to the backed tools of the Lupemban, then the co-evolution of behavioural and anatomical modernity is challenged (e.g., Stringer, 2001). The apparent emergence of symbol based technological complexity in the Middle Pleistocene long precedes the evolution of anatomically modern humans (as defined by Lieberman et al., 2002).

Given the potential behavioural significance of early backed tool technology, the Zambian database warrants close scrutiny. The site of Twin Rivers in particular is problematical because of the potential for the mixing of deposits and the creation of a spurious association of old dates with younger artefacts. As the most recent excavator at Twin Rivers, I want to draw attention to the formation of the site and its contents so that the reader can make an informed opinion about the above claims. The recent publication of the results from the original excavation at Twin Rivers in the 1950s (Clark & Brown, 2001) can now be considered alongside those from the 1999 excavations (Barham, 2000). The dating and stratigraphic context of the artefacts are reviewed and the extent of possible mixing is assessed. The evidence for backed tools at Kalambo Falls is considered separately. The two datasets are then combined and compared to the Howiesons Poort industry. The backed pieces of the Lower Lupemban lack
Figure 1. (a) Location map of Twin Rivers and section through the length of A Block (1999 excavation) showing the relationship between breccia, red sandy sediment and U-series dates on speleothem (numbered). Samples 2 and 3 are >400 ka and sample 1 is 265 ka (see Barham et al., 2000: Table 10.1 for analytical details). (b) Photograph of A Block section, north wall, at start of excavation in 1999. The excavator is sitting on breccia and pointing to area of red sediment fill between the breccia and remnant cave passage at back and above.
the standardization of the Howiesons Poort tools and there is no evidence of preferential selection of raw materials for backing. These differences aside, the Zambian tools do demonstrably reflect a degree of planning and problem solving comparable to that exhibited by Late Pleistocene modern humans in southern Africa.

**Twin Rivers**

The hilltop site of Twin Rivers (15°31′S; 28°11′E) is an extension of the Lusaka limestone plateau which is composed of dolomitic marble in which vadose fissures and phreatic caves are common. The Lupemban inhabitants of Twin Rivers lived on the surface of the hilltop where two phreatic cave entrances once existed. The mouths of the caves may have been used as shelters, but the caves themselves were unlikely living sites because of the narrow (<2 m wide) and dipping passages. The former caves were excavated in 1954 and 1956 and labelled A and F Block respectively (Clark, 1971). The remaining deposits in both passages were excavated in 1999 (Barham, 2000). Stone artefacts and bone accumulated in the passages as gentle debris flows on which lenses of flowstone were deposited (ibid:169). The oldest and stratigraphically lowest flowstone occurs in A Block and is U-series dated to >400 ka (ibid:178–9) (Figure 1). In A Block, the sediments were largely consolidated into breccia by the time of the collapse of the cave roofs, a process which was completed late in the Middle Pleistocene. The youngest U-series date on speleothem from F Block is 138 ka BP (corrected age) and 160 ka BP (corrected age) from A Block (ibid: Table 10.1). A thermoluminescence date on calcite of 135 ± 27 ka also comes from A Block (ibid:181–3) and falls within the final age range for the two caves. The maximum age for F Block appears to be about 200 ka based on U-series dating of a speleothem that capped the breccia in the centre of the cave passage (Barham & Smart, 1996; Barham, 1998).

Human occupation continued on the hilltop from the Late Pleistocene to the historic present (ibid:183). This later use of the site is a potential source of contamination of the collapsed cave deposits, especially of the unconsolidated sediments. It could be argued that the backed tools found in the cave fills were simply intrusive from the more recent surface deposits. To assess the likelihood of contamination, the topography of the site will be examined in relation to the loose sediments found in the passages. Excavation methods have a role to play too and are discussed as a source of taphonomic bias. The backed tools from A and F Block will also be compared to those found during recent excavations of the surface deposits on the central platform (G Block).

**A Block**

A plan of Twin Rivers (Figure 2) shows the location of A and F Blocks in relation to each other and the extent of the platform available to more recent occupants. The A Block passage is located downslope of the hilltop and once the roof collapsed, younger sediments could have entered the deposits by erosion from above. The surface of A Block was an unlikely living area given its narrow width of <2 m and the pronounced dip of the slope. F Block is entirely within the hilltop platform and the surface created

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1The labelling of A Block was changed to C Block in Clark & Brown (2001), but the original attribution of Clark (1971 and his fieldnotes) has been retained here and in Barham (2000).

2The U-series dates for F Block are not conformable with the younger speleothem (168/140 ka corrected) underlying the capping speleothem dated to 195 ± 15 ka. The younger speleothem is shown in Clark (1971) as a dipping lens of flowstone that originated at the same surface level as the capping flowstone, but presumably flowed downwards and settled around existing blocks of breccia.
by the cave collapse was occupied by Later Stone Age (LSA) hunter-gatherers. The excavation methods used by Clark and his descriptions of the unconsolidated sediments bear directly on the issue of possible contamination. In both blocks he removed
all brown topsoil before excavating the breccias and intact cave sediments. This soil contained LSA material and was not analysed further (Clark, 1971). In A Block, he recognized a surface layer of brown sediment that “changed fairly rapidly to a red furruginized sand that contained densely packed quantities of bone fragments, worked quartz flakes and other worked pieces” (Clark and Brown, 2001:309). The presence of breccia fragments throughout the red sediment indicated that this deposit formed from decalcified breccia. Breccia filled much of the passage with red unconsolidated sediment occupying the space between the cave walls and breccia core and cavities in the breccia “with no apparent opening from above” (ibid:309). Most of the breccia was removed from A Block by controlled blasting and then broken down with hammer and chisel (Clark, personal communication). The mechanical reduction of breccia would have favoured the recovery of larger artefacts at the expense of smaller pieces as is shown in Figure 3. This block of breccia was found in the blast rubble from the 1954 excavation and contains small quartz flakes and a piece of hematite. The method of excavating and sieving the loose sediment is not reported, but it appears that the small flake and debris fraction (<25 mm) is underrepresented [Clark & Brown, 2001; Figure 19(a)] by comparison with the assemblage recovered in 1999 (see below). A single backed quartz segment (lunate) was found in A Block in 1954.3

The 1999 excavation of A Block concentrated on the only remaining breccia and associated sediments. At the time of the 1954 excavation, the sediments had been sandwiched between the cave passage wall and a central core of breccia [Figure 4(a)]. The area excavated in 1999 had been effectively sealed from surface contamination. Since 1954, the sediments have been exposed to weathering and bioturbation during which time contamination by younger deposits (derived from the hilltop) could have taken place. In 1999, a thin layer (1 cm) of leaf litter covered the sediments at the start of excavations. A low wall of breccia approximately 60–80 cm deep, 25 cm wide and a maximum of 300 cm long still adhered to the northern side of the former cave passage [Figures 1(a),(b)]. Approximately 0·58 m³ of material was excavated, largely comprising unconsolidated red sandy sediment. Two sediment filled cavities were excavated from behind

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3The crescent illustrated in Clark & Brown (2001: Figure 20.11) as coming from C Block is not included in the artefact count (Table 2). A backed piece is attributed to A Block in Table 2, but is not illustrated. The change in labelling of A and C Blocks may have resulted in the transposition.
the breccia and as illustrated in Figure 4a they would have originally been sealed from contact with surface sediments by breccia. The sediments were similar to those described as formed from decalcified breccia with the characteristic red colour and dense concentrations of fragmentary bone, quartzdebitage and fragmented breccia. All the sediment was sieved through a 2.0 mm mesh and approximately 112,720 artefacts were recovered. Of these an estimated 106,466 were <10 mm in size (see Barham, 2000:204). The assemblage included 120 retouched pieces of which 22 (15%) were backed and truncated tools including three segments (see Table 2; see Figure 7). The remainder of the assemblage comprised manuports \((n=186)\), cores \((n=160)\), core by-products \((n=70)\), whole flakes \((n=367)\), broken flakes \((n=1348)\), and chunks \((n=4003)\) (see Barham, 2000 for details of analysis). Among the manuports, 180 pieces were identified as iron oxide or iron hydroxide and interpreted as pigments (Barham,
The recovery of backed and truncated tools (and a substantial quantity of pigment) in 1999 is attributed to improvements in recovery techniques, in particular the use of a fine-mesh sieve.

Attempts to dissolve the breccia in the field were unsuccessful. Only four flakes could be extricated, but one of these was refitted to a core excavated in the red sandy sediment at the same depth [Figure 5(a),(b)]. Breccia also adhered to many of the artefacts in the sediment [Barham et al., 2000: Figure 10.41(b)]. The refit and the breccia remnants support the interpretation that the sediment and breccia are contemporaneous. U-series dates for the breccia, and by association the sediments, are derived from interstratified speleothem. Flowstone on the cave floor and incorporated in the overlying breccia are >400 ka (Figure 1) (Barham et al., 2000: Table 10.1). A solution cavity containing degraded breccia and sediment...
was excavated from beneath a dolomitic boulder (probable roof block). The contents graded into firm breccia which overlay flowstone dated to 265 ka (age corrected for detrital contamination) (Figure 1). This date is taken as an accurate estimate of the age of the Lupemban in the middle of A Block. Progressively younger dates (225–160 ka) are recorded from flowstone found higher up the passage, but these cannot be linked directly to the material excavated in 1999. They do confirm the Middle Pleistocene age of the cave fill and show a rough contemporaneity with the age range of speleothem in F Block.

F Block

F Block is located on the top of Twin Rivers hill and was extensively excavated in 1956. The hilltop platform is today covered with a deposit of brown sediment that varies in depth from 1–70 cm and contains Later and Middle Stone Age as well as Iron Age artefacts. This later material is the primary source of potential contaminants of the Lupemban cave fills. Clark cleared the surface of F Block of this brown sediment before beginning excavations. He observed that the underlying breccia and red sediment filled irregular spaces between eroded ridges and boulders of dolomite. Clark & Brown (2001:311) suggest that the breccia formed inside a small rock shelter with artefacts washing in and filling interstices between boulders before becoming calcified. This interpretation has been superseded by the re-analysis of the sediments and breccia in 1999 and their identification as originating as slurry deposits filling phreatic passages. Quartz flakes in the breccia show imbrication which indicates water-flow. The irregular surface of F Block is attributed to the incorporation of roof blocks into the deposits and to subsequent solutional weathering of the hilltop. Weathering may also have contributed to the higher proportion of loose sediment to breccia in F Block as compared to A Block.

Not all the unconsolidated sediment was the product of decalcification of breccia. A small phreatic passage (dip tube) excavated in 1999 [Figures 2, 4(b)] contained loose red sandy material that showed no evidence of having been cemented. The sediments were preserved in the steeply dipping passage because of the depth of chamber below the hilltop surface. The solutional weathering that led to the collapse of the cave roof elsewhere in F Block had not reached the dip tube (Barham et al., 2000:169). The contents of this deposit are described in detail below.

Clark excavated an estimated 129 m³ (ibid:190) of deposit in F Block using controlled blasting and mechanical reduction of the breccia. As in A Block, the method of excavation and sieving of the loose sediments is not reported. The recovery methods used in 1956 favoured the retention of larger artefacts, with few flakes found less than 25 mm in length (Clark & Brown, 2001: Figure 31). This contrasts with the overwhelming predominance of small debris in the 1999 assemblage. In total, 2239 stone artefacts were recovered of which 1380 pieces were unmodified, 486 utilized/modified and 373 were retouched (ibid: Table 2). Among the retouched tools were 21 backed pieces and truncated flakes/blades which as a group account for 5-6% of the category. Nine backed pieces were found in the first excavation level, F1, which is a typologically mixed unit containing both LSA (bored stones) and MSA artefacts. No bored stones or fragments were found in the underlying levels (F2 & F3) which Clark & Brown (2001:316) affirm as wholly Lupemban. F2 does contain ten backed pieces and three truncated blades/flakes. The possibility remains that these small artefacts were introduced into the Lupemban sediments by bioturbation or other taphonomic processes. There is no mention in
Clark (1971) or Clark & Brown (2001) or in the field notes from 1954 and 1956 that backed tools were recovered from the breccia.

The 1999 excavation in F Block was restricted to the dip tube off the main passage as this was the only area with surviving deposits. On the 1956 section [Figure 4(b)], the entrance to the side chamber was originally sealed by breccia before being exposed on excavation. The chamber was partially cleared with approximately 20–30 cm of sediment left intact and these deposits were the focus of excavation in 1999. As with the A Block sediments, the dip tube deposits had been open to weathering and bioturbation since the mid-1950s. A thin layer (2 cm) of leaf litter and brown sediment covered the surface of the deposit, and this material was removed and sieved. No artefacts were found. The underlying red sediment, like that in A Block, was characterized by a high density of largely quartz debitage and fragmented bone. A rectangular area (100 × 150 cm) was excavated in 5–10 cm levels to bedrock. The smooth surface of the bedrock and the walls of the passage confirmed a phreatic origin of the passage. Approximately 0·45 m$^3$ of deposit was excavated and sieved through a 0·5 mm fabric mesh. An 8–10 cm thick ferro-manganese crust filled the lowermost 10 cm of the deposit and created a largely solid and impervious cap over the deposits. The sediments within and beneath the crust contained abundant small mammal remains and a fragment of a robust hominid humerus (Pearson, 2000) as well a dense concentration of lithic debris. The crust is of particular importance because it formed a barrier to vertical mixing of the deposit. Its contemporaneity with the cave deposits is demonstrated by the unbroken extension of the crust beyond the dip tube and up the passage where it grades into tufa [Figure 4(b); Barham et al., 2000: Figure 10.4(a)].

There are no dated speleothem in the immediate passage leading to the dip tube. U-series dates for the main cave passage in F Block range from ~200 ka to 140 ka with a probable gap in flowstone formation between 170 ka–140 ka (Barham et al., 2000:181). The dip tube deposits are assumed to have formed early in the history of the cave because of the greater depth of this area of the cave. It would have acted as a sediment trap where water ponded and vegetation decayed to form the manganese concretion.

The excavations produced a dense concentration of approximately 223,644 stone artefacts of which the vast majority were <10 mm in size (~220,270). The topography of the passage upslope of the chamber acted as barrier to the movement of large clasts. (The heavy-duty core-axes and large cutting tools characteristic of the Lupemban were recovered by Clark (Clark & Brown, 2001: Figure 24) in the main passage that precedes the dip tube.) In the dip tube, the lithic assemblage contained only 27 retouched tools of which nine were backed or truncated pieces, including three small segments (<25 mm) and 3 petit tranchets (Figure 6; Table 2). Both types were found above and below the crust. The remainder of the assemblage included 127 manuports (122 pieces of pigment), 59 cores, 12 core by-products, 118 flakes, 396 broken flakes, and 2635 chunks (see Barham et al., 2000:189–210 for detailed analysis).

The presence of small segments in the F Block assemblage suggests the possibility of contamination from the surface deposits, despite the manganese crust. Three segments were found in the A Block sediments, of which one was <25 mm. Segments of varying size are a distinctive component of Zambian Later Stone Age assemblages, especially in the Holocene (Savage, 1983). Large segments have been reported from the Last Interglacial deposits at Mumbwa Caves in association with otherwise typically MSA technology (Figure 8) (Barham, 2000:117).
The presence of segments in both A and F Blocks may be indicative of contamination from the later occupation of the platform at Twin Rivers, or be a genuine reflection of the technological variability in the Lupemban. (See Barham et al., 2000:216 for discussion of the attribution of flaking strategies to the MSA as deduced from core morphologies and dorsal scar patterns on flakes and blades in A & F Blocks.) To assess the likelihood of the mixing of cave and surface deposits, a 4 m × 3 m area of surface sediments called G Block (Figure 2) was excavated in 1999 to provide a comparative sample. If the backed artefact content of the surface deposits resembled that of the cave passages then the argument for contamination would be strengthened. The results are summarized in Tables 1 and 2 and described below.
G Block sample

G Block is located north of F Block on the central platform of the hilltop and is the nearest source of surface deposits to A Block (Figure 2). The brown sediment cleared from the top of A Block by Clark probably originated in G Block. In G Block, dolomite bedrock was reached at a maximum depth of 70 cm below the surface and no breccia or cave passages were found. The bedrock surface was irregular with deposits channelled into an erosional gulley or grike where dense concentrations of lithic debris and comminuted bone were found. Clark observed that the brown surface soil overlying F Block contained LSA artefacts (Clark & Brown, 2001:310), but in G Block both Middle and Later Stone Age artefacts were found along with Iron Age pottery. The dating of G Block shows that the surface of Twin Rivers was occupied at varying times during the Late Pleistocene and Holocene, and the dates reveal the effect of the formation of the grike on the depositional sequence. Five TL dates are available from the basal 20 cm of the grike and range from $12.7 \pm 1.5$ ka.

### Table 1
G Block (unit B1) artefact totals by size or reduction category per excavation level including pigment

<table>
<thead>
<tr>
<th>B1 levels</th>
<th>Flakes/ chunks &lt;10 mm</th>
<th>Flake fragments &gt;10 mm</th>
<th>Chunks &gt;10 mm</th>
<th>Whole flakes</th>
<th>Cores</th>
<th>Modified</th>
<th>Retouched</th>
<th>Pigment</th>
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</thead>
<tbody>
<tr>
<td>B1-1</td>
<td>40,450</td>
<td>100</td>
<td>211</td>
<td>24</td>
<td>20</td>
<td>3</td>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>B1-2</td>
<td>26,010</td>
<td>974</td>
<td>125</td>
<td>16</td>
<td>18</td>
<td>3</td>
<td>9</td>
<td>25</td>
</tr>
<tr>
<td>B1-3</td>
<td>14,205</td>
<td>854</td>
<td>138</td>
<td>18</td>
<td>22</td>
<td>1</td>
<td>6</td>
<td>25</td>
</tr>
<tr>
<td>B1-4</td>
<td>7563</td>
<td>179</td>
<td>54</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>B1-5</td>
<td>26,321</td>
<td>722</td>
<td>158</td>
<td>11</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>18</td>
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<td>B1-6</td>
<td>11,526</td>
<td>553</td>
<td>146</td>
<td>8</td>
<td>16</td>
<td>1</td>
<td>9</td>
<td>25</td>
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<td>5440</td>
<td>1551</td>
<td>493</td>
<td>43</td>
<td>49</td>
<td>5</td>
<td>16</td>
<td>50</td>
</tr>
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<td>B1-8</td>
<td>13,321</td>
<td>2032</td>
<td>590</td>
<td>50</td>
<td>46</td>
<td>6</td>
<td>11</td>
<td>80</td>
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<tr>
<td>Totals</td>
<td>144,836</td>
<td>6965</td>
<td>1915</td>
<td>173</td>
<td>179</td>
<td>21</td>
<td>58</td>
<td>249</td>
</tr>
</tbody>
</table>

### Table 2
Backed tool totals for Twin Rivers including G Block (unit B1 by level), A and F Blocks (1999 excavations) and for Lupemban aggregates at Kalambo Falls

<table>
<thead>
<tr>
<th>G block</th>
<th>Segments &lt;25 mm</th>
<th>Segments &gt;25 mm</th>
<th>Backed flakes/blades</th>
<th>Truncated flakes/blades</th>
<th>Trapezoids</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1-1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>B1-2</td>
<td>3</td>
<td>0</td>
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<td>0</td>
<td>0</td>
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<tr>
<td>B1-3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>B1-4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>B1-5</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>B1-6</td>
<td>2</td>
<td>0</td>
<td>0</td>
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<td>0</td>
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<tr>
<td>B1-7</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>1</td>
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<tr>
<td>B1-8</td>
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<td>2</td>
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<tr>
<td>Totals</td>
<td>9</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>0</td>
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<tr>
<td>A Block</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>F Block</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Combined Total</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>8</td>
<td>14</td>
</tr>
</tbody>
</table>

The Kalambo Falls data are based on tables and illustrations in Clark (2001) and are not complete totals for the site. The probable segment from Kalambo Falls is illustrated in Figure 6(i).
to $101 \pm 16$ ka with intermediary ages of $56.5 \pm 8.3$ ka, $17 \pm 3.1$ ka and $15.8 \pm 2.4$ ka (Barham et al., 2000: Table 10.3), but they are not in stratigraphic order by age. Two AMS dates from the top 20 cm of G Block are effectively modern (ibid: Table 10.5). The G Block deposits are typologically and chronologically mixed, and their content is assumed to be similar to that of the surface sediments that covered F Block.

G Block was divided into two $2 \times 3$ m units (B1 & B2) and the results of the analysis of the lithic artefacts from unit B1 are summarized in Table 1. The unit was excavated in arbitrary levels (B1-1 to B1-8) in the absence of natural stratigraphic divisions. Beneath the 5 cm thick humic surface layer, the sediment was a uniform brown throughout the deposit. No typological distinctions are given here between Later and Middle Stone Age artefacts, but a stratigraphic trend is discernible with MSA artefacts (e.g., radial, blade and Levallois cores, burins, points and large segments) being more common in the lower 20 cm than in the overlying levels. The results are tabulated by excavation level and by general artefact category in Table 1. Approximately 153,000 lithic artefacts were recovered of which 95% were <10 mm in size. The same overwhelming presence of small debris is seen in A and F Block and interpreted as evidence of occupation near the cave entrances. Only 58 retouched tools were found in B1 and of these 14 (28%) were backed or truncated pieces (Table 2). The remainder of the assemblages comprised scrapers ($n=17$, 29%), awls/borers ($n=13$, 22%), denticulates ($n=9$, 15.5%), burins ($n=2$, 3%), points ($n=2$, 3%) and miscellaneous retouched pieces ($n=1$, 1.5%). (The two points are typologically Middle Stone Age and occur in B1-7.) Table 2 shows the frequency of backed tools by level and artefact type in B1. Segments are the most common tool type ($n=13$, 93%), among which small (<25 mm) specimens pre-dominate ($n=9$). Large segments (>25 mm) occur only in the lower two levels ($n=4$). There are no backed/flakes or trapezoids in the assemblage (trapeses and tranchets combined) and one blade truncated by snapping.

The B1 pattern of a segment dominated assemblage is typical of the Holocene LSA of Zambia (Savage, 1983) and contrasts markedly with the combined content of A and F Blocks (Table 2). Trapezoids and truncated flakes/blades account for 73% ($n=22$) of the combined backed tool total ($n=30$), with a small percentage consisting of segments of varying size. To sustain the argument that A Block contains intrusive later material would involve the selective incorporation of segments derived from the hilltop deposits. In F Block, the small segments could be intrusive, but their presence within and beneath the manganese crust makes this less likely. The areas of A and F Block excavated in 1999 were originally sealed by breccia and have been exposed to mixing only since the 1950s. In both areas, the potential for later contamination has been unintentionally minimized by Clark’s clearance of surface deposits before his excavations began. The association of segments with trapezoids and other backed tool types appears to be a genuine feature of the Lupemban at Twin Rivers.

Kalambo Falls

Twin Rivers is one of two Lupemban sites in Zambia, the other being Kalambo Falls on the Tanzanian border ($8^\circ 30’S$, $31^\circ 15’E$). Kalambo Falls was excavated in the 1950s and 1960s and provides the largest published collection of Lupemban material from a stratified context (Clark, 2001). If backed tools are a feature of the Lupemban at Twin Rivers they should also be found at Kalambo. Before reviewing the Kalambo material, the taphonomic biases that affect
the Lupemban assemblages are considered. The artefacts occur in secondary contexts as stone lines (“rubble” horizons) from which small material (<30 mm) has been winnowed by fluvial action or other mechanisms of selective transport (Sheppard & Kleindeinst, 1996; Schick, 2001). The result is a database that is not directly comparable to Twin Rivers where the <10 mm fraction dominates in all periods and areas of the site. Small backed tools such as segments and trapezes will be poorly represented, if at all, at Kalambo Falls. The Lupemban aggregates also contain artefacts from Early Stone Age (Acheulian, Sangoan) and later MSA (“Polungu”) industries. (The industry labels applied to the MSA at Kalambo Falls include Polungu, Siszya and Nakisasa—see below for definitions—and simply distinguish the various aggregates at this site. They have not been applied elsewhere in the region.) Clark (2001) applies an abrasion index to exclude later material belonging to the overlying Polungu Industry which tends to be in fresh condition in contrast to the Lupemban which exhibits varying states of abrasion. Only those artefacts clearly assigned to the Lupemban are used in the tabulations below.

The Polungu is the primary source of potential intrusive material because the LSA is clearly separated stratigraphically from the earlier deposits. There are backed tools in this later MSA assemblage and its content and dating warrants a brief overview. The Polungu is an informal MSA industry characterized by tools made on flakes and blades from radial, discoid, bipolar, Levallois and blade cores (Clark, 1974: Table 10) with elements seen in the Lupemban including rare core-axes, unifacial and bifacial points and burins. Backed flakes and blades account for approximately 8% of the Polungu assemblages combined (ibid: Figure 35), and these include rare (n=4 from total 210 retouched tools) lunates or segments and trapezes between 30–50 mm in length. The Polungu is associated with a single radiocarbon date of 9500 ± 210 BP (L395D) derived from a bulk sample of charcoal. The date should be considered a minimum age at best because the assemblage is typologically much earlier and the MSA elsewhere in Zambia has a minimum age of ~25,000 ka (Barham, 2000:245). The content of the Polungu industry most closely resembles the OIS5e MSA assemblage reported from Mumbwa Caves which also has a few backed blades and flakes including large segments (ibid: Figure 8.23). Polungu stone lines do occur in the same localities as the Lupemban aggregates with the exception of Rubble Ic and Ic(iii) (A1/56) (Clark, 2001:83). Backed artefacts do occur in these two deposits, but tool counts and details of size and raw material are unavailable (see Clark, 2001:31, 89–90 for explanation).

The Lupemban at Kalambo Falls is divided into an early (Nakisasa) and later industry (Siszya) with both exhibiting the long bifacially retouched lanceolates that are distinctive of the Lupemban. The early Lupemban is characterized by a higher proportion of heavy-duty tools, primarily core-axes, and fewer types of light-duty tools by comparison with the later Lupemban. There are no backed tools in the early Lupemban. Levallois and blade cores first appear in the Nakisasa and become more common in the later Lupemban with the punch technique of blade making being an innovation of the Siszya industry. The later Lupemban contains several new tool forms as well, including truncated flakes/blades, trapeziums, backed flakes and backed blades and possibly large backed tranchets (Clark, 2001:54–5) (Figure 7). Pigment also first appears in the later Lupemban (ibid:89). The Lupemban at Twin Rivers as described from the 1999 excavation most closely resembles the Siszya industry in terms of patterns of flake and blade production, the range of light-duty tools made and the systematic use of
pigment (Barham, 2002). In the absence of reliable dates from Kalambo Falls, the age of the later Lupemban is estimated to be between 200–300 ka based on the U-series dates from Twin Rivers.

Clark (2001) published the available data on the frequency and type of backed tools from the Siszya industry at Kalambo Falls. The database is not complete, however, with tool counts unavailable for some of the major excavation units as mentioned above. Table 2 shows the frequency and type of backed tools derived from the tables and illustrations in Clark (2001:82–233). The frequencies cannot be considered definitive and may not be representative of the later Lupemban, but in the absence of the full dataset they are considered to be indicative of the kinds of tools made at this site. Backed and truncated flakes and blades predominate (n=20, 83%) with trapezoids a rare (n=3, 13%), but distinctive component of the later Lupemban at Kalambo Falls and in the Congo basin (ibid:92). A large broken trapezium (>40 mm) with convex backing

4Clark & Brown (2001) assign the Twin Rivers material to the early (Lower) Lupemban, but the recovery of a larger range of light-duty tools in 1999 indicates a later (Upper) Lupemban attribution.
[Figure 7i] is interpreted here as a segment. The rarity of trapezoids and the near absence of segments may reflect the winnowing of the stone lines or a genuine preference for informal backed flakes (many convex) and blades.

By contrast, the preference at Twin Rivers appears to be for small trapezoidal tools (<30 mm) made on snapped or backed flakes and blades and for truncated flakes and blades. The differences in tool frequencies between the two Lupemban sites can be attributed to site specific activities as well as taphonomic factors. The two sites are situated in very different locations with Twin Rivers being a hilltop site overlooking a large shallow lake basin (Simms & Davies, 2000) and Kalambo Falls in what is today a forested riverside location. In the case of Kalambo Falls, the sampling, dating and analysis of the pollen attributed to the early MSA is problematical (Taylor et al., 2001) so for the purposes of this discussion the Kalambo Lupemban is placed in an interglacial (OIS7) by correlation with dates from Twin Rivers, A Block. The differing structure of the local habitats is presumably reflected in the range of tools made assuming that the Kalambo environment was similar of that today. Clark (2001:91) argues that core-axes were primarily wood working and bark stripping tools and if this is the case then their prevalence at Kalambo makes sense in the context of the woodland setting. Their comparative rarity at Twin Rivers (Clark & Brown, 2001: Table 1) could be explained by the relatively open environment of the hilltop and its slopes. The differing frequencies of backed tools may also be activity and habitat related, but there is no experimental or use-wear data with which to develop this argument further.

Comparisons and conclusion

Backed tools are undoubtedly part of the later Lupemban at Kalambo Falls and arguably so at Twin Rivers. If the Middle Pleistocene dates from Twin Rivers are representative of the Lupemban across central Africa, then backed tool technology is approximately 300,000 years old and linked with the development of the MSA in this region. Why this form of composite tool technology should emerge in central Africa earlier than elsewhere is a question for future research. Barham (2001:70) speculates that the variety of tool forms in the Lupemban was part of a suite of new behaviours, including syntactic language that enabled Middle Pleistocene hominids to settle in the previously unoccupied tropical forests of the Congo basin. Backed tools continue to feature in the Pleistocene archaeological sequence of the Congo basin (van Noten, 1983) and at Kalambo Falls they are a component of the effectively undated Polungu industry. Backed flakes are also recorded from Broken Hill cave (Kabwe), central Zambia (Clark et al., 1947). The Broken Hill assemblage is arguably late Middle Pleistocene in age and possibly Lupemban in attribution (Barham et al., 2002) and the artefacts are presumed to be contemporary with the fossils of Homo heidelbergensis for which the site is well known (Rightmire, 2001). At Mumbwa Caves, central Zambia, a few large segments occur in the Last Interglacial and are possibly a legacy of the Lupemban of the region (Figure 8) (Barham, 2000:242). In east Africa, backed flakes appear in the MSA of the Lake Eyasi basin, Tanzania, at Mumba rockshelter (Mehlman, 1989) and are associated with two Last Interglacial dates (U-series on single bone fragment, 5 The biogeography of central Africa shifted in concert with orbitally driven cycles of climate change during the Late Pleistocene and similar shifts are assumed for the Middle Pleistocene. The extent of tropical woodland was much reduced during cool dry glacial/stadials, but some closed canopy forest remained intact in what is now Equatorial Guinea (Dupont et al., 2000). This area was settled by Lupemban foragers (Mercader & Marti, 1999).
131 ± 6 ka and 109+44/−22 ka, Bed VI). Large segments occur in the overlying Bed V at Mumba shelter (~66–22 ka) and these may be contemporaneous with the Howiesons Poort industry of southern Africa, but the dates for Bed V are internally inconsistent (ibid).

The Howiesons Poort is restricted to OIS4 (75–60 ka) (Grün & Beaumont, 2001) and is found primarily south of the Limpopo river (J. Deacon, 1995). The backed tool component is characterized by segments and some trapezoids made on punch struck blades, and sometimes on imported fine-grained raw materials (H.J. Deacon, 1989; Wurz, 1999). The backed tools, especially segments, are more standardized in form (cf. Thackeray, 1992) and occur in greater percentage frequency than those of the Lupemban. Backed tools arguably played a prominent role in the technological repertoire of hunter-gatherers in southern Africa during OIS4. They may also have been part of a wider social network recognizable by its shared arbitrary conventions for tool making (Wurz, 1999; Deacon & Wurz, 2001).

In contrast, there is no evidence in the Lupemban for preferential raw material transport, with local resources used at both Twin Rivers and Kalambo Falls. As for arbitrary, culturally determined constructs governing tool morphology these are not obvious among the backed tools, with the possible exception of trapezoids. The trapezoids at both sites were shaped by blunt retouch or by the deliberate snapping of blades to remove butts and distal ends, leaving a tapered mid-section with a cutting edge opposite [Figure 7(a)–(c)]. If cultural conventions shaped the Lupemban they are to be found in the combined assemblage of heavy and light duty tools that includes carefully crafted lanceolates, core-axes, backed tools and blade and prepared core technology. To this assemblage can be added the systematic use of pigments (Barham, 2002). This package is restricted in time to the later Middle Pleistocene and biogeographically constrained to the woodlands of south central Africa, and the Congo basin.

The later Lupemban represents an expansion and consolidation of the behavioural variability evident in the archaeological record of the late Acheulian/Sangoan/early Lupemban transition in central Africa and east Africa (McBrearty, 2001). It also represents the first regionally distinctive industry in sub-Saharan Africa and backed tools would appear to be a part of this development. If this is indeed the case, then the use of composite tool technology (with backed inserts) emerged about 300 ka. Backed tool technology involves a degree of planning and problem solving in the preparation of hafts and binders that is usually associated with behaviourally modern humans (Ambrose, 2001). The evidence from the later Lupemban of Zambia places this behaviour long before the evolution of anatomical modernity at 120 ka and supports McBrearty & Brooks’ (2000) model of the gradual development of modern behaviours in Africa starting in the later Middle Pleistocene.

The Zambian database is admittedly limited and this review of the taphonomic
history of Twin Rivers and Kalambo Falls highlights the need for new sites excavated to modern standards. The recovery of substantially more backed tools at Twin Rivers in 1999 is attributed to improvements in recovery methods. The challenge for archaeologists working in central Africa is to locate stratified Lupban deposits in sealed and dated contexts (Barham, 2001). In the interim, the data from previous excavations in the region should be integrated into current models of modern human origins with cautious optimism.

Acknowledgements

The research at Twin Rivers was supported by the Leakey Foundation, the British Academy and the Natural Environment Research Council. Sue Grice expertly created the artwork for which I am grateful. Two anonymous reviewers have contributed constructive comments that have improved the content of the argument, but I take full responsibility for the speculative nature of this piece.

References


