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Is This an Anvil? Iron Bloom Crushing Sites in Northern Togo

Philip de Barros and Gabriella Lucidi

Abstract

This study of iron bloom crushing mortar sites in the Bassar region of northern Togo has revealed several important points: 1) the heterogeneous nature of sub-Saharan African iron blooms required that they be broken up to remove slag and charcoal as part of a refining process prior to the making of iron tools, 2) this process has been documented in the Bassar region and to a lesser extent in the Sukur iron-working area of the Mandara highlands of Nigeria, but it is likely to have been present in many other areas of West Africa and beyond that have not as yet been described, 3) the larger iron bloom crushing mortar sites or outcrops, called likumanjool in the western Bassar region, were used from the Late Stone Age through the Later Iron Age for a variety of purposes, including stone axe polishing, iron bloom crushing and refining, hot forging of iron ingots and tools, and the sharpening of metal tools, but were probably not used extensively for the grinding of grain as appears to have been the case in the Mandara mountains of north-eastern Nigeria, and 4) the Bassar region study has revealed at least two stages in the location, preparation and use of stone anvils for hot forging as the Bitchabe region of Bassar moved from generalised iron working toward specialising in smithing as the intensity of iron production and trade began to grow significantly after the sixteenth century. The results of this study will hopefully encourage others to identify and study iron bloom processing sites elsewhere in sub-Saharan Africa.

Résumé

Cette étude des sites mortiers de concassage du fer dans la région nord de Bassar du Togo a révélé plusieurs points importants : 1) la nature hétérogène des grosses barres de fer d’Afrique sub-saharienne nécessitent qu’elles soient brisées pour enlever les scories et le charbon de bois dans le cadre d’un processus de raffinage avant la fabrication d’outils ferreux ; 2) ce processus a été documenté dans la région de Bassar et dans une moindre mesure dans la ferronnerie de la région de Sukur dans les hauts plateaux de Mandara du Nigeria, mais il est probable qu’il ait été présent sans avoir été décrit dans de nombreuses autres régions de l’Afrique de l’Ouest et au-delà ; 3) les plus grands sites mortiers de concassage des produits du laminage ou des affleurements, appelés
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likumanjool dans la région occidentale de Bassar, ont été utilisés à partir de la fin de l’âge de pierre à travers l’âge du fer ultérieur pour une variété de raisons, y compris le polissage de la hache de pierre, le concassage et le raffinage de grosses barres de fer, le forgeage à chaud des lingots et des outils, et l’affûtage des outils métalliques, mais n’ont probablement pas été largement utilisés pour le broyage des grains comme cela semble avoir été le cas dans les monts Mandara du nord-est du Nigeria ; 4) l’étude de la région de Bassar a révélé au moins deux étapes dans l’emplacement, la préparation et l’utilisation des enclumes de pierre pour le forgeage à chaud. C’est le cas pour la région de Bitchabe de Bassar partie de la ferrerie généralisée vers la spécialisation en frappe comme l’intensité de la production et du commerce du fer a commencé à croître significativement après le 16ème siècle ; et 5) les résultats de cette étude, espérons-le, encourageront les autres à identifier et étudier les sites de traitement de grosses barres de fer ailleurs en Afrique sub-saharienne.

The Bassar region iron-working industry
The iron-working industry of the Bassar region of northern Togo (figures 4.1 & 4.2) has been studied since the German mining engineer F. Hupfeld (1899) described it more than

When the German colonialists arrived in the 1890s, the western and eastern parts of the Bassar region differed in their political and economic organisation. To the west, the Bandjeli zone north of Natchamba specialised in smelting, the area from Natchamba south to Bitchabe and Ignare specialised in smithing, and Dimuri specialised in charcoal production (figure 4.2). It is not clear whether chiefdoms were present in the western region much before the colonial era. In the eastern region, smelting and smithing villages were associated with chiefdoms centred at Bassar and Kabu. The Bassar chiefdom developed in the late 1700s and the Kabu chiefdom ca. 1850 to 1860.
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(Gnon 1967; De Barros 1985). The richest ores were in the Bandjeli region with hematite as high as 69% iron, whereas eastern region ore sources ranged from 35–45% iron (Koert 1906; Lawson 1972; De Barros 1985: 126). Major Later Iron Age production centres existed not only near Bandjeli but also north of Kabu, east of Nababoun and just north of Bassar. The focus of this paper is on the zone that specialised in blacksmithing. These smithing villages included Natchamba, Lowatchule and Bitchalambe, but this study has focused on those to the south, including Bidjobebe, Bidjomambe, Bitchabe, Binadjoube and Ignare (figure 4.2).

**Refining traditional iron blooms in Bassar**

In traditional sub-Saharan African iron working, the iron bloom produced in a traditional clay smelting furnace contains considerable slag and charcoal that must be removed prior to the forging of iron tools (Hupfeld 1899; Cline 1937). In the Bassar region this was done by using a large, roughly spherical stone crusher or pounder (figure 4.3) for breaking up the bloom (*ŋkuyiki*) into smaller and smaller chunks of pure iron.
or nearly pure iron (akubil) suitable in size for the hot forging of various tools, while at the same time removing bits of attached slag and charcoal (De Barros 1985: 166; Dugast 1986: 38–42). This was followed by the pulverising of the smaller pieces thought to contain a mixture of iron and slag, as well as material formerly removed from the exterior of the bloom, including kukwoŋ, a mixture of wood and charcoal located within the interior of the semi-circular to horseshoe-shaped bloom. Both types of material were referred to as ‘gravier de fer’ or ‘iron gravel’ (ŋkutam) (De Barros 1985: 161; Dugast 2013: 30–32). The latter activity was performed using smaller spheroidal stone hammers (figure 4.4). According to Yao Nambou of Bidjoebe (pers. comm. 1981), whose father was a master smith, the large, roughly spherical crushing hammers were used by his mother in a standing position and were thrown down with both hands, crushing the bloom chunks against the bedrock. This bloom crushing process often produced outcrops with one or more large and deep cylindrical mortars surrounded by numerous small to medium saucer mortars (figure 4.5). Rock outcrops that have been intensively used may include a combination of deep cylindrical mortars, shallow

Figure 4.4  Smaller spheroidal hammer for pulverising smaller bloom fragments and small saucer mortars its action produces over time (site 312). Photograph: P. de Barros (1981)
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to deep conical or ellipsoid/ovoid mortars, and slicks, with some areas containing saucer mortars (figure 4.6). The slick areas are most likely the result of wear from pulverising smaller pieces of bloom containing iron and slag to create the ‘iron gravel’ (ŋkutam) noted earlier. While this usually produced small saucer mortars over time, it is likely such activity was not always confined to the holes but also affected adjacent areas. Other less intensively worked rocks may include circular to elliptical/ovoid mortars where larger pieces of bloom were broken up and small pockmarks where a rock was first used to pulverise smaller pieces.

The sexual division of labour for bloom crushing and refining varied in the different smithing villages of the Bassar region (De Barros 1986: 166–173; Dugast 2013: 29–36). For example, it appears that men as well as women broke up the bloom in Binaparba-Bassar (Dugast 2013: 30–31; Dugast, pers. comm. 2015), whereas women usually performed this task in the western region (De Barros 1986: 153; Dugast 2013: 32 n14, 35 n20). Women more often than not were engaged in the process of crushing or pulverising or grinding the smaller pieces into what is called ‘farine de fer’ or ‘iron flour’ (ŋkuyim)
After pulverisation, the iron flour or powder was separated from the slag powder by shaking the material up and down in a calabash, which brought the lighter slag powder to the surface, allowing it to be removed. This separation was aided by the fact that the iron flour is distinctly lighter in colour than the slag powder (Dugast 2013: 33 n16). The iron flour is viewed as indispensable for welding together the iron bloom pieces into a state where it can be forged into an ingot (likɔpiil or dikɔpiil) or iron hoe (dikool) or another tool (De Barros 1985: 173; Dugast 1986: 38–47, 2013: 28).

It should be noted that while the iron flour (ŋkuyim) is used in the clay ball refining process described below, the remaining darker slag powder or ‘micro-slag’ is viewed as a waste product (ncaakoɔom) by the blacksmith. However, his wife or wives as well as their relatives added it to harden house walls and courtyard floors and/or to give them a brilliant decorative sheen (De Barros 1985: 161; Dugast 2013: 36).

The critical step in bloom iron refining involved the mixing of iron bloom pieces (akubil) with the iron flour (ŋkuyim) and the leaves of a riparian plant (titaykummoɔol), which served as an adhesive, into a ball made from a red clay (diwulindi). The clay ball

In the Bitchabe region, the rock outcrop used to crush and/or pulverise the iron bloom is called a *likumanjool*; in Binaparba-Bassar, the term is *dikugbataykpal* for men and *dikusanjool* for women (De Barros 1985: 166–173; Dugast 2013: 35). The larger *likumanjool* sites usually consist of a large outcrop or a cluster of smaller rock outcrops that may contain both deep cylindrical mortars with a spheroidal bottom and relatively deep conical or ellipsoid basins resulting from the use of the large stone crusher or pounder, as well as many small, relatively shallow saucer mortars or simple pockmarks produced by the use of small hammers to create the iron flour (*ŋkuyim*) (figures 4.3–4.6). Based on the study of archaeological and ethnoarchaeological smithing village sites in the Bitchabe region in 2013, the smaller saucer mortars and pockmarks can be found alone (without the large mortars or basins) on clusters of large and small bedrock outcrops, large boulders and even small portable boulders or stones. The larger *likumanjool* sites are usually found near the smithing village and women often worked there in groups processing the iron bloom (see also Dugast 2013: 34–35). The smaller *likumanjool* sites found on boulders and sometimes portable stones are most often found scattered within areas reserved for forging called *ncamɔŋki* (outside courtyard [mɔŋki] for the forge [kucaau]), situated below the village habitation area (Dugast 2013: 34 n18). Given that only men actually forged tools, these small *likumanjool* were probably only used by men (Dugast 2013: 33, 37). An individual smithing workshop or ‘atelier’ within this forging zone area was called *kucaadi* (Dugast 2013: 36). In terms of the spatial organisation of the smithing village, habitation and forging areas were thus separated but adjoining (see also De Barros 1985: 173; David 1998: 42).

**Iron bloom crushing mortar sites in West Africa and beyond**

Since we know that traditional sub-Saharan iron blooms were a heterogeneous mixture of iron, slag and charcoal that had to be refined before forging iron ingots or tools, one would expect that iron bloom crushing mortar sites would be found throughout much of Africa. What is the evidence for West Africa?

David (1998: 29–31), in his study of grinding sites in the Sukur region in the Mandara mountains of north-eastern Nigeria, focuses primarily on food grinding, but he does discuss ‘fining hollows and complexes’ that are often dominated by what he calls ‘crushing mortars’ used for breaking up iron blooms. Crushing mortars are usually deeper than they are wide, with a bell-shaped cross-section (David 1998: 41).

Fining hollows and complexes were used for the breaking up and initial mechanical fining of the iron blooms that Sukur used to produce in industrial quantities. … Fining hollows only occur as clusters or groups of clusters of hollows [mortars or basins] on bedrock outcrops,
boulders and large blocks, rarely on smaller blocks. ... A limited degree of tilting of all or part of the support was tolerated. Clusters include small, rough surfaced, sub circular pock marks or cupules ... and in almost every case a smaller number of larger, smoother examples, some of which may be reused basin hollows and crushing mortars (David 1998: 34).

David (1998: 29, 41) states that such fining complexes exist in other areas of the Mandara mountains and notes that Sassoon (1962: 145, plate Lb) illustrates comparable sites from the Jos Plateau, but that the latter sites seem to lack the smaller hollows (saucer mortars) found at Sukur. This may be because bloom processing was different on the Jos Plateau (David 1998: 42), in that the refining process perhaps did not include the creation and use of ‘iron flour’ or it was produced in other ways. This is suggested by Sassoon’s (1962: 145) description of the process. When describing how iron bloom (composed of slag, charcoal and iron granules) was crushed in large, deep, slightly oval to circular mortars, he says the furnace core (bloom) was broken into lumps and then pounded so that the charcoal and slag are reduced to a fine dust; the granules of metal resist the blows of the hammerstone. The slag and charcoal dust is then winnowed away, and the granules of iron can be gathered together and handed over to the blacksmith, who consolidates them by heating them in a small closed crucible in his forge, and then hammering the red-hot mass into a lump (Sassoon 1962: 145).

The deep pits where the bloom was crushed were as much as 12 inches (30.5 cm) deep and 24 inches (61 cm) in longest dimension (Sassoon 1962: plate Lb). No average figures are provided.

For the Sukur region, David (1998: 42) continues:

Fining complexes often occur on supports large enough for several persons to have worked together. Groups of 40–50 hollows are not exceptional. The smallest might be described as pockmarks. Somewhat larger are those 5–8 cm across and 2–3 cm deep, their interior surfaces roughened by the repeated impacts of stone hammers transmitted through irregular fragments of bloomery iron. As hollows continued to be used, achieving diameters over 15 cm and depths of 8 cm or more, the randomising effects of continued hammering resulted in smoother interiors and more nearly circular plans and hemispherical cross-sections. As some hollows became favoured over others for breaking larger pieces of bloom, mature complexes came to include a number of larger hollows ...

The iron bloom crushing mortar sites in the Bassar region generally conform to David’s descriptions, but due to the intensity of iron production at some sites, these mortars average as much as 34 cm in depth, with some as deep as 44 cm, sometimes
with a spheroidal bulge at the bottom (De Barros 1985: 174). Other areas used for bloom crushing that did not evolve into cylindrical crushing mortars have taken the shape of more conical or ellipsoid basins with smooth sides (figures 4.5 & 4.6). Some intensively used likumanjool outcrops have well over 100 features on a single outcrop, such as outcrop A at site 298A (figure 4.6), and some have as many as 50–60 small saucer mortars crowded into a small area on a single relatively small outcrop. Smaller portable or nearly portable likumanjool found in smith workshop areas may have 20–30 pockmarks or saucer mortars taking up every available space.

Iron bloom crushing mortars are thus present in northern Togo (Bassar region) and parts of northern Nigeria (the Mandara highlands and the Jos Plateau). What about elsewhere? In the area of Bamessing in the Ndop Plain of the Cameroon grasslands, Warnier and Fowler (1979: 344) describe iron bloom processing on bedrock outcrops that is similar to that described for the Bassar region, also producing deep, more or less cylindrical mortar holes. In email correspondence with colleagues in Ghana, some are of the opinion that such sites exist in the Volta region in Kpando, but they have been insufficiently studied to be certain (Mustapha Mohammed, pers. comm. 2014). In the Ivory Coast, there may be such a site near Korhogo, described by Célis (1991: 167, figure 136) (Vincent Serneels, pers. comm. 2014).

What about elsewhere in sub-Saharan Africa? While no information has yet been located for southern Africa, probable iron bloom crushing mortar sites have been noted in East Africa. Fosbrooke (1954: 101–102, plate G) describes ‘pock marks’ resulting from the crushing of iron bloom pieces in the Pare region of northern Tanganyika, now Tanzania (see David 1998: 14). These marks average about 5 cm in diameter and are 1–2 cm deep, and they vary from a few to up to 53 on a given rock outcrop (Fosbrooke 1954: 101). The rock outcrops resemble those with small saucer mortars produced from crushing smaller pieces of iron bloom in the Bassar region. However, the goal was not to crush the bloom into ‘iron gravel’ for fining purposes, but rather to break up the bloom into the pieces needed to make a particular iron tool (Fosbrooke 1954: 102). Similar features are present in the neighbouring Chagga area (Fosbrooke 1954: 102 n2).

More recently, Humphris (2010: 265), in her work on the iron-smelting traditions of southern Rwanda, discusses ‘grinding hollows’ near a furnace site:

… 3 m north of f1 [furnace remains], on a number of rocky outcrops, over thirty grinding hollows were observed (figure 6.6.3). These were all of a similar oval shape … with dimensions of between 10–25 cm in depth, and 25–45 cm in width, (measured at the widest point). All of the hollows had a smooth bottom, the rock having been ground flat over the years.

Local informants were interviewed but they had no memory of either the iron production or the use of the grinding hollows (Humphris 2010: 264–265, figure 6.6.3).
The hollows look similar to those illustrated by Sassoon (1962), but are somewhat smaller in size. Their proximity to the smelting furnace suggests they may be iron bloom crushing mortars, but more research is needed.

In discussion with colleagues, it would seem that aside from David's (1998) study, which focused primarily on food grinding, and the current study, little research has been done on rock outcrops used to process iron blooms. Moreover, as David (1998) suggests, without a careful archaeological and ethnographic study of specific outcrop types, many sites that were used as iron bloom crushing sites may be mistakenly assigned to grain grinding. Given the heterogeneous nature of traditional sub-Saharan African iron blooms, which must be broken up and refined prior to the making of iron tools, more research on this topic is clearly needed.

**Is this an anvil?**

In 2013, the authors spent several months in the Bassar region. One of the goals was to map and document *likumanjool* sites for comparative purposes. After recording site and rock outcrop dimensions at each site, and after mapping them with GPS, chalk was used to outline each rock feature: mortars, basins, grooves, abraded areas and slicks. The dimensions of each feature were then measured with the ultimate goal of measuring their volumes to establish a rough total volume figure for each major *likumanjool* site that could serve as a rough indicator of the intensity of iron tool production at the various sites studied near Bidjobebe, Bidjomambe, Bitchabe, Binadjoube and Ignare (figure 4.7). Time constraints precluded the study of Lowatchule, Bitchalambe and Natchamba.

While documenting site 312 near Bidjobebe, a co-author of this study, Gabriella Lucidi, asked whether a rock outcrop labelled FF might be an anvil rather than an outcrop used for bloom crushing. This question seemed reasonable so two soil samples were collected from adjacent to both sides of outcrop FF, as well as from an adjacent low, flat outcrop, to see if any hammerscales and/or microspatter were present that would confirm that hot forging had indeed taken place (Allen 1986; De Barros 2011). These hot forging waste products, also called *battitures*, are only a few millimetres long. Soil samples were taken in 29x20 cm cloth bags filled half-way, producing about a 1 kg soil sample. The samples were obtained adjacent to the potential anvils. The goal was to determine whether or not hammerscales and microspatter were clearly present, not to suggest a quantitative comparison between anvils.

During hot forging, hammerscales are derived from the flaking off of thin, generally bluish-grey flakes of iron from the tool being forged, whereas microspatter is the result of liquid slag being squeezed out of the iron and departing as a tiny sphere, which may occasionally be deformed upon striking a hard surface (Allen 1986). Standard geological sieves measuring 3.35, 1.7 and 1.0 mm were used to separate the hammerscales and microspatter into different-sized categories. These were stacked with the largest
sieve-opening on top and the soil from each sample was then sieved, with the finest part of the sample (≤1 mm) being lost in the process.

For each screen size, a magnetic pencil was then used to extract magnetised particles. This is a tedious process that requires multiple passes of the pencil through the material in the screen, until one ceases to attract any particles. The magnetic samples were bagged separately and later washed and scrubbed with a toothbrush in

Figure 4.7  Iron bloom crushing mortar sites (likumanjool) discussed in the text. Source: J. Paulson
their screens so hammerscales and microspatter could be more easily identified. After drying, each washed sample was then carefully examined, piece by piece, under a small incandescent lamp to check for hammerscales and/or microspatter, which were then counted and bagged separately. The results were encouraging. All of the initial soil samples from site 312 near Bidjobebe tested positive for hammerscales and

Table 4.1  Evidence for hammerscales and microspatter at iron bloom crushing mortar sites investigated in the Bitchabe region. Source: P. de Barros

<table>
<thead>
<tr>
<th>Village</th>
<th>Site</th>
<th>Feature*</th>
<th>Hammerscales (HS) Sieve Size (mm)</th>
<th>Microspatter (MS) Sieve Size (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>3.35</td>
<td>1.7</td>
</tr>
<tr>
<td>Bidjobebe</td>
<td>312</td>
<td>H (north side)</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>H (south side)</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Q</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>U–V</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CC</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FF (east side)</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FF (west side)</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Bitchabe</td>
<td>298A</td>
<td>PA1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PA2</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PA3 (E)</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>298B</td>
<td>PA1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PA5</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PA2 (H)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PA3?</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PA4?</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>298C</td>
<td>PA1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PA2 (H)</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Bidjomambe</td>
<td>299A</td>
<td>PA22 (E&amp;W sides)</td>
<td>0</td>
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<td></td>
<td></td>
<td>PA23 (X)</td>
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<td></td>
<td>PA24</td>
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<td>0</td>
</tr>
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<td></td>
<td></td>
<td>PA25</td>
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<td>7</td>
</tr>
<tr>
<td></td>
<td>299B</td>
<td>PA27</td>
<td>0</td>
<td>51</td>
</tr>
<tr>
<td>Binadjoube</td>
<td>356A</td>
<td>PA1??</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

* PA = potential anvils; on site maps in this report, those with evidence of HS and MS are shown as A = anvil, whereas PA = potential anvil was used on the maps if the level of such evidence is limited or ambiguous due to the presence of an adjacent outcrop which might also be the source of the HS and MS. Letters in parentheses represent outcrops with iron bloom crushing mortar features.
usually microspatter. Outcrop FF (two samples), which prompted the study, produced
64 hammerscales and 24 microspatter, but the most dramatic evidence came from
outcrop CC with 232 hammerscales and 29 microspatter (table 4.1). These results
led to further soil sampling adjacent to outcrops H, Q and U–V. H is similar to FF in
general shape and Q and U–V are low, flat outcrops like CC. Outcrop H (two samples)
produced 113 hammerscales and 39 microspatter; outcrop Q, 33 hammerscales and
4 microspatter; and between outcrops U and V, 15 hammerscales and 0 microspatter.

Given this initial success, soil samples for potential anvils were also collected for
sites 356A, 298A–C and 299A and B, and one or more anvils were demonstrated to
be present at all of these sites except 356A (tables 4.1 & 4.2; figures 4.8–4.11). These
newly discovered anvils are outcrops that vary in size and shape but generally have an
upper surface that is more or less flat.

Table 4.2 The multi-functionality of iron bloom crushing mortar (likumanjool) sites in the Bassar region of Togo.
Source: P. de Barros

<table>
<thead>
<tr>
<th>Associated Village</th>
<th>Site</th>
<th>Rock Outcrops</th>
<th>All Rock Features</th>
<th>Anvils¹</th>
<th>Polished Stone Axe Grooves</th>
<th>Metal Tool Sharpening Surfaces</th>
<th>LPAs²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bidjopebe</td>
<td>312</td>
<td>30</td>
<td>414</td>
<td>5–6</td>
<td>2 (Q)</td>
<td>11 (A&amp;B)</td>
<td></td>
</tr>
<tr>
<td>Bitchabe</td>
<td>298A</td>
<td>15</td>
<td>432</td>
<td>2–3</td>
<td>1 (A)</td>
<td>3 (A, H)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>298B</td>
<td>18</td>
<td>220</td>
<td>3–5</td>
<td>11 (J&amp;S)</td>
<td>3 (A, H)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>298C</td>
<td>9</td>
<td>57</td>
<td>3</td>
<td></td>
<td>1 (D)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>298D</td>
<td>3</td>
<td>14</td>
<td>ND</td>
<td></td>
<td>1 (C)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>298E</td>
<td>2</td>
<td>22</td>
<td>ND</td>
<td></td>
<td>1 (A)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>298A–E</td>
<td>47</td>
<td>745</td>
<td>8–11</td>
<td>12</td>
<td>17</td>
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</tr>
<tr>
<td>Bidjomombe</td>
<td>299A</td>
<td>28</td>
<td>434</td>
<td>4</td>
<td>13 (G, X, AA)</td>
<td>5–6 (G, N, Q?, AA; SS1–2)</td>
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<tr>
<td></td>
<td>299B</td>
<td>8</td>
<td>67</td>
<td>1</td>
<td>4 (A)</td>
<td>15 (SS1–5)</td>
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<tr>
<td></td>
<td>299C</td>
<td>10</td>
<td>42</td>
<td>ND</td>
<td>2–5 (B, SS1?)</td>
<td>19 (SS1–6)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>299D</td>
<td>10</td>
<td>23</td>
<td>ND</td>
<td>1 (LPA3)</td>
<td>2 (SS1–2)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>299E</td>
<td>6</td>
<td>9</td>
<td>ND</td>
<td>LPA1?</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>299F</td>
<td>7</td>
<td>28</td>
<td>ND</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>299A–F</td>
<td>69</td>
<td>603</td>
<td>5</td>
<td>20–23</td>
<td>41–43</td>
<td>6</td>
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<tr>
<td>Binadjoube</td>
<td>356A</td>
<td>10</td>
<td>65</td>
<td>1?</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Ignare 1</td>
<td>320</td>
<td>9</td>
<td>27</td>
<td>ND</td>
<td>3 (A, D)</td>
<td>3 (A, C)</td>
<td></td>
</tr>
<tr>
<td>Ignare 2</td>
<td>359</td>
<td>12</td>
<td>128</td>
<td>ND</td>
<td>0</td>
<td>1 (D)</td>
<td></td>
</tr>
</tbody>
</table>

¹Includes all mortars, basins, grooves, slicks, sharpening surfaces
²Anvils are viewed as rock outcrops, not features
³Clay ball (litaykunti) preparation anvils
Letters in parentheses refer to outcrops with iron bloom crushing mortar features.
Figure 4.8 Site 312 likumanjool near Bidjobebe. Source: J. Paulson

Figure 4.9 Site 298A likumanjool near Bitchabe. Source: J. Paulson
Figure 4.10 Site 298B likumanjool near Bitchabe. Source: J. Paulson

Figure 4.11 Site 299A likumanjool near Bidjomambe. Source: J. Paulson
Given the frequent presence of anvils at likumanjool sites it was decided to check for other potential site uses over time, including the presence of Late Stone Age stone axe polishing grooves and Iron Age metal tool sharpening surfaces. This unexpectedly led to the discovery of clay ball (litaykunli) preparation anvils at sites 299D and E (table 4.2; figure 4.7). The issue of whether these outcrops were used for grain grinding was also considered (see below).

**Stone axe polishing grooves**

These were found at all of the larger likumanjool sites except site 312 near Bidjobebe, including sites 298A and B near Bitchabe, 299A–D near Bidjomambe, and at site 320 near Ignore (table 4.2; figures 4.7–4.11). All of the axe polishing grooves are long and narrow (mostly 2–3 cm in width) and readily distinguishable from iron bloom crushing mortars and basins and metal tool sharpening surfaces. The number of grooves varied from 1–3 per outcrop to a set of 10 grooves on outcrop J at site 298B (figure 4.12). Some of the outcrops with axe grooves also had iron bloom crushing
mortars, including outcrops Q at site 312; A and D at site 320; A at site 298A; G, X and AA at site 299A; A at site 299B; and B at site 299C (table 4.2).

**Metal tool sharpening surfaces**

These were recorded in the field in 2013 and additional ones were identified from field photos in 2014. While none were identified at site 312, one or more were recorded at sites 298A–E near Bitchabe, including 11 examples on the large and intensely used outcrops A and B at site 298A (table 4.2). Two sharpening surfaces on outcrop ridges are illustrated, including feature 96 abraded on top of a polished stone axe groove (figure 4.13). At site 299A at Bidjomambe, sharpening surfaces were found on iron bloom crushing mortar outcrops (G, N & AA), and two outcrops (SS1 & 2) had only metal tool sharpening surfaces. For *likumanjool* sites 299B and C, all metal tool sharpening surfaces were found on rock outcrops adjacent to but not within the *likumanjool* outcrop cluster, whereas at 299D, one was associated with the *likumanjool* and one was not.

![Figure 4.13](image)

**Figure 4.13** Two metal tool sharpening surfaces, with feature 96 on top of stone axe polishing groove, outcrop A, site 298A near Bitchabe. Photograph: P. de Barros (2013)
**Litaykunli preparation anvils**

Finally, while recording likumanjool sites at Bidjomambe, Chief Djayo, an 85-year-old traditional smith who worked as a hammerman, pointed out six rock outcrops associated with sites 299D and E that he said were used as anvils by the wives of blacksmiths to help prepare and shape the clay balls (*litaykunli*) prior to them being worked in the forge by their husbands. Their work involved mixing the iron bloom chunks with iron flour and the leaves of the riparian plant (*titaykummoool*) into the red clay ball, which was then shaped with one of the stone hammer types described by Dugast (1986: 42–45). This was somewhat of a surprise as previous studies suggested only men prepared, shaped and worked the clay balls (Dugast 1986, 2013). These anvils are designated as *litaykunli* preparation anvils (LPAs) in table 4.2, and they deserve more study than was possible for this article.

**Grain grinding mortars vs iron bloom crushing mortars**

Until now, sites 320 and 359 near Ignare and site 356A near Binadjoube have not been discussed (figure 4.7; table 4.2). These are smaller sites than the large complexes found near Bitchabe, Bidjomambe and Bidjobebe.

Site 320 contains only 9 rock outcrops with 27 features, most of which are shallow slicks or basins, slicks and axe grooves. However, 10 features consist of large, relatively deep ovoid mortar features whose dimensions range as follows: 33.5–49 cm (length) by 30–42 cm (width) by 3–13 cm (depth) with mean dimensions of 44.6 by 35.6 by 8.1 cm (figure 4.14). There are no deep cylindrical mortars or groups of small saucer mortars. Site 356A has 10 rock outcrops with 65 features, including 16 ovoid mortars similar to those at site 320 with dimension ranges as follows: 28–53 cm (length) by 18–44 cm (width) by 2.5–12.5 cm (depth) with mean dimensions of 40.1 by 31.2 by 6.2 cm. Although shallower than those at site 320, the length-to-width ratio is virtually the same for the two sites (0.80 vs 0.78, respectively), suggesting they were produced by similar processes. This site also has a few relatively deep conical/semi-cylindrical mortars and groups of small saucer mortars.

Were the ovoid mortars at these two sites produced by grinding grain or crushing iron bloom? David (1998: 29) indicates that mature grain (millet and sorghum) grinding mortars in the Sukur region of the Mandara mountains of north-eastern Nigeria are ovoid in shape with dimensions typically ranging from 36–44 cm long by 23–32 cm wide by 7–11 cm deep, but provides no mean dimensions. While similar to those at sites 320 and 356A, given that David’s data focus on well-worn basins, those at Bassar appear to be longer and especially wider than those at Sukur, suggesting perhaps differences in the size, shape and/or manner in which the crushing tool was used. The ovoid mortars at site 320 near Ignare were definitely assigned to iron bloom.
crushing by Chief Ali Nambou, whose father was a master smith who engaged in bloom crushing at the site (Ali Nambou, pers. comm. 1981). When asked to take us to an iron bloom crushing mortar site, the landowner of the site, who is also the local earth priest at Binadjoube, Bingitcha Kyiole, took us to site 356A. Site 356A also has some cylindrical mortars and groups of small saucer mortars that are typical of the sites near Bitchabe, Bidjomambe and Bidjobebe.

Site 359, situated north of site 320 (figure 4.7), is a somewhat larger site with 12 outcrops and 128 features. It is dominated by relatively deep conical or ovoid mortars which are sometimes associated with large groups of small saucer mortars; however, the mortars here are not as large as at sites 320 and 356A. Some of the ovoid mortars appear to have been reworked and deepened with smaller ovals or saucer mortars inside them (figure 4.15), and this kind of deepening reuse is also present near Binadjoube at site 356A at outcrops A and B. There is also evidence of reuse of existing basins and mortars at sites 298A and B and 299A and B. David (1998: 29–31) suggests this reuse pattern involves the reuse of grain and other grinding features for iron bloom crushing. Could this be the case at sites 320, 356A and elsewhere?
First, it should be emphasised that in the Bitchabe region, archaeological sites of the last few centuries, including those occupied during the late nineteenth and early twentieth centuries as well as present-day villages, consistently show the presence of deep, semi-portable to portable mortars (called basin metates in California), which local informants state were used for the grinding of millet and sorghum. These mortars are found in direct association with habitation areas and there is little archaeological evidence of communal grinding sites as reported near Sukur (David 1998). Site types recorded during the intensive survey of 10 km$^2$ between the Katcha River and Bidjilib ore source to the east, as well as more critical surveys conducted elsewhere in the Bassar region, have produced only one or two possible communal bedrock mortar grinding sites (De Barros 1985: 730–740).

Second, there is at present no ethnographic evidence regarding a second iron bloom crushing method, though it is possible one existed in the distant past. In addition, large and small crushing hammers similar to those used elsewhere are present at sites 320 and 356A. As noted earlier, Sassoon (1962) has discussed and illustrated large, deep, slightly ovoid or conical mortars on the Jos Plateau of northern Nigeria, where bloom was crushed until all slag and charcoal were reduced to powder and winnowed out as dust, apparently without the separate step of using small hammers.
in small saucer mortars to create such powder (David 1998: 29–31). For the Bitchabe region, however, what is perhaps more likely is that crushing mortar feature differences reflect differences in the duration and intensity of bloom crushing over time at particular sites, especially after the rise of large-scale iron production. As the intensity of production increased, and after ovoid mortars had reached a certain depth, some of them were deepened to eventually form the deep cylindrical mortars seen at Bidjobebe, Bitchabe and Bidjomambe.

**Likumanjool site multi-functionality: discussion**

The results of this study are summarised in table 4.2, which illustrates the historical multi-functionality of these sites, beginning with stone axe polishing during the Later Stone Age and their later use as anvils for the hot forging of iron tools, for iron bloom crushing and for metal tool sharpening during the Later Iron Age. The litajkunli preparation anvils were identified via oral traditions for the village of Bidjomambe and may not be typical of other smithing centres. Moreover, it would be hard to identify their presence with archaeological evidence as there do not seem to be any distinctive markings on these outcrops and battitures would not be present. At present, it seems unlikely that likumanjool sites were significantly used for grain grinding, but this use, especially during the Late Stone Age, cannot be excluded. The most intriguing aspect of the multi-functionality of the likumanjool sites is the presence of hot forging anvils, something that seems to have been forgotten in local oral traditions.

**A proposed history of anvil production and use in the Bassar region**

When the senior author first visited the Bitchabe region in 1981, the then district chief (chef de canton) Kofi Seydou emphasised that the reason the region had specialised in smithing for as long as they were able to remember was because of the high-quality (quartzite) stone used for the production of both stone anvils as well as some types of stone hammers (De Barros 1985: 205; Dugast 2013: 52 n45). This hard, compact, homogeneous, bluish-grey quartzite was particularly sought after for the large anvils used in the Bitchabe zone and at Binaparba-Bassar when the Germans first arrived in the late nineteenth century. In Binaparba-Bassar, the word for anvil is dicaatyঁkpal (Dugast 1986, 2013), literally ‘forge stone’. However, based on the authors’ field research in 2013, the term used in the Bitchabe area is kukpɔkɔ, a term Dugast (2013: 39 n30) says cannot be broken up into separate words in the Bassar language. The type of stone used for such anvils is referred to as ntaŋkpajil (Dugast 2013: 47 n39).

These large quartzite anvils were quarried in the nearby mountains (Dugast 1986, 2013; see also De Barros 1985: 173). A master smith would travel to a known source area and select a good-quality stone outcrop or large boulder. He would then return
with a group of powerful young men with a wooden transport frame lashed together with vines. After removing and partially shaping the stone by using alternating fire and water treatment, the team would then push and pull the transport frame along a path that was first cleared of vegetation. The trip back to the home village might take two to three days. Once there, it would be further shaped through a combination of fire and water treatment and by blows with a stone hammer. About half of its length was buried in a hole in the ground with a relatively flat surface exposed as the top of the anvil, which usually protruded about 20 cm above ground for young smiths but may be much lower for older smiths (see De Barros 2013: field notes; Dugast 2013: 54–55).

The discovery of numerous anvils within likumanjool sites, some with and some without iron bloom crushing mortars, suggests natural rock outcrops were first used as anvils, perhaps before and during the early period of specialisation in smithing in the Bitchabe region. With the rise of large-scale production, smiths became more particular about the stones used and began to quarry high-quality, homogeneous, hard and compact quartzite from the neighbouring hills for careful shaping and placement in the ground. The areas where natural stone outcrops were used as anvils often later became part of large likumanjool sites needed to deal with the rise of large-scale production. Additional radiocarbon dates obtained from various smelting mounds from Bidjobebe, Bidjomambe, Bitchabe, Binadjoube and Ignare in 2013 indicate decisively that specialisation in smithing began to develop by the mid-fifteenth century. Large-scale production began in the Bassar region by at least the mid-sixteenth century based on existing radiocarbon dates from the Bandjeli smelting zone (De Barros 1986).

**Linguistic notes**

The words in the Bassar language (ncam) are written using an agreed upon transcription method by a committee of linguists (Dugast 2013: 25–26 n4). The Latin alphabet is used with the addition of ɔ (similar to ‘aw’) and ŋ (as in ‘ng’ in camping). In addition, long vowels are doubled (oo), u is pronounced as in ‘who’, c as in ‘tch’, j as in ‘dj’ like in ‘job’, and w as in ‘week’.

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References


