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# A Closer Look at Margin "Grinding" on Folsom and Clovis Points

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ONE distinctive attribute of most fluted points is the presence of intentionally dulled lateral and basal margins. This attribute, variously called "grinding," "abrading," or "dulling," has been assumed to have been incorporated into the tool design to prevent cutting the fiber wrapping by the otherwise freshly flaked margins.

It is herein proposed that there is an alternative explanation for the intentional dulling of tool margins. Experimental replication offers insights into the methods used to dull tool margins, and breakage pattern analysis suggests dulled margins may have served to strengthen the basal portion of stone projectiles, thus preventing breakage of the projectile within the wood or bone foreshaft.

Fluted points recovered from the Snake River Plain of southern Idaho were examined to document their diversity in form and technological attributes (Titmus and Woods 1988, 1991). Although hundreds of fluted points had been recovered from this area, only 38 were reported in the professional literature, and of these, only 28, including 12 Clovis and 16 Folsom points, were available for this reanalysis. The 28 points were recovered from 20 locales, and most were isolated surface finds, excluding the materials from the well-known Simon site (Butler 1963; Butler and Fitzwater 1965) and Wasden site (Dort and Miller 1977; Miller and Dort 1978; Miller 1982). One other locale with subsurface materials was the Crystal Springs site (10GG207) reported by Murphey (1985).

The Crystal Springs site has received little attention in the literature but has been the sub-

ject of considerable oral debate because of the questionable context of the recovered cultural materials. The artifacts were uncovered by heavy equipment during fish hatchery construction and most were immediately collected by construction workers. Further, while one distinctive Clovis point, several large Clovis-like bifaces, and several Clovis-like percussion macroblades were recovered, some of the artifacts found with them are typologically abnormal in comparison with other Clovis-age materials from this region.

While much of the material unearthed at the Crystal Springs site was removed by construction workers, some was later salvaged by archaeologist Kelly Murphey. The material Murphey retrieved included a single Clovis point, large ovate bifaces, percussion macroblades, a shouldered bone point with tapered stem, and assorted flake tools.

We were initially interested in incorporating technological data from the single Clovis point from this site into a comparative base for southern Idaho fluted points (Titmus and Woods 1988, 1991). During this investigation, our attention was drawn to a large leaf-shaped biface. This biface was interesting because it had Clovis-like percussion-flake scars and blade form, yet had wide, shallow side-notches, a trait not associated with Clovis materials (Fig. 1). Interestingly, similar notches have been noted on the distal end of the largest Clovis point from the Simon site (Woods and Titmus 1985). While examining the Crystal Springs biface, a bright sheen was observed on the margin around

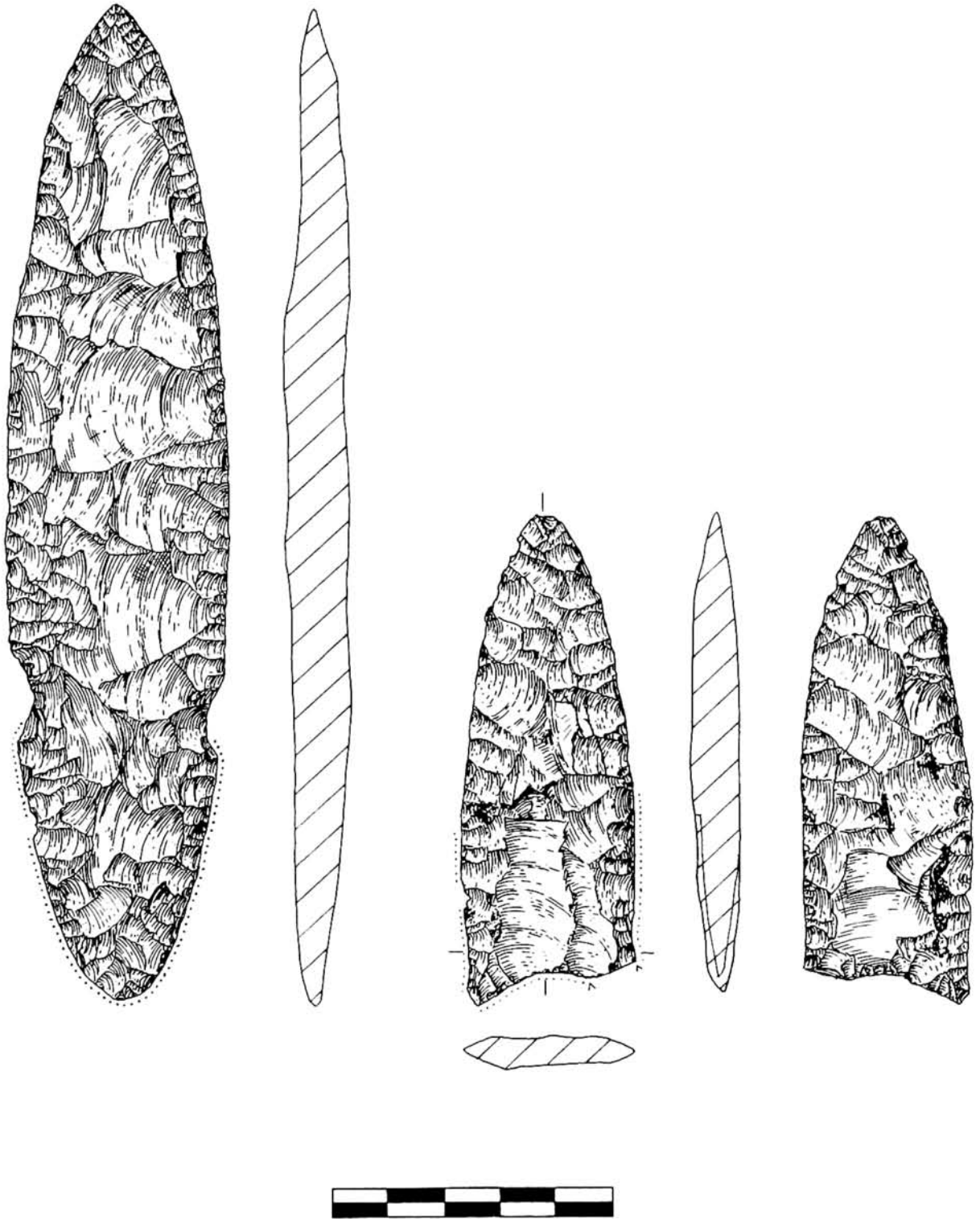


Fig. 1. Lanceolate biface and Clovis point from the Crystal Springs site, Idaho. Dots indicate extent of lateral margin dulling (cm. scale).

its proximal end, extending from one notch to the other, and covering the basal one-third of the biface. The smoothing extended into the notches and appeared to be the result of intentional smoothing; it was much too well-developed to have resulted from use.

The presence and character of this unusual margin treatment prompted us to look more closely at the margins of the Clovis point from this site and subsequently at the margins of other fluted points from the Snake River Plain assembled during this study. We have since made comparisons of basal-margin dulling on fluted points from sites in Nevada, Arizona, and New Mexico. Our preliminary investigations indicated that margins of fluted points from the Snake River Plain and peripheral areas were typically dulled using a technique far different from that used on fluted points from several sites in the Southwest. The traits of dulled margins on fluted points from the Snake River Plain indicate that replicative techniques used by many modern flintknappers who simply "grind" margins with stone abraders are not accurate reconstructions of the methods used in the past.

Following is a brief appraisal of what is commonly assumed about how and why basal margins of fluted points were dulled, a description of basal-margin dulling on fluted points from southern Idaho and several sites in the Southwest, a description of preliminary experiments directed at replicating this margin dulling, and a few precursory speculations addressing why grinding may have been incorporated into the tool design by prehistoric craftsmen.

### BASAL MARGIN DULLING

Intentionally dulled basal margins are salient attributes of fluted points and are included in nearly every published description including the original type descriptions for Clovis and Folsom points. This intentional margin smoothing has been variously called "grinding," "abrading," or "dulling." When the purpose of this dulling

is speculated on, most authors suggested it aided hafting by preventing cutting of the fiber or sinew wrapping by sharp, freshly-flaked lateral margins (see Wormington 1957:23; Young and Bonnichsen 1985:119), an assumption which, to our knowledge, has not been formally tested.

A close examination of dulled basal and lateral margins on the study collection from the Snake River Plain raises two questions about the method of margin dulling and rationale for its use. First, observations on fluted points indicated that indented basal margins were dulled almost as frequently and thoroughly as were lateral margins. Why were the basal concavities frequently dulled if the purpose of margin dulling was to prevent cutting the haft wrapping? No archaeological or ethnographic analog is known where fiber wrapping could possibly contact the margin within the basal concavity.

Second, experimental studies have shown that only a few strokes with a hammerstone or abrader, or a light "buffeting" (Young and Bonnichsen 1985:98) with a billet or hammerstone is necessary to sufficiently dull acute angles and prevent cutting of any soft wrapping. Further, experiments have shown that sinew or fiber wrapping is resilient to damage even from a freshly-flaked tool margin. In a study designed to examine breakage patterns of Late Archaic corner-notched arrow points and lanceolate dart points from southern Idaho (Woods 1987, 1988), it was observed that sinew wrapping was not damaged from sharp projectile margins even when catastrophic lateral movement of the projectile occurred within the haft during impact. Thus, why were the margins on nearly every point in the study collection dulled well beyond what would be necessary to protect even the softest wrappings?

In an attempt to address these questions, special attention was directed at observing the location, extent, and type of margin dulling on the fluted points assembled for this study (Titmus and Woods 1988, 1991). It was ob-

served that dulling occurred on both margins of all but one specimen. The average length of dulling was 3.4 cm. (29.5% of maximum length) on complete Clovis points and 2.1 cm. (57.8% of maximum length) on complete Folsom points. Dulling also extended across the basal concavity on 10 of 11 Clovis points with intact bases and 4 of 8 Folsom points with intact bases (Titmus and Woods 1991).

The character of this dulling was observed using low-power microscopy at varying degrees of magnification from 10X to 70X, although most of our observations were recorded at 20X, a magnification we found quite suitable for this study. Visual examination of the dulled margins revealed that most were extremely light-reflective in direct lighting. Review of use-wear and related literature (Ahler 1979; Del Bene 1979; Del Bene and Shelley 1979; Diamond 1979; Kamminga 1979; Odell 1979) suggested that this dulling can more accurately be defined as a "polish" (see Frison and Bradley 1980:31).

Although there is disagreement over the mechanics of the polishing process as it is applied to lithic materials, most authors concur that a polished surface is identifiable by a high luster and smooth surface topography (Del Bene 1979:171). Using this simplified criteria, we can determine that many specimens from southern Idaho have polished lateral and basal margins (Fig. 2). These polished margins can be easily contrasted with margins on specimens ground with coarse abrasives.

The identification of this attribute may seem insignificant. However, the determination of how and why margins were polished could offer important insights into Clovis and Folsom technology and possibly have implications in the reconstruction of Paleo-Indian culture history.

#### **REPLICATING INTENTIONALLY DULLED TOOL MARGINS**

Preliminary replication experiments by the authors have shown that lateral margins on

pressure-flaked bifaces can be dulled using simple tools and with minimal effort. Coarse abrasers quickly wore away tool margins, yielding a flattened surface with coarse striations whereas smooth abrasers took more time, removed less material, resulted in sub-rounded abrasion surfaces, and produced minute striations that appeared to the unaided eye to have a satin finish. Experiments also revealed that a bright polish could be created easily by adding a polishing agent like red ocher to the dulling procedure. A large number of abrasives and polishes are used by modern lapidarians, although we restricted our investigations to the use of red iron oxide, a commonly observed material at Paleo-Indian sites across North America. The ocher can be used in a dry, powdered form or in suspension with saliva or water.

Various materials were used in the experiments to hold this polishing compound including leather, wood, and flat stone surfaces. Ocher used with a soft, yielding underlayment like leather resulted in a margin polish that wrapped around the tool margin and onto the faces of the tool. The margins to be polished using this approach were first abraded to prevent the sharp margins from cutting the soft underlayment. If ocher was applied on an unyielding surface, such as a flat piece of wood, the polish was restricted to the area contacting the flat surface, and a faceted, polished margin resulted. In this instance we found the polishing process could be expedited by first lightly smoothing the margin with a coarse abradant.

If ocher was applied over a flat, slightly abrasive surface, like fine-grained quartzite, flint, or chert, and the tool margin was not pre-ground, abrasion and polish occurred simultaneously. However, material attrition was slowed considerably in contrast to the above two routines. Even at this slower rate, the time required to achieve a "polish" on one tool margin seldom exceeded three minutes.



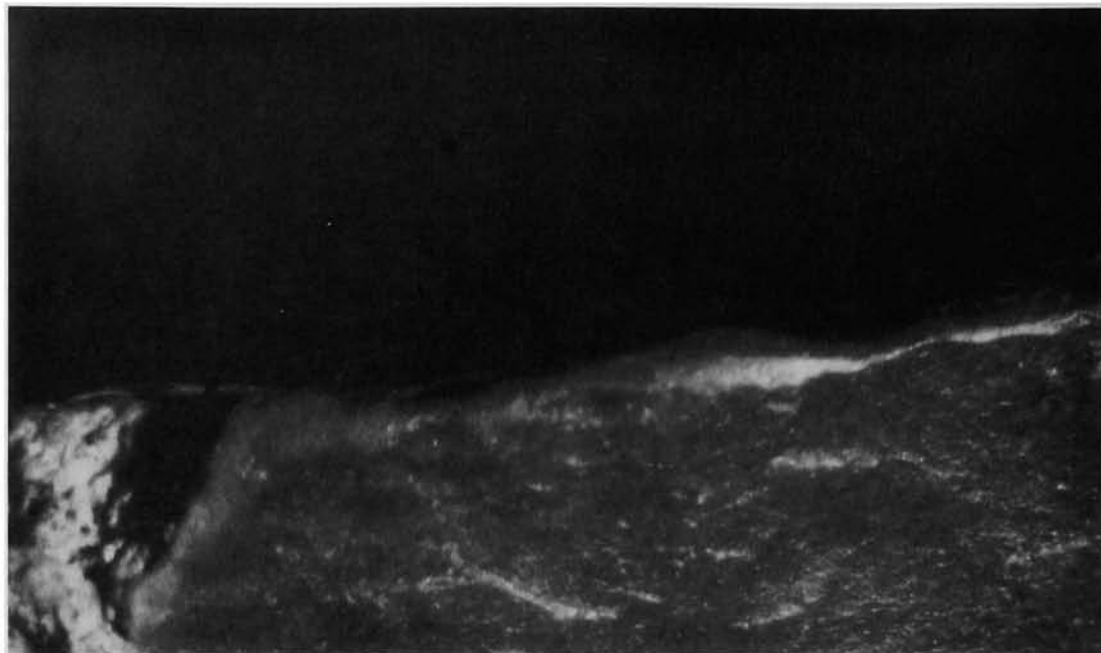


Fig. 2. Micrograph (22X) of margin polish on Crystal Springs Clovis point.

The above polishing experiments indicate there could be functional as well as ritual explanations for the recovery of red ocher found at some sites. It has already been established that ocher is commonly recovered at sites interpreted as workshops (Frison and Bradley 1980). Further, our low-power microscopic examination reveals that many of the fluted points recovered from nonburial contexts in southern Idaho retain traces of ocher in surface irregularities. Examination of the breakage patterns of these points, many recovered as isolated finds, indicates these were not associated with ritual burials, as has been proposed for the Simon site (Bonnichsen 1977). Thus, another explanation for the presence of red ocher staining on these artifacts might be warranted.

Although we relied on ocher as a polishing agent in our earlier experiments, subsequent attempts revealed that polished margins were also obtained without the use of ocher. A simplified experiment was conducted to determine

the effort necessary to produce an intentionally polished lateral margin on a Clovis point replica made of chert. Margins of a replica (Fig. 3) were first abraded for 60 seconds using a quartzite material as the abrader (Fig. 4). We were also able successfully to employ abraders made of the same material as the tool being ground. With most stone-on-stone abrading, the friction at the point of contact results in a fine silica powder which is an efficient abrasive. After this preliminary abrading, polish was obtained by adding a suspension agent such as water or saliva to the silica powder. Polish usually started about one minute after moisture was added (Fig. 5), and after two or three additional minutes the polish was visible to the naked eye. The abrader stone which the tool margin contacted showed distinctive wear traces including grooving and polish.

During this experiment, we noted that obsidian could not be used to polish obsidian. In this instance, dulling would occur, and a reflective surface could not be created. How-



Fig. 3. Micrograph (10X) of Clovis point replica, lateral margin prior to margin dulling.



Fig. 4. Micrograph (10X) of Clovis point replica, margin dulled by rubbing against quartzite flake for 60 seconds.



Fig. 5. Micrograph (10X) of Clovis point replica, margin dulled by rubbing against quartzite flake for 60 seconds, then adding moisture and rubbing for an additional one minute.

ever, obsidian margins could be polished using ocher or an appropriate microcrystalline material.

### THE NATURE OF POLISH ON FLUTED POINTS FROM THE SNAKE RIVER PLAIN

Some of the specimens from southern Idaho retain evidence which indicates they were initially ground with an abrasive agent, then polished in a separate action. On these margins, the grinding appears to extend further along the lateral margins than does the polish. The margin polish on the leaf-shaped biface from the Crystal Springs site appears to have been generated in this manner.

Other fluted points with dulled margins show some variation in the polishing technique. Some appear to have been heavily abraded, then polished; some were polished without prior abrasion. On others, the polish rounded the tool margin, suggesting the use of a yielding polishing pad (Fig. 1). Most of the polished Clovis points show this distinctive margin rounding. A few of the fluted points in this collection have a distinctively flat-polished surface, a characteristic replicated using a hard polishing surface. This flat-polished margin was more common on Folsom points.

### SPECULATIONS ABOUT THE PURPOSES OF POLISHED MARGINS

The processes used to generate margin polish were not necessarily arduous or time-consuming. However, any margin polishing clearly involved an additional procedure beyond grinding, and the reason for this warrants investigation. In attempting to understand this phenomenon, we adopted two assumptions. First, the reasons for polishing tool margins cannot adequately be explained as an attempt to prevent damage to the haft wrapping, and second, polish probably served another functional purpose.

Although not every possibility has been exhausted, we are currently speculating that margins were polished to strengthen the point at its juncture with the foreshaft to eliminate breaks that initiate within the wrapped portion of the haft element. Point breakage in this area would most likely result in damage to the wood or bone foreshaft, necessitating time-consuming repair. Earlier work by Titmus (1987) addressed the possibility that much of the reason for the morphology of fluted points, including the channel flake scars, indented base, and long, tapering cross-section was to produce a durable juncture between the point and shaft or foreshaft. The thinned cross-section, resulting from the removal of the channel flakes, allowed the wood or bone foreshaft material to extend further along the long axis of the stone projectile, supporting it from potential flexing and the resulting bending breaks. Margin dulling may have further strengthened the projectile at the area where much bending stress was to be expected.

The goal of this durable juncture may have been a projectile system that was reliable in design. Reliable systems are defined in contrast to maintainable systems and incorporate design principles which include overdesign of components, carefully fitted parts, and good craftsmanship, among others (Bleed 1986:739).

In a recent study (Woods 1987, 1988), it was shown that the basal portion of a lanceolate form was subjected to breakage from many forms of use-stress, especially bending stresses. Examination of the bend-break attributes suggests that fracture initiates on some minute imperfection in the stone, most commonly an irregularity of the tool margin. These irregularities can include imperfections like vugs, crystal inclusions, microscopic cracks resulting from either percussion or pressure flaking, or most commonly, deep margin indentions resulting from negative bulbs of force which interrupt the tool outline. Most small irregularities

located immediately at the tool margins can be quickly removed or reinforced by rounding and smoothing the margins.

A modern analogy to this can be found in the commercial glass industry. Glass is cut by inducing an irregularity in the surface with a scribe (scoring) and bending in a direction which forces the fracture to initiate on this irregularity. Plate glass cut in this manner as well as glass labware cut by scoring and bending can be strengthened by "glazing" the freshly-sheared edges with heat or mechanically smoothing and rounding them with fine abrasive power grinders. Fracture propagation on deep water submarine windows is prevented using sophisticated treatment of glass to remove any surface irregularities (Freiman 1988). Modern flintknappers quickly learn that an overly ground platform will make subsequent flake removal from that platform almost impossible. Likewise, projectile margins regularized by polishing would strengthen the form and help prevent fracture initiation in the area of dulling by removing irregularities.

It is possible that basal concavities were nearly always polished along with the lateral margins to prevent fracture initiation at the area where the point contacts the shaft material, an area subject to heavy static loads during impact. Longitudinally oriented breaks initiating at the basal concavity exist in the archaeological record. One specimen from the Naco site (Haury et al. 1953) provides an excellent example of this form of breakage (Fig. 6). Interestingly, none of the Southwestern specimens examined were polished, and none of the polished specimens from southern Idaho had this distinctive breakage pattern.

#### SUMMARY

This paper has suggested that basal dulling on fluted points might be technologically more complex than generally recognized. Basal margins on fluted points from the Snake River Plain





Fig. 6. Clovis point from Naco, Arizona, showing longitudinal fracture which initiated within the basal concavity, burinating the lateral margin (cm. scale).

in southern Idaho appear to have been polished, unlike Clovis materials from the Escapule, Lehner, Leikum, Murray Springs, and Naco sites, curated at the Arizona State Museum, which show a fine abrasion without subsequent polishing. This might support an earlier hypothesis presented by Bonnichsen (1977) who

suggested the possibility of a northern and southern dichotomy in the western Clovis tradition. Bonnichsen cited variation in general tool outline, depth of basal concavity, cross-section morphology, and channel-flake length as the primary distinguishing characteristics separating the northwestern from the southwestern Clovis points.

This apparent regional difference may not apply to Folsom points. An examination of fluted points from the Lindenmeier site indicates a light polish, and the basal margins of Folsom points from the Hanson site were reportedly polished (Frison and Bradley 1980:31).

It may be premature to use a technological feature like basal margin treatment to define regional variations in fluted points. However, margin dulling appears more complex than previously reported and an understanding of this variation could help in the interpretation of the relationship between fluted points and other Paleo-Indian points. For example, we have noted that stemmed points, like Haskett points found on the Snake River Plain, generally have dulled margins that are heavily striated. Out of many specimens examined, only a few unusually large examples show evidence of polishing. There has been past speculation (B. Robert Butler, personal communication 1985) that there was a strong relationship between stemmed and fluted points on the Snake River Plain, although the difference in basal margin dulling might suggest a much weaker relationship.

Replication and breakage experiments have suggested that margin dulling may not be adequately explained as an attempt to prevent damage to the haft wrapping. More importantly, dulling may have been used to negate fracture initiation within the haft element from use-related stresses. Polished margins are much stronger than ground margins as edge imperfections and grinding striations are eliminated.

By the nature of its design, the hafting system for fluted points was reliable as defined

by Bleed (1986). This reliability, enhanced by margin polishing, would extend the use-life of the system and would also help assure that when it failed, the point would not fracture inside the haft element. Experiments have shown that the preparation of the shaft/foreshaft element with stone tools is difficult and much more time-consuming than the manufacture of the point. If point failure occurs within the haft juncture, damage to the shaft or foreshaft is possible. The careful preparation of the basal portion of fluted points, including carefully engineered contact between the point and foreshaft, elimination of lateral movement by use of a concave base, and margin dulling and polish, make fluted points part of a durable hunting system. This durability is affirmed by the apparent common practice of resharpening of fluted points (see Titmus and Woods 1988), an exercise that would only be necessary if fluted points could be subjected to multiple use without suffering macrodamage near their proximal ends.

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