[Supplementary material]

Lithic technological strategies of the earliest herders at Lake Turkana, northern Kenya

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Materials and methods

Dongodien

Dongodien presents the best evidence for the subsistence strategies of early herders in northern Kenya. Excavations by John Barthelme (1977, 1981) revealed large faunal, lithic and ceramic assemblages concentrated in beach sand deposits within a 3 × 5m excavation trench. The upper parts of these deposits were slightly disturbed / reworked. This horizon contained circular burnt features, and likely represented a living surface (Barthelme 1981).

Of the identifiable mammals, 88 per cent are small bovids (probably goat or sheep), and 6 per cent are cattle (Marshall *et al*. 1984). Roughly 35 per cent of the assemblage is fish, and so the inhabitants of the site appear to be diversified herders. Of the 294 artefacts sampled for analysis, 85 per cent is obsidian and reflects a predominately blade-based microlithic toolkit (Table 1; Figures 3–4). The lithic assemblage for Dongodien is housed in the National Museums of Kenya, Department of Archaeology.

Additional work was carried out by John Kamau in 1991, and again by Ashley *et al*. (2011) from 2008 to 2009. The latter excavations consisted of a 20m^2 trench nearby to the original Barthelme excavations. These excavations identified a 0.3m cultural horizon with lithics, ceramics and faunal remains (Ndiema 2011). Ashley *et al*. (2017) conducted comprehensive isotopic analyses on sediment samples from the Ndiema excavations for the purposes of environmental reconstruction and also submitted new radiocarbon dating samples and OSL dating samples.

Jarigole

Excavations at Jarigole were undertaken by the Koobi Fora field-school in the late 1980s under the direction of Charles Nelson. Approximately 18m^2 were excavated to 0.65–0.9m below the surface, targeting the central platform of the site (Nelson 1995: 51). Human remains in the archaeological deposit were highly fragmented and were associated with numerous beads, Nderit ceramic sherds, clay animal figurines and a large lithic assemblage. The 245-artefact sample from Jarigole also reflects a preference for obsidian but with greater evidence for use of basalt pebbles that are abundant around the site (Figure 5). Local raw materials may be over-represented in the current collection. The original excavations never extended beyond 0.9m below surface- and it is clear from Lothagam North that this is the depth at which one begins to encounter the primary burial/archaeological contexts where obsidian is more common. If construction of the platforms is similar at these sites, the upper fill may present a biased raw material sample. The lithic assemblage for Jarigole is curated in the National Museums of Kenya in Nairobi, Department of Archaeology.

Lothagam North

Lothagam North is the largest pillar site on the western side of Lake Turkana, with over 48 basalt pillars. The site sits on the western ridge of the Lothagam paleontological formation, just under 2km north of the Lothagam fishing site, where early Holocene fishers produced lithic industries characterised by thick flake tools on local basalts (Robbins 1979). Lothagam North was excavated between 2009 and 2014 by the LPWT project under the direction of Elisabeth Hildebrand and John J. Shea. Excavations on the main “platform” totalled 8m^2 to depths between 0.6m and 2m. The site contained high frequencies of primary human burials and fragmentary human remains (Hildebrand *et al*. 2011). Radiocarbon dates reported in Hildebrand and Grillo (2012) and Hildebrand *et al.* (2018) all fall between *c.* 4400 and 5000 cal BP. Note also that Hildebrand *et al.* (2018) argue for at least two phases of pillar site use and construction at Lothagam North.

Material culture was largely identical to Jarigole, but lacked any figurines. I sampled 492 artefacts from this site (Figure 6). Among the material sampled was a series of eight refitting obsidian bladelets associated with a burial that form a large portion of a cylindrical core (Figure 7). The more recent excavations at Lothagam used intensive screening and recovery protocols, leading to a biased recovery of small flakes and bipolar flake debris, as reflected in Table 2. The lithic assemblage for Lothagam North is curated at the Turkana Basin Institute: Lodwar facility, in Turkana County Kenya.

Sampling and lithic analysis

Each site was excavated using different collection strategies, and all were curated differently. Analysis relied on stratified non-random sampling of context-specific bags to collect representative samples of cores, tools, and complete and proximal flakes from each lithic assemblage.

I recorded weight and raw material type for all specimens sampled. Tools were measured and classified using regional typologies (Nelson 1973; Phillipson 1977). I recorded the location and form of retouch for all formal and informal tools, and the type of blank used in tool production. All flakes were measured during analysis, and flakes that measured at least twice, as long as they were wide were classified as blades *a posteriori*. Given the limited size range for blades, I did not distinguish between "blades" and "bladelets". Bipolar flakes and cores were identified based on the presence of pronounced bi-directional wedge-initiation conchoidal scars along at least one flake face, edge shattering, ventral compression rings, and lateral splitting (after Andrefsky 2005; de le Peña 2011).

For cores and flakes, I measured length, width, and thickness, as well as striking platform type, striking platform width, and striking platform thickness. Lengths were measured as a vector perpendicular to that of the striking platform, not the maximum possible length. This strategy ensures that blade length measures will more accurately reflect the length of the parent core at the time of removal. Width and thickness were the maximum measurements along the flake. Platform variables have been identified as important axes of variation in the East African later Stone Age (Ambrose 1998). They were classified as being plain (unmodified), ground, faceted, shattered, or "point" if the platform was intact, but too small to practically measure. Point platforms appeared in equal proportions, and were not included in the platform-to-flake size analyses (Figures S3–4)

I also recorded attributes relevant to core design and reduction strategy, specifically flake curvature (after Andrefsky 2005) and flake scar orientation. Blade morphology captures dimension of core shape and design at the moment it was struck, and so I used aspects of blade shape to reconstruct core shapes before they reached the state where they were ultimately abandoned. Using the qualitative and quantitative data from the above methods, I was able to reconstruct the operational sequence for core reduction at these sites.

Using Shapiro-Wilk tests, I determined that the observations for each measure were not normally distributed around the mean ($p < .05$). To compare multiple non-parametric groups together, I employed the Kruskal Wallis H test (ranked ANOVA). I interpret any results where $p < .05$ to be significant, which would indicate at least one group demonstrates difference in medians from at least one other group. For comparison of core types (counts of categorical variables), I employed a chi-squared test using sum of squared errors.

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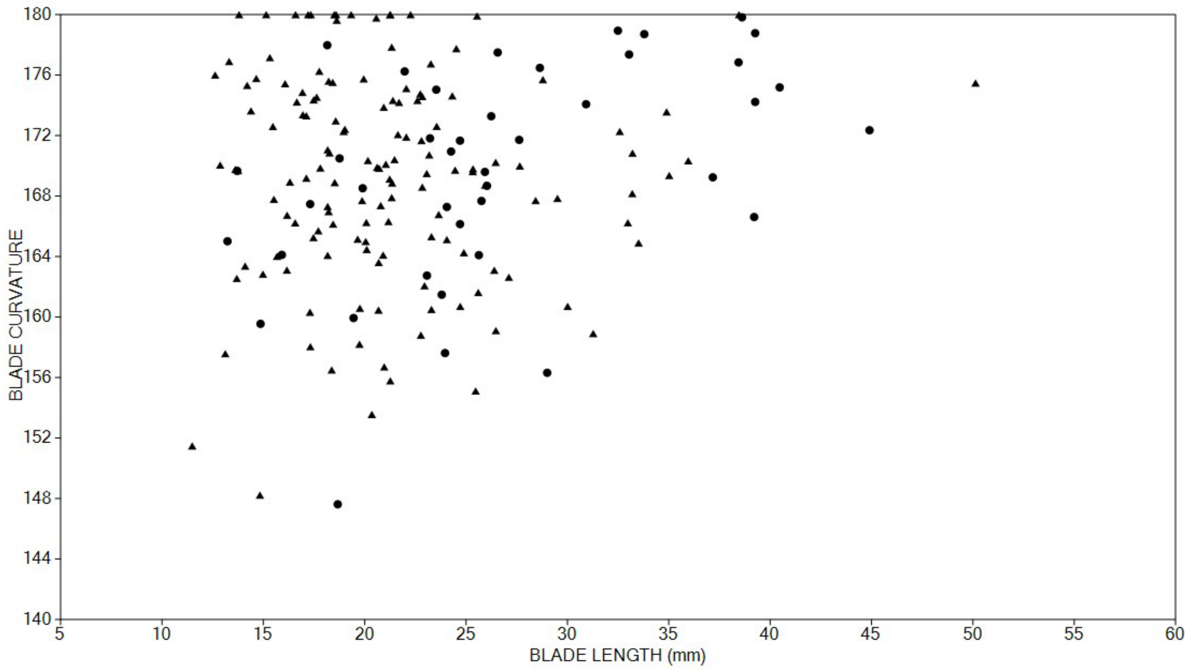

Figure S1. Blade curvatures relative to blade lengths at Lothagam (triangles) and Dongodien (circles). Average blade curvature increases (e.g. lower y values) exponentially as blade size decreases.

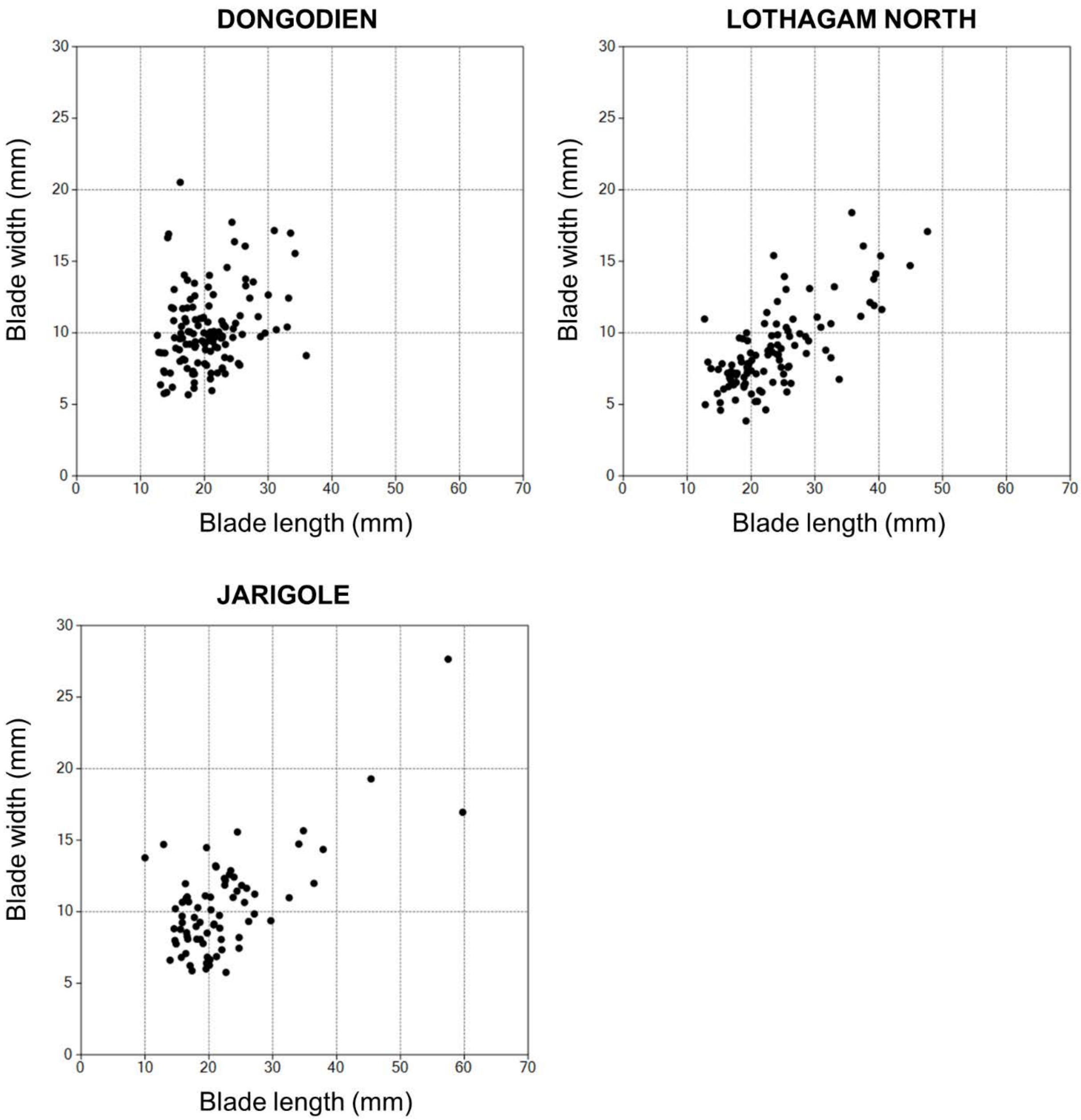

Figure S2. Relationship between blade length and width at sampled sites.

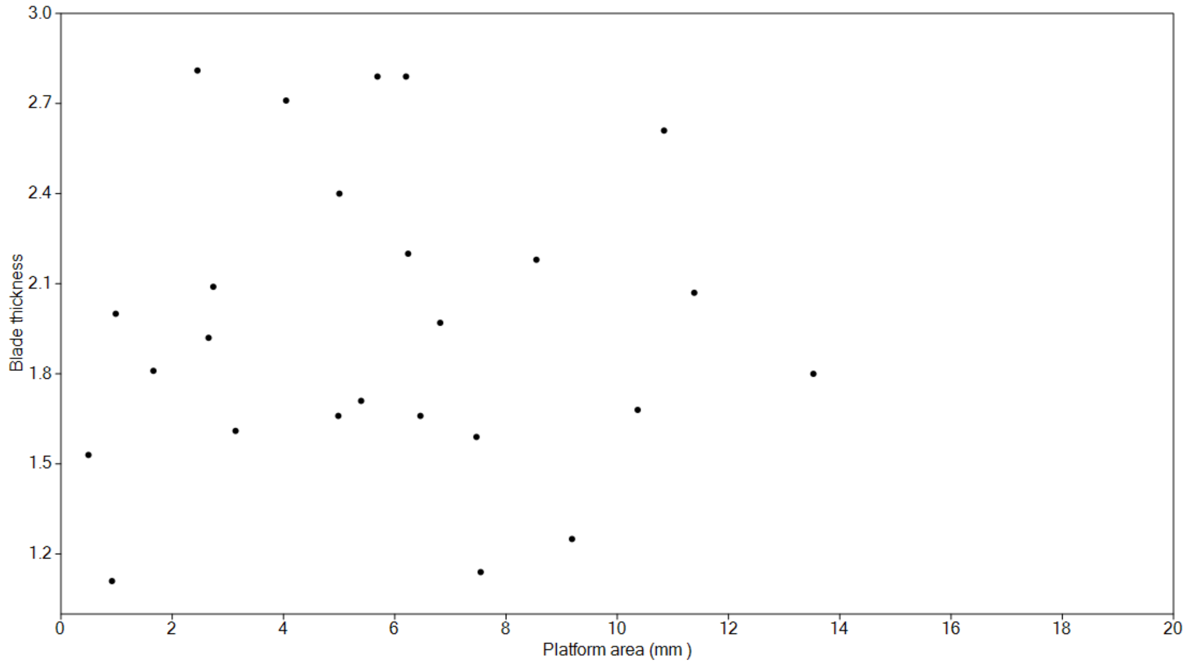

Figure S3. Relationship between striking platform area (mm2) and blade thickness (mm) at Dongodien.

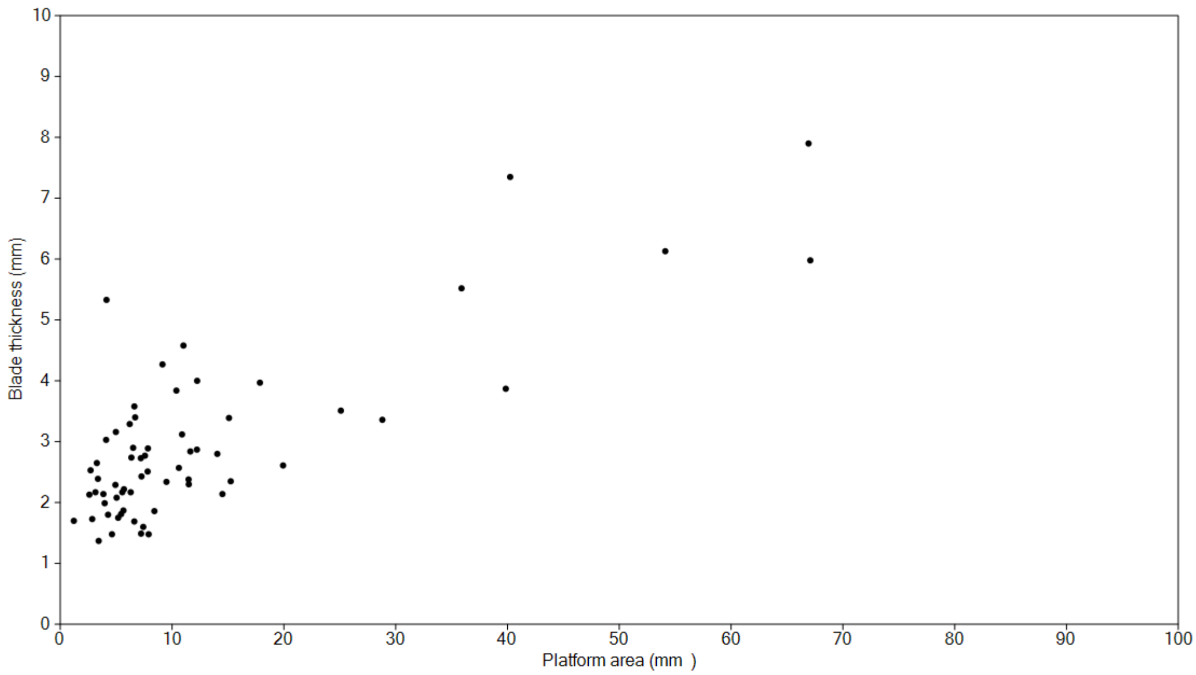

Figure S4. Relationship between striking platform area (mm2) and blade thickness (mm) at Jarigole and Lothagam North (pooled). Compare to distribution in Figure S3.