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About the Cover: Several of the Paleo-Indian projectile points documented in C. K. Chandler's article in this issue are reproduced on the cover. Artifacts are from the collection of George S. Meyer.

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THE BINGAMAN CACHE OF STONE TOOLS FROM WEBB COUNTY

Kenneth M. Brown

ABSTRACT

A cache of 23 stone tools, all probably made from small cobbles or pebbles collected from Rio Grande gravel deposits, was found in 1949 by Mr. M. E. Bingaman in northwestern Webb County and is reported here for the first time. The assemblage includes four *Guadalupe* tools, 18 picklike bifacial implements, and one partially bifaced small cobble that probably represents a picklike implement begun but not finished. All have been measured and examined microscopically for use wear. The possible function of these two tool classes is discussed, and the cache is compared to previously reported examples. The *Guadalupe* tools are also compared to those in the Lindner, Peterson, and Granberg caches by means of cluster analysis of selected metric attributes.

INTRODUCTION

In 1949, while hunting for a mountain lion in northwestern Webb County, Mr. M. E. Bingaman found a cache of 23 prehistoric stone tools partially exposed by erosion and collected them, keeping them together as a unit over the past 40 years. In 1988, thanks to STAA member Ray Blackburn, I was able to examine and photograph them. The cache is part of a larger collection amassed by Mr. Bingaman, which Ray is documenting. According to a note written by Mr. Bingaman, the tools were clustered tightly together when found, occupying a space roughly equivalent to that displaced by a small coffee can. The location cannot be pinpointed but is said to be 15 miles from the Rio Grande and 30 miles north of Laredo. This would place it near the old Galvan Ranch or Brewster Ranch, probably near the Cuchara Creek drainage, perhaps somewhere on the USGS 7.5' Velenzuela Creek SE sheet. This location is due south of the Valenzuela Ranch--Piloncillo Ranch area (see Hester 1983) and west of Encinal (Figure 1). A survey west of this area, much closer to the Rio Grande, located two sheetwashed areas with lithic debris among terraces and slopes covered with abundant terrace gravels (Paull and Zavaleta 1979:Figures 6,9).

Each of the tools was assigned an arbitrary specimen number to aid in distinguishing them, and all were photographed in black and white, then examined under low power magnification, usually at 20X or less. All edges were examined for microchipping, edge rounding, or polish, and surfaces were scanned to check for microscopic traces of polish. Measurements, conventions for orientation, and morphological landmarks recognized on the four *Guadalupe* tools follow the precedent set by an earlier study of *Guadalupe* tool caches (Brown 1985:82-83); see that study for definition of terms such as "bit facet" or "dorsal face" (see Figure 2). Linear measurements were made with vernier calipers, angular measurements with a goniometer ruled in one degree increments. Descriptions of individual tools are given below, followed by some remarks on the two tool classes.

GUADALUPE TOOLS

Specimen 1 (Figure 3, A, A')

The largest of the four *Guadalupe* tools and one of the largest implements in the cache, this specimen is made of matte-textured, light gray-brown chert. The distal end is considerably thicker than the proximal end, which has a small patch of tan cobble cortex. Viewed from the side, the ventral face is somewhat irregular in profile. The dorsal ridge is

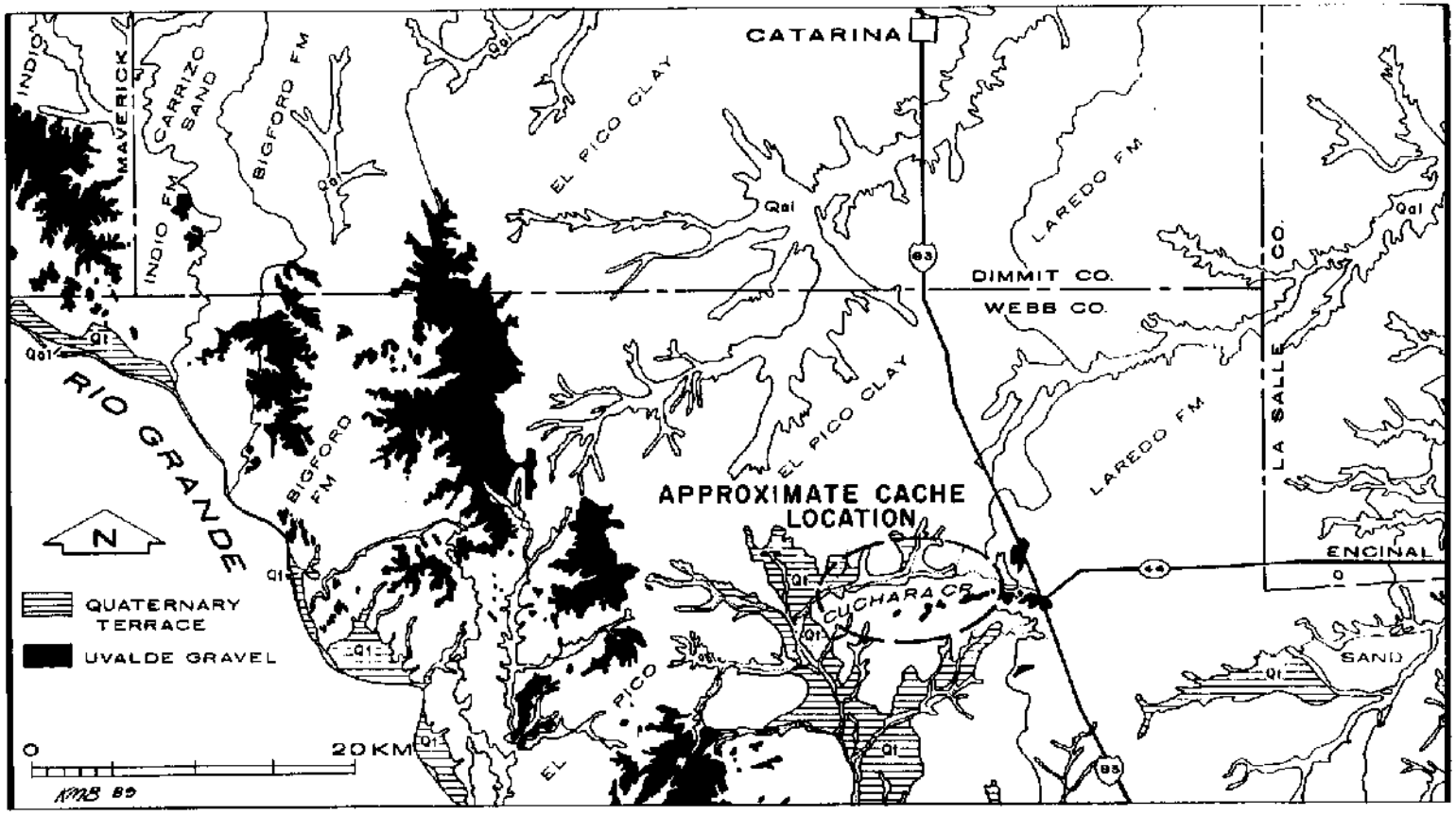

Figure 1. Approximate location and geologic context of the cache. The Bingaman Cache is thought to have been found near the oval area indicated, though not necessarily inside it. The most extensive gravel-bearing deposits (shaded units) lie west of this area, although smaller gravel deposits are present nearby, especially near Highway 83. Base map: Geologic Atlas of Texas, Laredo and Crystal City-Eagle Pass sheets.

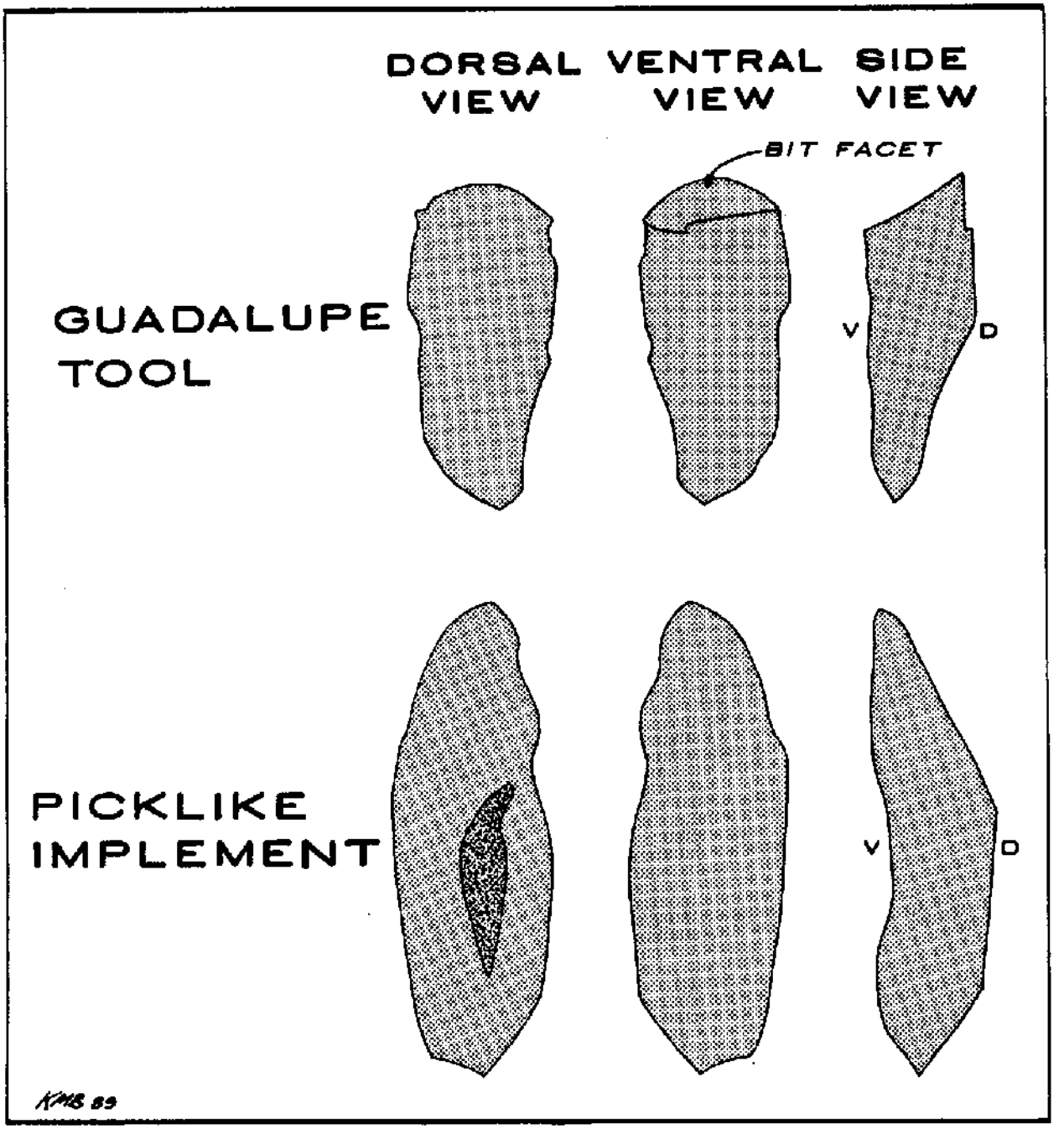

Figure 2. Idealized sketches of *Guadalupe* tool and picklike bifacial implement. Note difference in side view and absence of bit on the picklike implement. Dorsal and ventral faces of side view are indicated by "D" and "V" respectively. Relative sizes of the two tool classes are not necessarily characteristic.

fairly heavily battered. The bit is symmetrically but weakly arched. At 20X, the bit appears to show light to moderate wear, consisting of crushing and light to moderate edge rounding. The working edge is evenly trimmed, lacking any notable protrusions or deep reentrants. Very slight polish is visible on a high area of the bit facet at about 5-7 mm from the working edge. Flake scar ridges on the dorsal face show little or no polish. The dorsal ridge appears ground, something never seen on previously examined Guadalupe tools. One area near the proximal end has light polish on the dorsal ridge (haft wear?). The left lateral edge is heavily ground, but the right edge is unaltered. Perhaps two-thirds (?) of the original bit facet, the posterior part, has been removed by flake scars originating from the left edge; one large scar and several smaller succeeding ones are involved.

Specimen 2 (Figure 3, B, B')

This specimen, as well as the other two Guadalupe tools, is considerably smaller than the first. It is made of a matte-textured light pinkish-beige chert, speckled with small light brown inclusions, and with no cortex present. The ventral face is flat. The bit is symmetrical and moderately arched. The posterior two-thirds of the bit facet has been removed by a flake scar originating from the left (?) edge, with part of this scar subsequently removed by a short scar with a step termination originating from the right edge. At 20X, the working edge appears lightly to moderately rounded, heavily rounded on a few edge projections; the rounding overlies light to moderate crushing of the edge. Several small recent flake scars (damage during curation) are present both on the bit facet and dorsal face. A few prominent dorsal scar ridges show very light polish. Transverse scar ridges on the ventral side show light polish; a transverse ridge at about 15-31 mm from the proximal end has moderate polish. Light polish is present on the ventral face at the proximal end for about 1 cm from the end of the tool. The lateral edges of this tool show variable degrees of (light to heavy) grinding.

Specimen 3 (Figure 3, C, C')

This tool is made of vitreous, variegated gray-brown chert, with a small patch of brown cobble cortex remaining on the proximal end. Small inclusions of light blue-gray, cream, and carmine (2.5 YR 5/7) chert are present, with euhedral quartz crystals and laminated opal inclusions filling some voids. The ventral face is relatively flat, with the tool increasing only slightly in thickness toward the distal end. The bit is symmetrical and weakly arched. A small part of the bit facet has been removed by a short flake scar originating from the left edge, at the posterior margin. The dorsal face has several short (7.5-9.0 mm in length) step-terminated flake scars that probably represent attempted rejuvenation, or possibly manufacturing scars. The working edge is more uneven than in the other three Guadalupe tools. The righthand part of the edge shows some moderately deep reentrants and pronounced edge protrusions. At 20X, protrusions show moderate rounding and crushing. Some small unresolved fractures show here on the bit facet. The left corner of the bit is very heavily step fractured, with multiple fractures stacked almost 5 mm deep. Reentrants show scars anywhere from 0.3 mm to 4.26 mm long with (usually) step or (occasionally) feather terminations. The bit facet shows several broad, shallow scars 0.8 mm to 5.80 mm long. At 40X, most of the working edge shows light to moderate rounding, including reentrants. Edge protrusions appear heavily rounded. This tool seems to have been more heavily used than any of the other three specimens. The left lateral edge has light to moderate rounding with rather heavy battering near the distal end. The right edge shows light to heavy rounding, with crushing and heavy step fracturing in some areas, especially near the proximal end.

A small area with fairly intense polish is visible (at 15X and above) on the ventral face, extending 4 mm back from the right edge; the polished area is 9 mm long and has fairly well developed striations parallel to the long axis of the tool. The area involved includes both low and high spots on a flake scar with undulating surface topography. No other areas of the ventral face seem to have noticeable polish. Some areas have a slight gloss, but this may be the natural luster of the chert.

Specimen 4 (Figure 3, D, D')

This specimen is small, made of light gray, very matte-textured chert with a very dull luster and some brown streaks. The ventral face is fairly flat. No cortex is present on the tool. The proximal end is bifacially chipped. The bit is slightly asymmetrical and moderately arched. The method of forming the bit facet is atypical. It appears to be formed by a concave flake scar apparently originating at the working edge, from a blow delivered to the dorsal face, rolling over onto the ventral face (for this reason, the bit thickness is somewhat indefinite). The working edge was probably lightly trimmed after this removal. Whether this represents evidence of resharpening or is the original method of manufacture is unknown. This mode of bit formation is more typical of *Clear Fork* tools, except that the bit facet occurs on the ventral side (as is typical of *Guadalupe* tools) rather than on the dorsal side.

At 20X, both dorsal and ventral faces show light polish developed on most flake scar ridges. The working edge appears relatively even, without prominent projections or reentrants. The edge is somewhat blunt, showing light to moderate rounding, crushing, and several small, short, broad step fractures on both the dorsal face and bit facet. In summary, this specimen seems to have light use wear.

PICKLIKE BIFACIAL IMPLEMENTS

Present in the cache are 18 stone tools which, for want of a better term, will be designated "picklike implements." These share some attributes with the *Guadalupe* tools -- they are generally long, narrow, thickly bifacial, and in most (but not all) cases tend to be plano-convex in cross-section. Like the *Guadalupe* tools, they are made by hard-hammer percussion. However, there are some important differences. None of these tools has a bit facet or (with two possible exceptions) a perceptible bit. Instead, nearly all the tools are bluntly to sharply pointed at what is presumed to be the distal end. In general, the tools are bipointed in plan view except where one end has been truncated by subsequent damage. Intentional lateral edge grinding seems to be absent. One of these tools is made of a volcanic rock, two or three are made of orthoquartzite (indurated fine-grained sandstone with siliceous cement), one is made of siltstone, while the rest are of chert. The 23rd specimen in the cache appears to be an aborted preform for one of these picklike tools, and is made on a naturally plano-convex cobble, perhaps showing the derivation of the cross-sectional form. Eight of the implements have traces of cobble cortex. Although two or possibly three of the tools may have been made on heavy percussion flakes, the usual mode of production was probably to select and biface a small, naturally plano-convex cobble. More significantly, perhaps nine (or as many as 11?) of the specimens show shearing truncations, hinge fractures, or some other type of damage at what is taken to be the proximal end, and which may represent traumatic in-haft damage.

Specimen 5 (Figure 4, A, A')

This specimen is made of grayish-pink rock, either a very grainy rhyolite or a diorite, and is very crudely chipped. Its rough form may be a function of

the raw material. The dorsal (convex) side retains a yellow-brown patch of weathering rind. This tool is bipointed in plan view, and in cross-section it is roughly plano-convex.

At 20X, all edges appear blunt and rounded, with various degrees of crushing, battering, and step fracturing. Neither flaked face shows any microscopic evidence of smoothing or polishing, although the rock type may not be conducive to polish development in any case. Both ends of the tool were examined at 30-40X. The distal end shows no perceptible use wear. The proximal end has a small truncation, visible without magnification. In summary, this tool is either little-used or not susceptible to formation of use wear. Foster, Bradley, and Foix (1982) have done an experimental study of rates of use wear formation on rhyolite samples collected in Mexico and at El Paso and found that rhyolite does not form diagnostic evidence of wear easily.

Specimen 6 (Figure 4, B, B')

The surface of this specimen is heavily weathered. The raw material is black (pyritic?) siltstone with a siliceous cement, covered with a speckled yellow weathering film. The overall color is greenish gray with a yellow tint. Under magnification, the surface is covered with very small eroded vesicles containing the yellowish weathered cortex. The black core rock shows through in a few small, recent chips. The specimen is bluntly pointed at one end, slightly rounded at the other. One side is fairly flat. The proximal end has a small possible truncation facet.

Some areas of flake scar ridges on both sides show smoothing, some of which appears curational in origin, but because of heavy weathering no observations on use wear or polish can be made. At 20X, edges appear rounded to battered. At 30X, the proximal end appears somewhat battered. As in the case of specimen 5, this tool shows no obvious evidence of wear.

Specimen 7 (Figure 4, C, C')

This specimen is made of light yellowish-gray quartzite, probably orthoquartzite. It appears to have been made from a large heavy percussion flake. The base seems to be formed by a flat, cortex-free, single facet striking platform remnant. In cross-section it is biconvex, although one side is slightly flatter. This side bears the bulb of percussion. The distal end is symmetrically pointed.

At 20X, the left edge shows light to heavy rounding and battering. Heavy smoothing or grinding with incipient faceting is present on the left edge at 20-34 mm from the distal end. Whether this represents edge preparation for bifacing, intentional edge dulling, or some sort of localized use wear is unclear. The right edge has light to heavy rounding, smoothing, and battering. Some edge projections show heavy smoothing or grinding. At 35X, the distal end appears moderately rounded. Some flake scar ridges near the distal end on both faces show slight smoothing.

Specimen 8 (Figure 4, D, D')

This specimen, oval in plan view, is made of coarse-grained, medium gray orthoquartzite and is probably a partially bifaced primary flake. About 80% of the ventral side is covered by grayish-orange cobble cortex; only a narrow area along most of one side has been bifacially flaked (Figure 4, D'). A small facet at the more rounded end may be a striking platform remnant, or else represents a small truncation facet.

At 20X, the distal (more pointed) end appears heavily smoothed and rounded. The left edge is heavily rounded on edge projections, but unaltered in reentrants. The right edge is mostly heavily to moderately rounded and smoothed, primarily on edge projections; some areas show crushing and step-fracturing.

This tool shows no conclusive evidence of use wear, but the rock type may not be conducive to use wear formation. The presence of extensive cortex on one face might suggest that the tool is unfinished, but the evenly trimmed outline seems to indicate that it was, in fact, a finished tool.

Specimen 9 (Figure 4, E, E')

This specimen is made of light gray-brown chert. It is roughly bipointed in plan view and plano-convex in cross-section. A small step fracture 7 mm long and about 9.5 mm wide originates at the distal end on the dorsal face and may represent use damage. A small patch of brown cobble cortex occupies the crest of the dorsal side. The specimen is roughly flaked by hard-hammer percussion with little secondary trimming evident except for part of the ventral face along the left posterior edge.

At 20X, the distal end appears blunt, with some battering and crushing of the tip and adjacent lateral edges. Whether this is manufacturing or use damage is unclear. The left edge shows predominately severe step fracturing, crushing, and battering, with some areas moderately to heavily rounded, chiefly on edge projections. The right edge is similar. Neither face shows any significant polish development.

Specimen 10 (Figure 4, F, F')

This specimen appears to be made of beige orthoquartzite or very grainy chert. It is similar in shape to specimen 7 and may also have been made on a large heavy percussion flake; however, no well-defined bulb of percussion is visible. Both ends have small patches of cobble cortex. The broader (proximal) end may represent the proximal end of the flake, which perhaps had a cortex-covered striking platform.

At 20X, the distal end is thoroughly rounded and partly covered with cortex. Both lateral edges show extensive rounding and smoothing which is generally less pronounced in reentrants and quite heavy on edge projections, especially near the proximal end. Edge rounding is probably a result of percussor scrubbing, though no striations or faceting were observed. No significant polish development was seen on either face.

Specimen 11 (Figure 4, G, G')

This specimen is made of light gray to light tan chert, fine-grained but without vitreous luster. A large patch of yellow-brown cobble cortex occupies the dorsal crest. The specimen is bluntly pointed at the distal end. The proximal end has been truncated by a small flake scar that originates on the ventral face, rolling over onto the dorsal face, ending in a hinge termination. The cross-section is plano-convex.

At 20X, the distal end shows some small-scale crushing and step fracturing (developed on the dorsal face) that probably represents percussor damage. A distal edge projection shows moderate rounding. The left edge shows chiefly step fracturing and crushing, with some edge rounding of projections near the proximal end. The right edge is similar, with perhaps more edge rounding. No significant polish development is present on either face. In summary, this tool shows no conspicuous evidence of use wear.

Specimen 12 (Figure 4, H, H')

This specimen is made of fine-grained, relatively vitreous chert. The distal end is evenly rounded, the proximal end truncated by a shearing fracture. This is perhaps the most carefully made of all the picklike implements. The ventral face is very flat and covered with broad, shallow (soft hammer?) flake scars and is also lightly patinated (the dorsal face is unpatinated). This tool

might possibly have been reworked from some other previously discarded artifact. No cortex is present anywhere on the tool.

At magnifications of about 15X and above, light polish can be seen on the ventral face on a flake scar adjacent to the distal edge, extending about 2.5 mm from the edge. Very light polish can be seen on ventral flake scar ridges, perhaps somewhat more pronounced on the distal end of the tool. A few very small (about 0.2 mm in diameter) burnished spots can be seen in the hollows of ventral flake scars. At 20X, the distal edge appears relatively sharp in reentrants, but edge projections appear collapsed and sheared, possibly from impact against some relatively hard target material. A small invasive scar on the ventral face is associated with one of these shattered edge projections. The dorsal face shows possible light polish both in scars and on scar ridges, but it is confined to within a few millimeters of the distal end.

At 20X, the left distal edge appears battered but somewhat rounded and smoothed on the most distal 15 mm of edge. The rest of the edge shows battering, crushing, and step fracturing. On the right edge, the distal part is again more acute and less damaged, but not rounded as on the left edge. The rest of the edge shows step fracturing, light to heavy battering, and edge rounding.

Specimen 13 (Figure 4, I, I')

This specimen is made of mottled, light gray-brown, highly fossiliferous chert. Visible fossils include fusilinids (*Tridisites* sp.), bivalves, gastropods, and cephalopods. In plan form, the tool is an elongated oval with a somewhat squared-off proximal end formed by a shearing truncation facet. In cross-section the specimen is biconvex, and the designation of one side as dorsal and the other as ventral is somewhat arbitrary (the flattest side is here termed ventral). Heavy battering at the intersection of the dorsal face with the truncation facet may indicate the facet served as a platform for an unsuccessful attempt at thinning of the proximal end. Alternatively, the tool may be made on a flake and the truncation facet might conceivably represent a striking platform remnant, but there is no bulb of percussion visible to indicate it.

At 20X, the distal end appears relatively sharp and pristine. Some small-scale crushing and step fracturing is present in a few places, but this is probably percussor damage left from manufacture. The proximal facet shows fairly heavy battering along both edges. Neither face of this bifacial tool shows any significant polish development. The left edge shows light to heavy battering and step fracturing. One short edge segment near the midpoint of the tool has what appears to be moderately well developed edge grinding. Because it is not very extensive, it may represent edge scrubbing rather than intentional dulling in preparation for hafting. Most of the right edge has moderate to heavy edge rounding and grinding. The grinding is not concentrated on edge projections, but occurs in reentrants as well. This indicates the tool edge was not ground against a large flat abrader, but rather against something like a small percussor that was able to follow the sinuosities of the edge to some extent. I suspect edge scrubbing is indicated, rather than pre-haft edge dulling. No pronounced faceting or longitudinal striations were observed after inspection at 40X.

Specimen 14 (Figure 5, A, A')

Made of matte-textured, light gray-brown chert, this specimen is rather sharply pointed at one end and somewhat squared off at the other. It is essentially triangular in cross-section. Several of the bifacing flakes removed on either side seem partly to have followed minor flaws in the chert, leaving an irregular nonconchoidal scar surface. No cortex is present. The proximal end has a small truncation facet. The pointed distal end is formed by the intersection of a nonconchoidal shearing facet with two other flaked faces.

At 20X, the distal point appears somewhat smoothed and rounded. Neither face shows any development of polish or smoothing of flake scar ridges. The left lateral edge shows (in turn, from distal to proximal end) step-fracturing, a section of unaltered edge, and moderate to heavy rounding (probably edge grinding). The right edge shows step fracturing and light to moderate edge rounding. In short, there is no obvious evidence of use wear on this tool.

Specimen 15 (Figure 5, B, B')

This specimen is made from a naturally fractured cobble fragment of light gray chert. The ventral face is formed by a smooth, slightly convex, curving natural fracture surface that has been modified by two major hard hammer percussion scars (plus one or two subsequent small ones) near the midpoint and another scar at the proximal end, all originating from the right edge. This natural fracture surface has been used as a platform for flaking the dorsal face, the right proximal part of which is still covered with cobble cortex. The proximal end has an irregular, concave truncation facet.

At 20X, no polish is visible on the ventral surface; a small area of (fortuitous?) very light polish is visible on dorsal cortex near the proximal end. At 20X, the distal end shows no conspicuous wear. A small invasive flake scar is present on the ventral face. The left edge shows step fracturing on the distal part, heavy edge rounding and possible grinding on the midpart, and discontinuous light to heavy edge rounding on the proximal part. The right edge shows mostly extensive step fracturing, overlaid in some places by light edge rounding.

Specimen 16 (Figure 5, C, C')

This specimen is made of light gray-brown chert and is plano-convex in cross-section. The distal end is bluntly pointed, while the proximal end has an angular truncation produced by small flake scars originating from the dorsal face. Some very small patches of what appear to be cortex remain on the dorsal crest near the proximal end. The distal point of this tool has been removed by a very small truncation fracture originating from the dorsal surface. The resulting edge is angular, with relatively little crushing visible at magnifications up to 40X. Light polish shows on the dorsal face adjacent to the distal (truncated) end and at various places on more prominent flake scar ridges on the distal part of the tool. It is visible at magnifications of about 30X and above, but shows more easily at higher magnifications. Some of the polished ridges extend to the lateral edges of the tool. A few very small burnished spots are present, both in scar hollows and on ridges; these are uncommon, however. The proximal truncation facet shows moderately well developed polish (on both high and low spots, but somewhat better developed on the former), including a cluster of small burnished spots. This damaged proximal end is tentatively regarded as artificial in origin, not a naturally fractured surface, although it is admittedly possible that both the polish and the polish-bearing surface could be a remnant of a naturally fractured surface.

On the ventral surface, beginning about 6 mm from the distal end, and adjacent to the left lateral edge, is a semicircular patch of very intense, glossy polish about 6.3 mm long and extending about 7.5 mm from the edge. The polish extends up to the bifacial edge, but does not lap over onto it or onto the opposite face. Without magnification it appears as a darker gray area. Inspection at up to 60X shows no striations or other directional features. The origin of this heavy gloss deposit is problematical. It does not seem to be the polished remnant of a previously used tool face isolated by resharpening flake scars. A tentative explanation might be that it is an area of anomalously accelerated polish development resulting from a localized textural change in the

chert. Whether this results from use, wind abrasion, or is a remnant of a previous naturally altered surface is uncertain.

The left lateral edge shows light to moderate edge rounding in some areas at 20X, with crushing and step-fracturing in others. Discontinuous moderate to heavy edge grinding is visible in the middle to proximal part of the edge, confined mostly to edge projections. This probably represents deliberate edge dulling, most likely edge scrubbing associated with manufacture. The right edge is essentially the same.

In summary, this specimen shows some fairly definite evidence of use in the form of light polish on dorsal scar ridges. More areally extensive and better developed polish is present on the ventral face and proximal end, but is less certainly a result of use.

Specimen 17 (Figure 5, D, D')

This specimen is made of relatively fine grained, light gray-brown chert. The dorsal ridge is covered with yellow-brown cobble cortex, extending to the proximal end. The specimen is more or less triangular in cross-section, and like specimen 12, has a rather flat, slightly patinated ventral face. The proximal end has been removed by an irregular truncation facet apparently originating in a blow delivered to the cortex-covered dorsal surface. In plan view, the specimen is fairly symmetrical with an arched distal end.

At 35X, slight crushing and rounding of the distal edge is visible. Considerable step fracturing of the ventral face is present along the right edge as a result of using the dorsal side as a platform from which to flake the ventral face, and some of this step fracturing approaches the distal end. It appears to represent manufacturing damage rather than use wear, however.

At 20X, light to moderate polish is visible on ventral scar ridges at various places. The best example (and heaviest development) occurs on a ridge near the midpoint of the tool, at the point of maximum convexity 46 mm from the distal end (viewed from the side, the ventral face is not flat but makes a convex arch from the distal to the proximal end). Other examples occur on the proximal half of the ventral face, but the polish seems to be confined entirely to scar ridges. It also occurs at the juncture of the ventral face and proximal truncation facet. Polished areas were inspected at magnifications up to 60X, but no striations or other linear features were seen.

The dorsal face also has polish very similar to that on the ventral face; it occurs mostly on scar ridges, although a few areas in scar hollows also have definite patches of polish. Ridges with polish occur both on the distal half of the tool and on the right proximal part. Scar ridges extending nearly to the distal end also have polish. Polish can be characterized as rather light in development; affected areas are neither very extensive or very glossy. Inspection at up to 60X shows no linear features.

At 20X, the left edge shows considerable crushing and small-scale step fracturing due to percussor damage. There is no significant evidence of edge grinding. The right edge is generally similar, but also shows slight edge rounding on some segments. Very light discontinuous polish appears on high spots on the dorsal face next to the right edge, in some places extending to the edge but not overlapping it. In other places, light polish can be seen on the edge itself, both in reentrants and projections. Edge polish is best developed at about 39-57 mm from the distal end. This section corresponds to the area of maximum convexity of the ventral face.

In summary, this specimen shows definite evidence of use wear, although use was clearly not traumatic or very extensive. The presence of polish on both faces and on both proximal and distal areas as well as one edge segment may suggest the tool was not hafted, since a haft presumably would have covered much of the proximal part of the tool and protected it from polish development. None

of the polish appears characteristic of haft wear. Polish development favoring high spots indicates the target substance was not very pliable.

Specimen 18 (Figure 5, E, E')

This specimen is made of a light gray-white chert with a milky, chalcedonic, matte texture. No cortex is present. In cross section the specimen is roughly biconvex, and designation of one side as "dorsal" and the other as "ventral" is rather arbitrary. Likewise, in plan view the tool forms an elongated oval with somewhat squared-off ends. One end has a truncation facet and is here arbitrarily designated proximal. The truncation consists of a concave snap facet originating from the surface designated dorsal, ending in a step termination; the edge created shows no microscopic damage.

The "distal" end has been retouched on the dorsal face, leaving some small step fractures. Viewed at 20X, the distal edge shows in various places slight rounding, heavy rounding and battering, and shattering that may be due either to percussor damage or to use.

At 20X and above, the dorsal face shows fairly well defined polish, restricted to high spots and chiefly concentrated along a prominent flake scar ridge running down the midline of the tool. Concentration of the polish on high spots indicates contact with a fairly hard, unyielding substance. Polish occurs on both proximal and distal parts but seems to be slightly better developed on the distal half. Inspection at up to 60X shows no linear features associated with the polish. Examination of the "ventral" side at 20X shows similar polish, also confined to high spots, though not as well developed. It is absent from the distal 2 cm, apparently because of unusually grainy surface texture. It is only weakly developed on the proximal half, and not very widespread. In summary, this specimen shows limited evidence of use, similar to that seen on specimen 17.

Specimen 19 (Figure 5, F, F')

This tool is made of very light gray, matte-textured chert, with widely scattered very small, orange iron-stained voids. A narrow strip of cobble cortex runs down the dorsal ridge. In plan form, it is bluntly bipointed. In transverse section it is roughly triangular, but in longitudinal section it is concavo-convex; that is, the ventral face is markedly convex while the dorsal side has a concave profile, resulting in upturned distal and proximal ends. For this specimen, the designation of ends as distal and proximal is essentially arbitrary.

At 20X, the distal end can be seen to have many very small step fractures *en echelon* on the dorsal face, probably due to percussor damage. A couple of small unresolved fractures appear on the ventral face; these could be either use damage or percussor damage. The edge is fairly acute. The tool edge at the proximal end is more irregular and shows moderate to heavy rounding on edge projections; some edge rounding appears in reentrant areas.

At 20X and above, poorly developed polish can be seen, confined almost entirely to flake scar ridges on both the ventral and dorsal faces. It is somewhat better developed on the ventral face but is neither well developed nor extensive anywhere. One ridge intersecting with a lateral edge has a polished high spot very near the edge.

At 20X, most of the left edge shows fairly continuous moderate to heavy rounding and battering, probably a result of intentional edge dulling. One edge projection about 6 mm from the proximal end shows heavy edge grinding. The right edge is similar, also apparently showing edge grinding; two edge projections may show incipient faceting. Whether this intentional edge dulling is related to manufacture or to use is unknown.

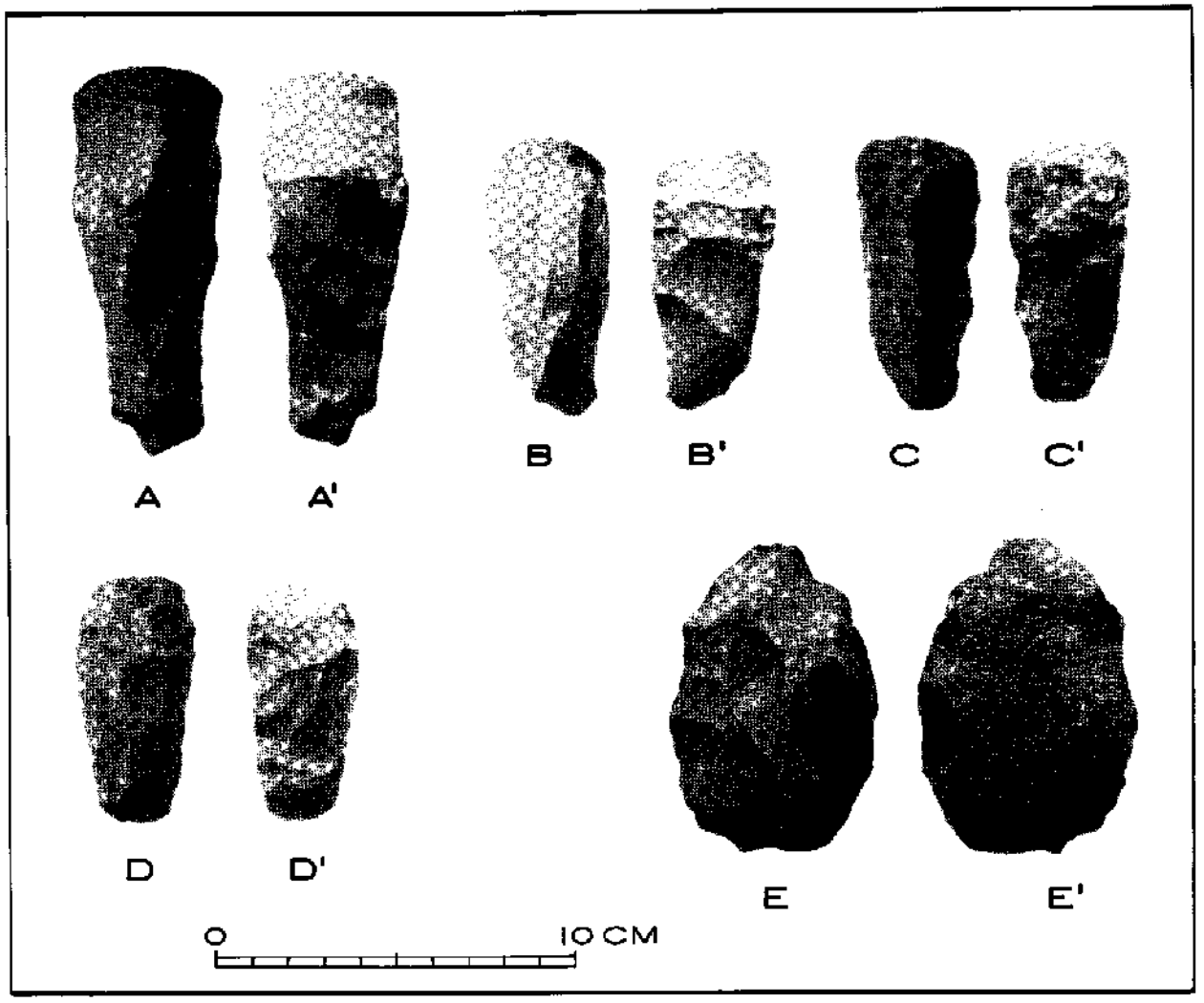

Figure 3. Guadalupe tools (A-D') and partially bifaced cobble (E, E'). A, A', Specimen 1; B, B', Specimen 2; C, C', Specimen 3; D, D', Specimen 4; E, E', Specimen 23. For each pair of specimens, dorsal face is shown on left and ventral face on right; distal end is at top of illustration.

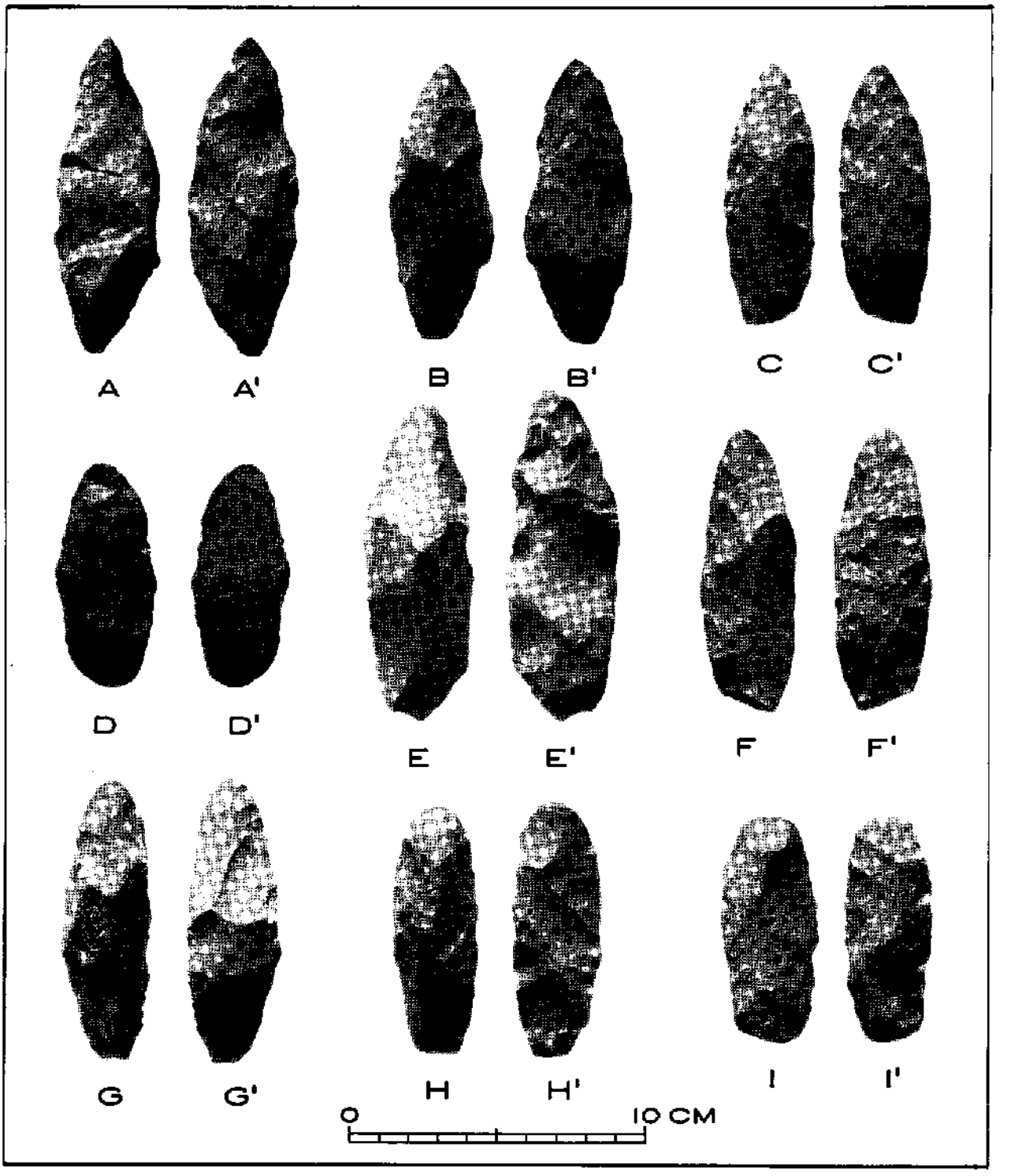

Figure 4. Picklike Bifacial implements. A, A', Specimen 5; B, B', Specimen 6; C, C', Specimen 7; D, D', Specimen 8; E, E', Specimen 9; F, F', Specimen 10; G, G', Specimen 11; H, H', Specimen 12; I, I', Specimen 13. For each pair of specimens, dorsal face is shown on left and ventral face on right; presumed distal end is at top of illustration.

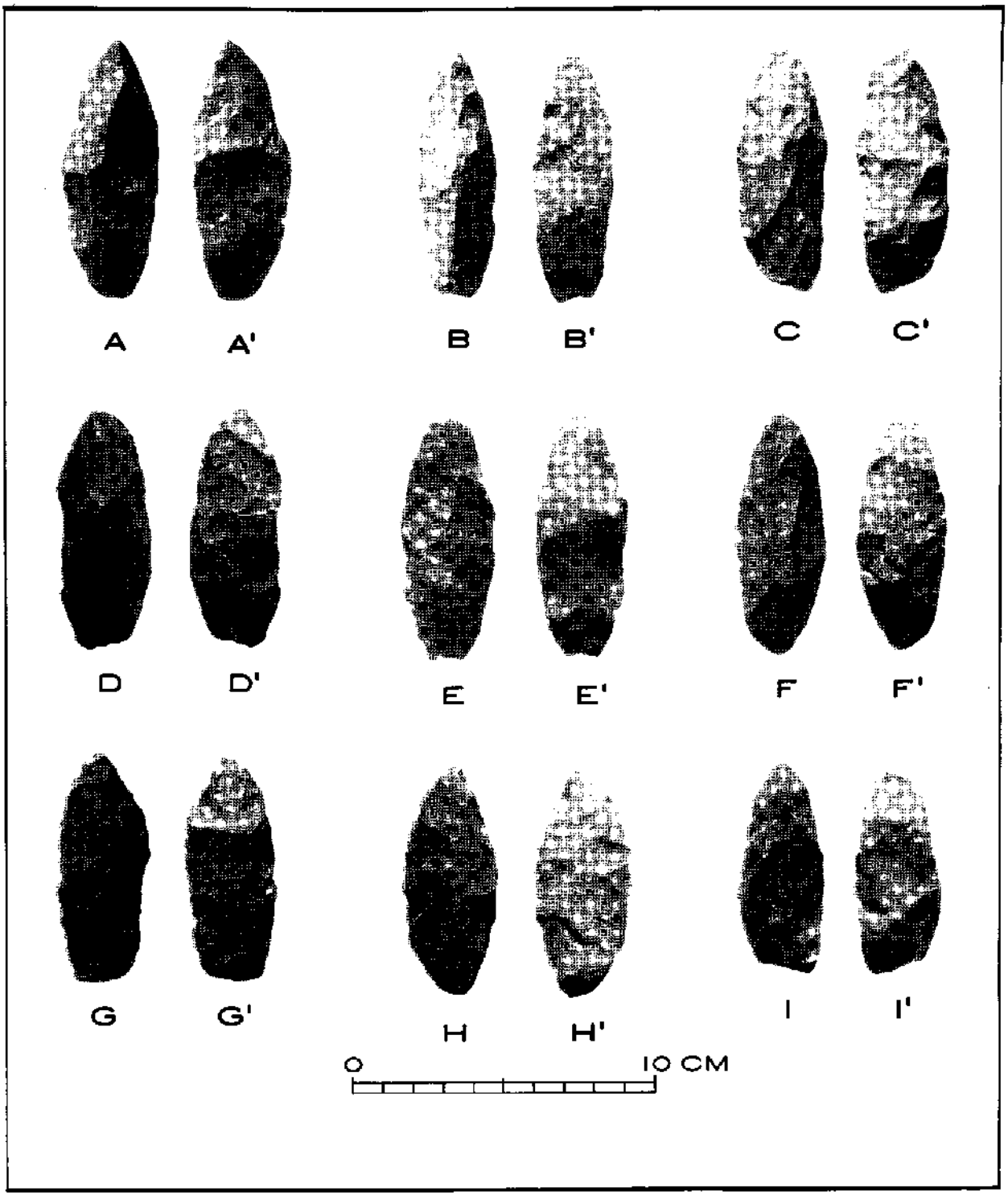

Figure 5. Picklike bifacial implements. A, A', Specimen 14; B, B', Specimen 15; C, C', Specimen 16; D, D', Specimen 17; E, E', Specimen 18; F, F', Specimen 19; G, G', Specimen 20; H, H', Specimen 21; I, I', Specimen 22. For each pair of specimens, dorsal face is shown on left and ventral face on right; presumed distal end is at top of illustration.

In summary, this specimen seems to show very slight evidence of use in the form of incipient polish, but it is less well developed than on specimens 17 or 18.

Specimen 20 (Figure 5, G, G')

This specimen is made of medium gray chert mottled with some small, very light gray patches. The chert is heavily flawed with hairline fissures throughout. Under magnification, the fissures can frequently be seen to be filled with microscopic crystals, and flake scar surfaces follow or are abruptly interrupted by these fissures. Because of this flawing of the chert, the flaking is exceptionally crude, and the lateral edges show heavy battering from the extra force required to detach flakes. In plan view, the specimen is bluntly pointed at the distal end, with a squared-off proximal end formed by a small remnant patch of yellowish-brown cobble cortex.

At 30-40X, the distal edge appears to have small-scale step fracturing partially obliterated by moderate edge rounding. This edge rounding may be use-related, rather than a result of manufacturing. Some of the abrasive rounding extends onto dorsal flake scar ridges near the distal end.

At 20X, on the dorsal face, some very small (about 0.1-0.2 mm in diameter) patchy, highly burnished areas can be seen in the left proximal quadrant of the tool, near the left edge. Moderately well developed polish appears on flake scar ridges in the right proximal quadrant, at roughly 9-13 mm from the proximal end and extending to the lateral edge. This area of polish is fairly extensive, but favors high spots on the surface of the tool; it extends to about 4 mm from the right edge but does not lap over onto the edge itself. No linear features are visible at 60X. Very light polish appears on a few scattered scar ridges on the distal part of the dorsal face; these are neither well developed nor extensive. The ventral face is similar and has scattered occurrences of light, poorly developed polish on flake scar ridges on both proximal and distal parts of the tool, visible at 35X.

The left lateral edge was inspected at 20X. One edge projection has very severe battering and crushing due to hard hammer damage. Most of the rest of the edge has extensive step fracturing, with light to moderate edge rounding. At 30X, the right edge appears similar; light to heavy edge rounding is present, and one section of edge near the midpoint of the tool has an abrupt shearing fracture. Very small traces of hematite or iron-rich sediment are visible in crevices along the right edge near the proximal end.

In summary, this specimen shows slight traces of use, both in the form of facial polish and possible use-related attrition of the distal end.

Specimen 21 (Figure 5, H, H')

This artifact is made of mottled light yellow-gray, matte-textured chert. A very small remnant strip of cobble cortex remains along the dorsal ridge, with another small patch on the proximal end. This specimen is fairly well made by comparison to most of the other representatives of this tool class. The ventral face is relatively flat, showing broad, shallow flake scars. In plan view the specimen is somewhat leaf-shaped, with a rather asymmetrically pointed distal end, and a slightly squared off, cortex-covered proximal end. In transverse section the specimen is more or less plano-convex.

Under magnification, the distal end appears somewhat irregular because of the percussion removal of small flakes from the dorsal face. The short remaining section of distal edge shows small crushed or shattered areas but is mostly characterized by light edge rounding. Very light facial polish is visible on the ventral face adjacent to the distal end. Most of the flake scar ridges on the ventral face show light polish that is somewhat better developed than that

at the distal end. In some cases polished scar ridges extend to lateral edges. Some areas near lateral edges have extensive but poorly developed patches of polish.

The dorsal face is similar. Both areally extensive but poorly developed polish in flake scars, plus somewhat better developed polish confined to flake scar ridges are visible and more or less evenly distributed over the dorsal face.

The left edge shows moderate step fracturing and light to moderate edge rounding, favoring edge projections. One edge projection near the proximal end may show evidence of percussor scrubbing. The right edge shows more crushing and less rounding. Neither edge shows any intentional edge dulling in relation to hafting. In summary, this specimen shows only slight evidence of wear.

Specimen 22 (Figure 5, I, I')

This specimen is made of light gray chert with a chalcedony-like appearance and matte texture. Small subcircular fossils with an oölitic growth pattern can be seen microscopically. No cortex is present and it is possible this specimen has been made on a flake, rather than by reduction of an entire cobble. A large truncation facet is present on the proximal end, and conceivably could represent a striking platform remnant, although flaking of the ventral face has left no discernible bulb of percussion.

At 20X, the edge at the distal end shows very small scale step fracturing on the dorsal face and minor rounding of the edge. A few very small, rather deep scars with step truncations are present on the ventral face.

At 20X, most of the flake scar ridges on the ventral side show moderately well developed, fairly extensive polish. The interior of a major flake scar near the center of the ventral face has a small, irregular burnished patch about 2 x 5 mm in size. A ventral facet (not a flake scar?) at the distal end of the tool is triangular in shape and about 5 x 9.6 mm across, and is uniformly covered with fairly well developed polish. The dorsal face shows little or no polish development.

At 20X, most of the left edge shows moderate rounding over step fracturing, generally favoring edge projections. The right edge is more acute and features a number of small but deep reentrants produced by percussor retouch. Comparatively little edge rounding is present. In summary, slight traces of use wear seem to be present on this tool, but are visible only on the ventral side.

PARTIALLY BIFACED COBBLE

Specimen 23 (Figure 3, E, E')

This specimen consists of a naturally plano-convex cobble partially bifaced by using the flat side as a striking platform to remove most of the cortex (except for a narrow longitudinal strip) on the convex side, accomplished by about 10 major flake removals plus an unknown number of smaller ones. The modified dorsal side was then used as a platform to remove four or five small flakes from the ventral side; perhaps 80% of this side remains covered by cortex, however. The rock type is an unidentified reddish brown to dark gray igneous (?) rock with a grainy rhyolitic texture.

This partially bifaced cobble may represent an aborted preform for another picklike implement. It suggests the plano-convex sectional form of many of these tools may be at least partially derivative from the original cobble shape, if cobbles with one flat and one rounded side were deliberately selected. Perhaps the manufacturing process was abandoned because the rock was too anisotropic and too difficult to flake, although obviously the specimen was retained in the cache and not discarded.

The edges were examined at 20X and are exceedingly irregular, blunt, and pitted (by exposed voids in the rock). A few edge projections that may show percussor scrubbing were noted, but otherwise there are no edge modifications. At 20X, slight polish is visible on a ventral flake scar at the distal end, particularly near the left edge. The origin is unknown.

length	88.44 mm
maximum width	60.00 mm
maximum thickness	30.00 mm
weight	164.9 g

CLUSTER ANALYSIS OF *GUADALUPE* TOOL CACHES

Having the four *Guadalupe* tools in the Bingaman cache available for measurement permits comparison with the previously examined Lindner, Peterson, and Granberg caches. All 23 *Guadalupe* tools from these four caches were compared metrically by means of cluster analysis. The first step was to select, from the nine variables recorded for all 23 tools, the four measurements that would best express the morphological consistency within each cache. The procedure used was to compute the coefficient of variation for each measurement, average the coefficients of variation across all four caches, and then pick the four variables that had the lowest average coefficients of variation. These proved to be 1) maximum tool width; 2) bit facet/ventral angle; 3) dorsal length; and 4) maximum bit width. These are the four variables out of the nine recorded that are believed to best document the extent to which caches may be morphologically homogeneous.

Data for each of these four measurements were entered in a data table for each of the 23 tools, then a matrix of pairwise Pearson's product-moment correlation coefficients was calculated as input to the clustering program. Cluster analysis was done on an IBM PC using MVSP, a program package written in Turbo Pascal by Warren Kovach. The unweighted pair group method of average linkage clustering was used.

The results (Figure 6) suggest that tool morphology is not sufficiently homogeneous within caches or distinct between caches to map cache membership faithfully, at least with the variables and clustering method chosen. Except for the Bingaman cache, the morphologically recognized clusters do not correspond very well to the actual specimen composition of the caches. In large part, this is due to the fact that all the tools are much the same. This is indicated by the tendency of most specimens to cluster at an average linkage distance of 1.00. The three smallest Guadalupe tools from the Bingaman cache form a cluster together with Granberg specimen 17, while the largest tool in the Bingaman cache joins a large cluster with specimens from the Lindner, Peterson, and Granberg caches (to the left side of Figure 6).

SUMMARY AND CONCLUSIONS

This cache of 23 prehistoric stone tools contains two tool classes, consisting of four *Guadalupe* tools and 18 picklike implements of unknown function, plus a partially bifaced cobble that is interpreted as an aborted preform for one of the picklike implements. Some examples of both tool classes have definite though not extensive microscopic use wear, while other examples seem to have little or no visible wear. There is a wide range of rock types evident in the cache, and it seems quite possible that some types of raw material represented here may not be conducive to rapid formation of polish or other use traces. Although one or two of the *Guadalupe* tools show possible evidence of incipient maintenance, none of the picklike implements shows any evidence of

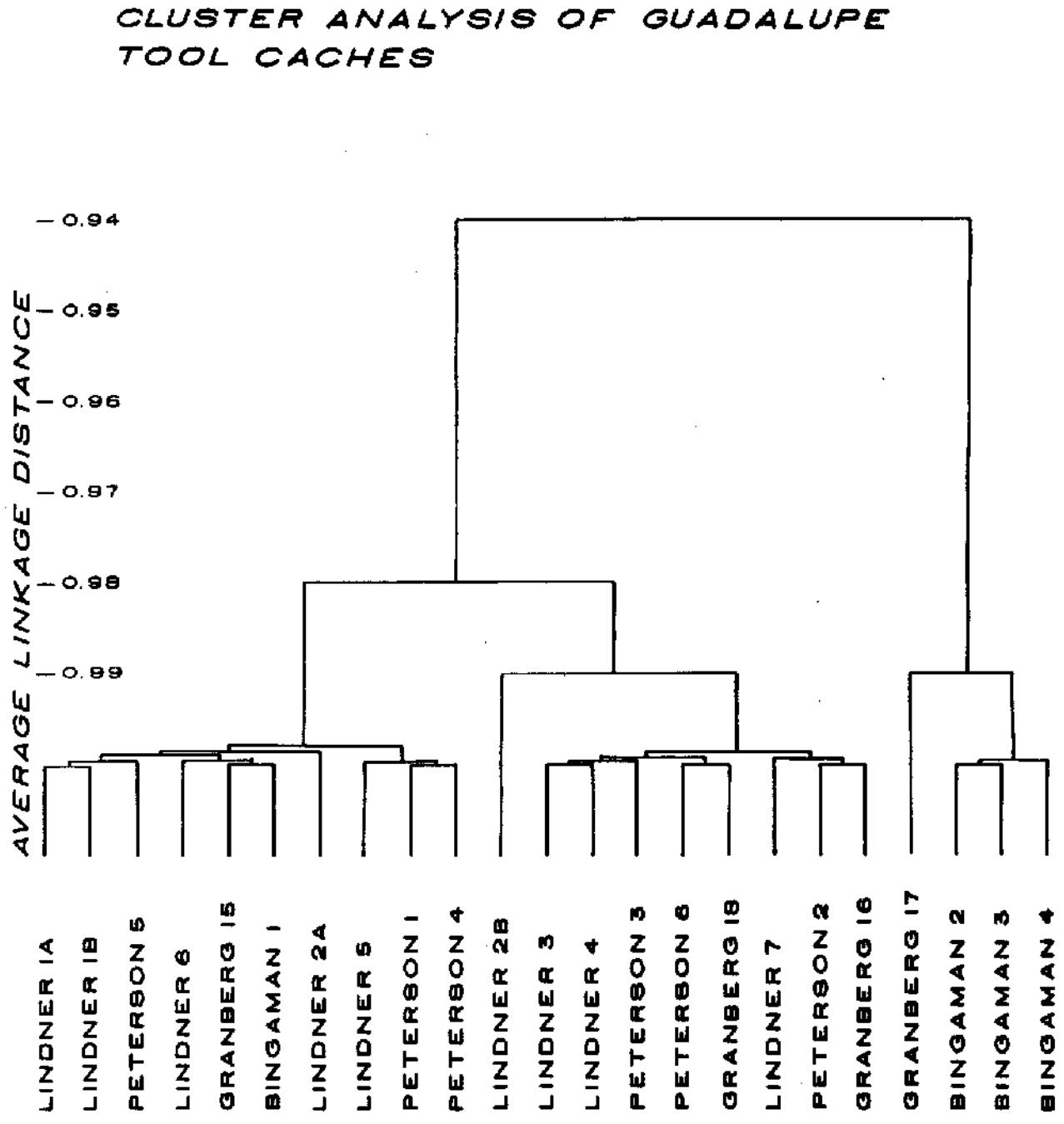

Figure 6. Cluster Analylis of 23 Guadalupe tools from the Lindner, Granberg, Peterson, and Bingaman caches. The four variables used were tool width, facet/ventral angle, dorsal length, and maximum bit width. The similarity coefficient used was Pearson's r, and the clustering method used was the unweighted pair group method.

resharpening. Looking at the cache as a whole and considering the two tool classes together, we can say that the specimens in the cache experienced rather limited use before caching and none were used heavily enough to require significant maintenance. Some specimens were either never used at all, or were made of rock types that do not signal wear easily.

The function of the picklike implements remains enigmatic. It is, however, quite clear that

1) they are not Guadalupe tools;
2) they are not preforms for Guadalupe tools;
3) they are not reworked or exhausted Guadalupe tools;
4) they are not cutting tools.

Unlike Guadalupe tools, which have a well-defined cutting edge along the margin of the bit facet, and are probably woodworking adzes, the picklike implements have no cutting edge at all. Most of them come to a blunt or slightly rounded point. None of the distal ends of the tools show any significant evidence of impact against a target material. The most frequent evidence of use consists of limited polish on flake scar ridges, on either face. The absence of purposeful edge grinding and the widespread occurrence of polish in areas of the tool that would otherwise be covered by a haft suggest these tools were not hafted, unlike the Guadalupe tools. And unlike the Guadalupe tools, they tend (except for a few examples such as specimens 20 and 21) to lack a cushion of cortex on the proximal end.

The two tool classes also show contrasting manufacturing trajectories. Guadalupe tools are made with a highly conventionalized manufacturing trajectory that is designed to produce an evenly arched cutting edge formed by the intesection of a quartering facet with a unifacially retouched edge and are always made on large heavy percussion flakes. The picklike implements, on the other hand, are simply relatively crude hard-hammer percussion bifaces. A few examples (specimens 7, 10, and possibly 22) may be made on large flakes, but most are probably bifaced cobbles originating from protoforms like specimen 23. One example (specimen 15) is made on a naturally fractured chert spall; other examples have one patinated face, perhaps suggesting expedient collection and reworking of older artifacts.

Caches are of particular interest to archaeologists for a variety of reasons. For one thing, membership in a cache implies that all specimens are essentially contemporaneous (allowing for the possibility that some specimens may have been retrieved or added to the cache over time). For another, in many cases there is a relatively high probability that all the specimens were cached by a single individual, and sometimes we can even make a convincing case that all the specimens were made by the same individual (see Brown 1985). Where the Lindner, Peterson, Granberg, and Bingaman caches are concerned, cluster analysis of metric attributes does not reproduce cache membership, but this probably just indicates that such morphologically simple artifacts as Guadalupe tools do not carry enough stylistic information to map cache membership faithfully. The Bingaman cache is of special interest because it contains two separate tool classes, distinct in manufacturing trajectory, in numbers, and in type of use wear. These two tool classes, Guadalupe tools and picklike implements, clearly had distinct functions, but do the functions represent tasks that were related as elements of an overall project (for example adzes to make wooden parts of an artifact and "picks" to make another part of different material) or do they represent otherwise unrelated tasks that were merely carried out in the same locality? Until we can learn more about the function of the picklike implements, this question will remain obscure.

TABLE 1. Metric Attributes of *Guadalupe* Tools

	Specimen 1	Specimen 2	Specimen 3	Specimen 4
Dorsal Length (mm)	115.70	77.74	74.92	68.10
Ventral Length (mm)	78.34	58.06+*	67.82	58.14
Maximum Bit Width (mm)	31.92	29.30	33.64	25.96
Maximum Tool Width (mm)	39.74	34.24	35.26	32.52
Maximum Tool Thickness (mm)	38.20	27.48	22.00	18.42
Bit Thickness (mm)	26.32+**	10.96+*	13.36	16.02***
Bit Facet/Ventral Angle (degrees)	128	128	124	119
Bit Spine-Plane Angle (degrees)	69	69	73	64 (approx.)
Weight (g)	150.03	70.02	58.40	44.00

* Posterior part of bit facet removed by sidestruck flake scar.
** Posterior part of bit facet removed by sidestruck flake except on one side.
*** Bit thickness is somewhat indeterminate because bit facet rolls over onto ventral face.

TABLE 2. Metric Attributes of Picklike Implements.

Specimen Number	Length (mm)	Maximum Width (mm)	Maximum Thickness (mm)	Weight (g)
5	109.14	36.96	32.22	98.0
6	95.58	35.68	31.54	91.7
7	90.26	31.16	19.42	55.1
8	77.82	35.52	18.60	51.0
9	110.86	37.36	28.70	122.0
10	98.86	37.78	17.28	57.1
11	96.18	30.38	30.92	91.8
12	86.46	30.50	19.88	62.3
13	79.10	33.54	16.92	52.4
14	87.36	33.00	26.28	60.4
15	84.18	27.36	21.86	49.0
16	82.78	31.28	20.68	51.9
17	78.12	29.60	23.66	58.5
18	79.50	31.36	19.98	52.5
19	78.00	29.76	20.38	46.0
20	75.48	31.00	22.88	51.0
21	77.92	33.32	17.38	44.6
22	70.94	29.50	16.42	38.0

Schlanger (n.d.) recognizes five types of caching behavior from the ethnographic record. Two of these may be relevant to the Bingaman cache: "moving-day" caching (short-term caching of goods to be collected at a later date; and "load-exchange" caching (storage of tools away from a site, at their point of use, allowing for transport of collected resources on the return trip). Most of the tools in the Bingaman cache showed some microscopic evidence of use, indicating that they were not simply fresh specimens cached near the site of manufacture. On the other hand, none of the tools were exhausted, indicating they were still functionally useful when put into storage. The total weight of the cache is only about 1.62 kg, not a burdensome weight. Taking all these properties together, we might tentatively conclude that the Bingaman specimens represent a load-exchange cache (pending better identification of the function of the picklike implements). Metric attributes of Guadalupe tools and Picklike implements are found in Tables 1 and 2.

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