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Antiquity and Function: Humboldt Basal-notched Bifaces in the Southwestern Great Basin

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A review of previous data sets and recent research indicates that Humboldt Basal-notched biface forms are characterized by distinctive temporal spans within the prehistoric record of the southwestern Great Basin [1]. Contrary to previous conclusions, we believe that the biface forms had two distinct periods of use, an early (4000 to 500 B.C.) and a late (500 B.C. to A.D. 800) manifestation. Humboldt Basal-notched bifaces from these two periods can be differentiated typologically and perhaps functionally.

There has been considerable typological and chronological confusion pertaining to the Humboldt Series. Heizer and Clewlow (1968) originally proposed the Humboldt types based on surficial archaeological materials recovered from the Humboldt Lakebed Site (NV-Ch-15) in western Nevada. Three variants of Humboldt series points were originally described: Concave Base A, Concave Base B, and Basal-notched. Most researchers subsequently merged the first two types as simply Concave Base (Heizer and Hester 1978).

Some researchers expressed considerable doubt regarding the use of the Humboldt styles as temporal diagnostics (Bettinger 1975; Thomas 1981; Thomas and Bettinger 1976). Chronological information suggested a lengthy temporal span for the Humboldt series (Aikens 1971:56; Bettinger 1989:59; Warren and Crabtree 1986). Thomas (1981) suggested that Humboldt forms spanned at least 5000 years and that their size was not a good indicator of their antiquity. He provided some limited data indicating that Humboldt bifaces might serve as chronological markers in the Monitor Valley area for a time range between ca. 3000 B.C. and A.D. 700.

The Concave Base examples have been suggested to date to an early period from 4000 to 1200 B.C. (Hester 1973; Warren and Crabtree 1986). Growing evidence indicates that Humboldt Concave Base points date roughly to 5000-3000 B.P. in the northwestern Great Basin where they are associated with Gatecliff Split Stem (Pinto) series points and have similar source-specific obsidian hydration rim measurements (Clewlow 1967; Layton and Thomas 1979). In the Inyo-Mono area, stratigraphic contexts and obsidian hydration readings argue for chronological placement of Humboldt Concave Base points roughly synchronous with the temporal range of the Elko series and the most recent span of Pinto points placing them from ca. 4000 to 1350 B.P. (Basgall and McGuire 1988; Delacorte 1999; Delacorte and McGuire 1993; Gilreath and Hildebrandt 1997; Hall 1983; Hall and Jackson 1989; Jackson 1985).

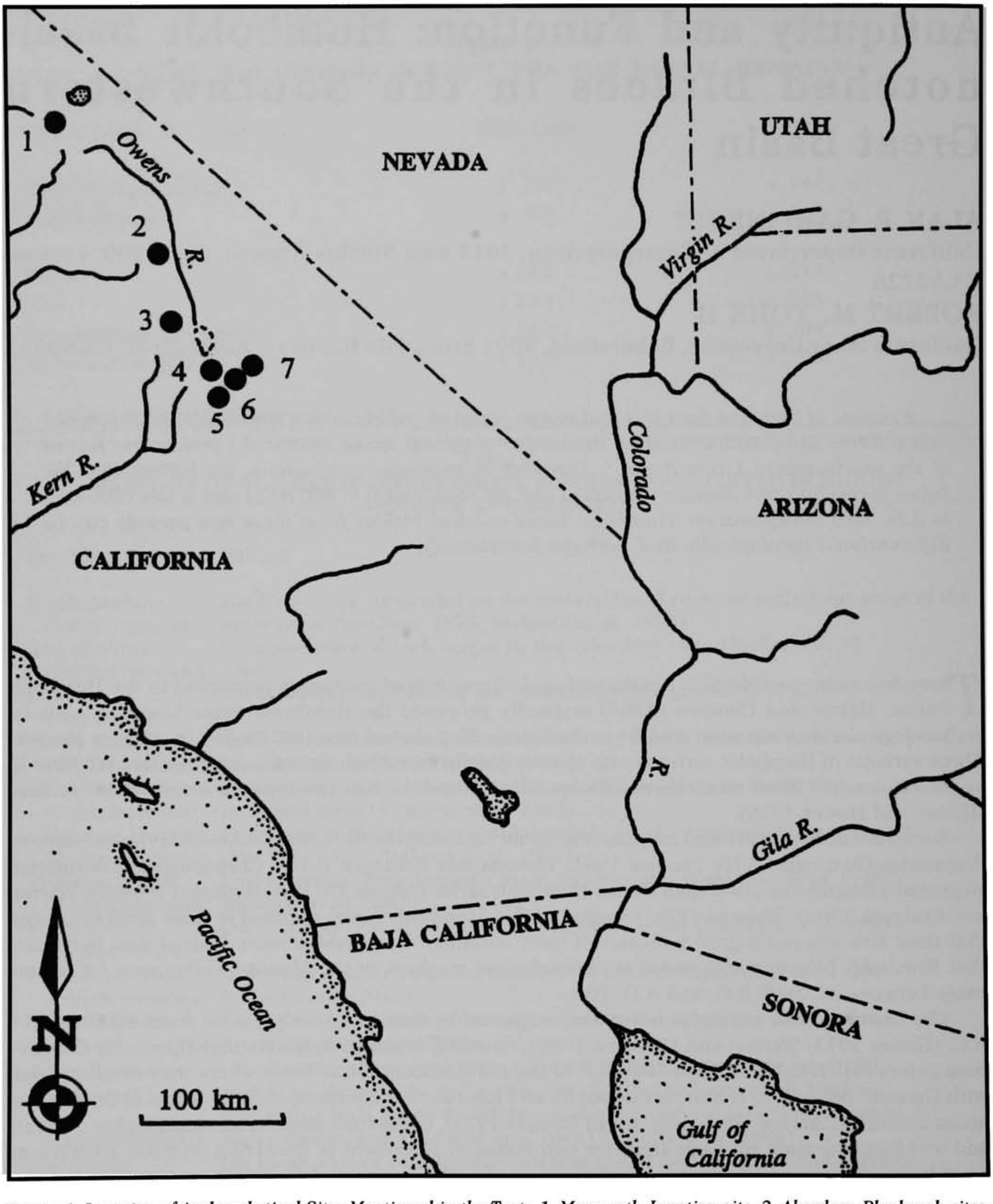

Figure 1. Location of Archaeological Sites Mentioned in the Text: 1. Mammoth Junction site; 2. Aberdeen-Blackrock sites; 3. Lubkin Creek site; 4. Rose Spring site; 5. the Stahl site; 6. Coso Volcanic Field; 7. Coso Pinyon Forests.

Bettinger (1978) proposed a distinctive chronological range for the Humboldt Basal-notched form. He used distributions and associations to argue that the basal-notched biface form was synchronous with the Rose Spring and Eastgate point types, dating them between ca. A.D. 600 and A.D. 1300 in the western Great Basin. Yohe (1998) generally supported Bettinger's conclusions as to a relatively recent date for the basal-notched form based on re-excavation and reanalysis of the Rose Spring Site (CA-Iny-372). He based his temporal determination on the vertical distribution of Humboldt Basal-notched bifaces and their association with Cottonwood, Desert Side-notched and Rose Spring points, suggesting a time range from ca. A.D. 500 to 1500 (Yohe 1998:35, 40, and Figure 8). Other researchers working in the Inyo-Mono region posit a short and somewhat earlier chronology for the Humboldt Basal-notched form, from about A.D. 1 through 800 (Basgall and McGuire 1988; Delacorte 1999; Gilreath and Hildebrandt 1997).

Formal Attributes and Classification

Classification of the Humboldt series has been difficult, because of the simplicity of the form (lack of corner or side notch morphology). Unshouldered, lanceolate bifacial forms have been found with basal indentations varying from slight concave indentations to deep basal notches. The Monitor Valley Projectile Point Key (Thomas 1981) defined the series as a residual category, with size limits expressed only as tendencies rather than as absolute boundaries, and with the individual types (Humboldt Concave Base A, Humboldt Concave Base B and Humboldt Basal-notched) left completely undefined. Justice considered the Humboldt series or "cluster" as rather ill-defined, "an optional variant useful to a wide number of groups over a long period reflecting differences in intended function in addition to formal change linked to resharpening" (Justice 2002:148).

Bettinger summarized the formal typological characteristics of Humboldt Basal-notched bifaces:

> Unshouldered and lanceolate bifaces with straight to slightly convex sides and lenticular in cross-sections. Bases exhibit parallel to moderately flared sides, and a deep basal notch or concavity, leaving two rounded as opposed to pointed ears. Workmanship is generally careful, most pieces showing extensive pressure retouch; examples of oblique parallel flaking are common. The available metric data indicate lengths ranging from 3.5 to 12.0 cm, widths from 2.3 to 3.0 cm, thickness from 0.4 to 1.0 cm, and weights from 4.5 to 13.0 grams (Bettinger 1978:1-3).

Most eastern California researchers seem to have disregarded the basal width measurement in this characterization, and consequently both narrower and wider specimens have been included within the Humboldt Basal-notched class.

Thomas' typology (1970, 1981) defined the Humboldt series, including the Basal-notched form, as unshouldered, weighing at least 1.5 g, having a center axis length less than 96% of the maximum length, and having a basal width greater than or equal to 90% of the maximum width.

Pendleton (1985) refined Thomas's typology for Humboldt Basal-notched bifaces from the Hidden Cave data, defining them as large (weight> 3.0 g, length $\geq$ 30.0 mm, thickness $\geq$4.0 mm) and triangular (Basal Width/Maximum Width > 0.95, Maximum Width Position averaging less than 10%), with distinctly concave bases (Basal Indentation Ratio < 0.96).

We see no reason to differ significantly from this formal operational definition, although again some pieces traditionally classified as Humboldt Basal-notched bifaces will not precisely fit these criteria. For the sake of the present discussion we include all large (weight>3.0 g), thick ($\geq$4.0mm), lanceolate, deeply basal-notched, biface forms within the Humboldt Basal-notched types.

Radiocarbon Dating

Associations of Humboldt bifaces with contextually sound strata and/or features that contain organic materials suitable for radiocarbon dating have been relatively uncommon in the southwestern Great Basin. Based on a survey of archaeological sites in the western Great Basin, Bettinger (1978) concluded that the chronology for Humboldt bifaces was much later than originally proposed by Heizer and Hester (1978), ranging from A.D. 600 to 1300. This is also much later than was observed by Thomas (1981) in his Monitor Valley projectile point sequence in central Nevada. Subsequently, radiometric dated contexts containing Humboldt specimens in the Owens Valley (Basgall and McGuire 1988) and the northwestern Mojave Desert (Sutton 1991; Yohe 1992, 1998) range from A.D. 200 to 1700.

The greatest number of Humboldt bifaces in this region from a single site in radiocarbon dated stratigraphic context come from Locus 1 of Rose Spring (Lanning 1963; Yohe 1992, 1998). A total of 17 complete or fragmentary specimens were recovered from stratigraphic contexts during excavations conducted by various investigators at the site between 1951 and 1989. All of these bifaces postdate 2,200 rcybp (uncorrected radiocarbon years before present), and the majority (n=10) occur post A.D. 500. At least five specimens appear in the upper strata of the site later or equal to 600 B.P. The conclusion based on these data led Yohe (1998) to contend that the span for the use of Humboldt Basal-notched bifaces was con-temporaneous with the use of Rose Spring/Eastgate projectile points (A.D. 500 to 1500), thereby supporting Bettinger's (1978) original proposed time-line with a minor expansion.

At present, the radiocarbon data would tend to support a somewhat longer, late chronology than what has been more recently proposed by investigators using obsidian hydration data (e.g., Basgall and McGuire 1988; Gilreath and Hildebrandt 1997). With this disparity in mind, and the recognition that both radiocarbon and obsidian hydration have their shortcomings (especially when we consider that obsidian hydration is often calibrated using "temporally sensitive" obsidian projectile points associated with radiocarbon dates to begin with), the remainder of this discussion will focus on chronology from the perspective of recent obsidian hydration studies.

Obsidian Hydration Dating

Volcanic glass from the vicinity of Sugarloaf Mountain in the Coso Range of eastern California may be one of the "most thoroughly investigated obsidians in North America" (Gilreath and Hildebrandt 1997:10). Assorted alternative rates for the hydration of Coso obsidian have been proposed (Basgall 1990; Basgall and Hall 2000; Drews and Elston 1983; Ericson 1977, 1978a, 1978b; Garfinkel et al. 1980, 1984; King 2000; McGuire and Garfinkel 1980; McGuire et al. 1982; Meighan 1978; 1981; Pearson 1995; Schiffman and Garfinkel 1981).

Two hydration rates will be employed here. Basgall (1990) proposed the formula:

$$\text{LOG } Y = (2.32\ [\text{LOG}(X \times \alpha)]) + 1.50,$$

where Y is the age in radiocarbon years before A.D. 1950, X is the hydration thickness measured in microns, and α is the effective hydration temperature correction, estimated as 0.8723 for the Haiwee/Coso area (cf. Gilreath and Hildebrandt 1997).

Basgall's rate was based on hydration readings associated with radiocarbon dates at the Lubkin Creek site, CA-Iny-30 (Basgall and McGuire 1988). Some minor refinements to this rate were proposed by Basgall and Hall (2000) and by King (2001). Basgall's rate was generally considered to give dates that were too early for early and middle Holocene specimens. Basgall also proposed to incorporate into the formula a factor for the mean annual temperature at the locations where specimens were recovered. For instance, Gilreath and Hildebrandt (1997) in their study of sites within the Coso Volcanic Field used an effective hydration temperature (EHT) correction factor of 0.8723.

In developing an alternative rate, Pearson (1995) matched chronological transitions in projectile point styles to hydration reading distributions at several sites in southern Owens Valley, resulting in the formula:

$$Y = X (125 + 25 X),$$

where Y equals radiocarbon years before A.D. 1950 and X is the hydration thickness in microns.

Rose Spring Site (CA-Iny-372). The Humboldt Basal-notched sample from this site in southwestern Inyo County was recovered from excavations by Riddell in 1956, Heizer and Davis in 1961, and Yohe in 1987 (Lanning 1963; Yohe 1992, 1998).[2] Hydration readings on these bifaces ranged from 4.8 to 7.6 microns, with most of these readings (9 out of 12 or 75%) falling within the range of 5.7 to 7.0 microns (Table 2). All specimens were chemically characterized to source via x-ray fluorescence to the Coso obsidian quarries. According to Basgall's formula, the overall range would correspond to ca. 2300-880 rcybp, and the smaller central range would be ca. 2100-1350 rcybp. According to Pearson's formula, the corresponding ranges would be ca. 2390-1180 and ca. 2100-1520 rcybp.

Coso Volcanic Field. Investigations at the Coso Volcanic Field, not far from the Rose Spring Site, recovered a sample of eight Humboldt Basal-notched bifaces (Gilreath and Hildebrandt 1997). Hydration measurements ranged from 4.8 to 7.7 microns, with the exception of one subjectively selected 2.3-micron outlier (Table 3). Basgall's hydration rate would give an age range of ca. 2620-880 rcybp. The range using Pearson's rate would be ca. 2440-1180 rcybp.

Lubkin Creek Site (CA-Iny-30). At the Lubkin Creek Site, in the southern end of the Owens Valley, 29 Humboldt Basal-notched bifaces were recovered (Basgall and McGuire 1988). Elko Series and Humboldt Basal Notched forms co-occur at the site both in features and stratigraphic contexts. Hydration readings range from 4.7 to 6.9 microns, excluding one 8.2-micron reading (Table 4). Using Basgall's rate, the age range would correspond to ca. 2030-830 rcybp; using Pearson's rate, the range would be ca. 2050-1140 rcybp. We believe that the large reading at 8.2 microns is not an anomaly or a product of re-use of an older point, but instead represents an earlier use of a similar style of biface form. This reading would correspond to ca. 3040 rcybp according to Basgall, or ca. 2710 rcybp according to Pearson.

Stahl Site (CA-Iny-182). The very diverse array of points from the Stahl Site at Little Lake (Harrington 1957) have been classified in a variety of ways. A number of researchers have commented that some of these points may best be recognized as Humboldt Basal-notched forms rather than Pinto types (Delacorte et al. 1995: 68; Pearson 1995: Schroth 1994 and others). Specimens originally identified as belonging to the "Pinto Shoulderless" and "Pinto Sloping-shouldered" subtypes are now more properly recognized as Humboldt Basal-notched bifaces (cf. Justice 2002:424-425, Figures 15.2, 15.4, 15.11, 15.14, 15.24,15.22 and metrics for illustrated specimens). The majority (13) of 15 hydration readings for such points range from 8.0 to 12.3 microns, excluding two outliers at 6.4 and 16.0 microns (Table 5). In Basgall's formula, this range corresponds to ca. 7780-3000 rcybp; Pearson's formula would give a more moderate range of ca. 5320-2600 rcybp. These values evidently challenge the recent consensus among Inyo-Mono researchers that Humboldt Basal-notched forms are attributable exclusively to a period from about A.D. 1 to 800 (Basgall and McGuire 1988; Delacorte 1999; Gilreath and Hildebrandt 1997).

Upland Coso Pinyon Forests. A large sample of 25 Humboldt Basal-notched bifaces comes from a recent survey of the Coso pinyon zone within the China Lake Naval Air Weapons Station (Hildebrandt and Ruby 2000). The hydration sample provided 17 rim readings (Table 6). Most of the readings cluster between 1.6 and 5.5 microns, while three intuitively selected outliers included one small reading at 1.2 microns and two larger readings of 6.9 and 8.4 microns. The higher elevation and cooler temperatures of the Upland Coso Pinyon Forest sites, as compared with the Rose Spring Site, Coso Volcanic Field, Lubkin Creek Site, and Stahl Site, would lead one to expect a slower hydration rate and consequently smaller readings for comparably aged specimens.

Aberdeen-Blackrock Sites. Thirteen Humboldt Basal-notched bifaces were recently

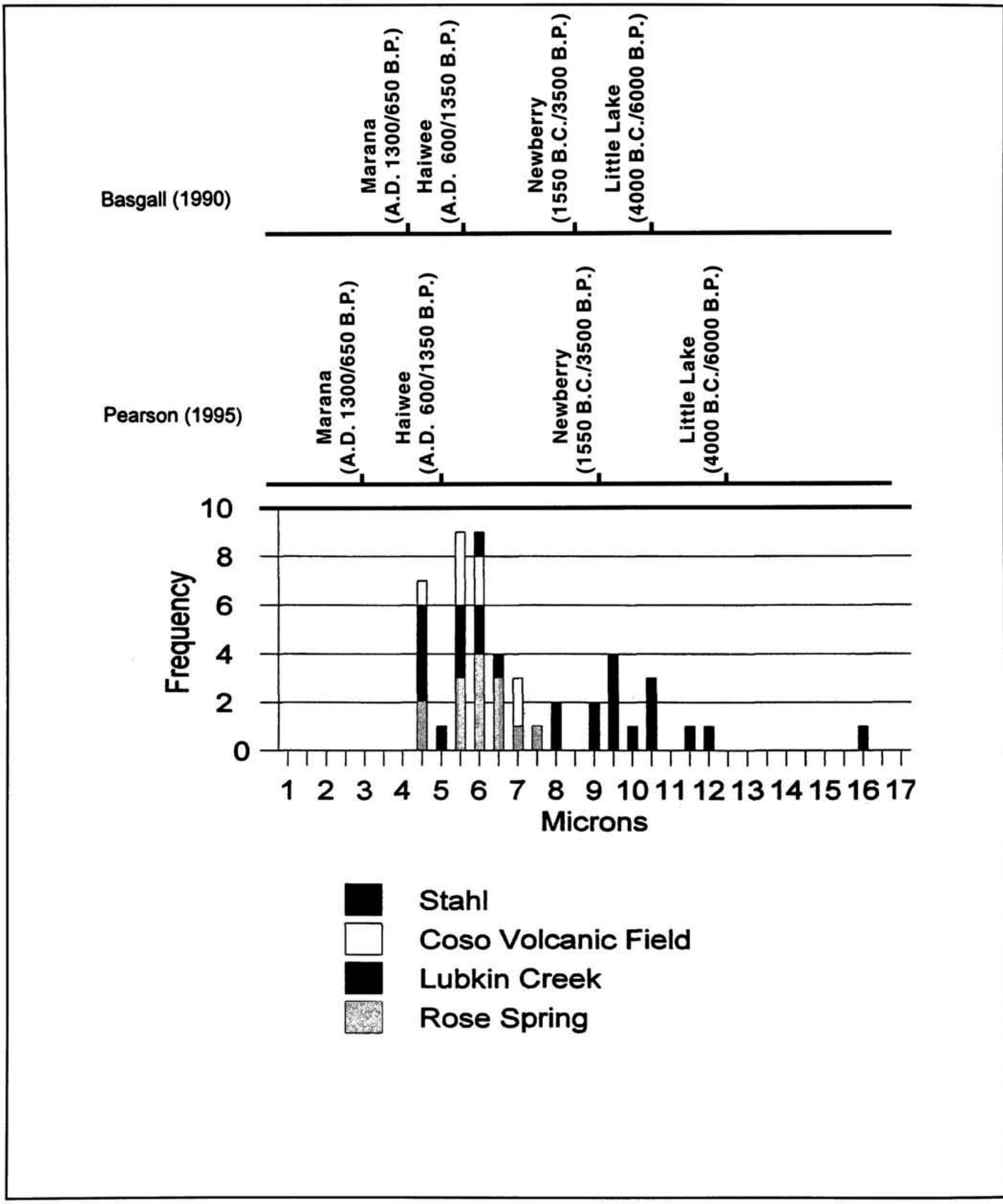

Figure 2. Age Estimates and Frequency of Lowland Coso Hydration Readings for Humboldt Basal-Notched Bifaces from Stahl, Rose Spring, Lubkin Creek and Coso Volcanic Field Sites

recovered in the Aberdeen-Blackrock investigations near Independence in Owens Valley (Basgall 2002). Eight of these were made from obsidian from the local Fish Springs source and with the exception of a single outlier (the smallest reading of 1.6) have rim values ranging from 3.9 to 6.4 microns (Table 7). Basgall (2002) proposed the following formula for Fish Springs hydration:

$$Y = 96.54\ X^{1.90},$$

where Y equals radiocarbon years before A.D. 1950 and X is the hydration thickness in microns.

Excluding the smallest reading, the Aberdeen-Blackrock specimens would range from ca. 3300-1300 rcybp according to this formula.

Mammoth Junction Site (CA-Mno-382). This site, near Mammoth Lakes in Mono County, was extensively investigated by Michels (1965), who recovered 24 specimens that appear to belong to the Humboldt Basal-notched type. Hydration readings ranged from 2.8 to 7.9 microns (Table 8). The specimens are assumed to be composed of obsidian from the Casa Diablo source area since the site lies at the quarry itself. Hall (1984) proposed a widely accepted hydration formula for Casa Diablo obsidian that was extensively evaluated and formalized in the Hall and Jackson (1989) research:

$$Y = 129.656\ X^{1.826}.$$

Using this rate, the range of hydration readings at this site would correspond to ca. 5650-850 rcybp.

Generalizations. Obsidian hydration measurements on Humboldt Basal-notched bifaces in the southwestern Great Basin, as well as their associations with other typed artifacts and radiocarbon dates, support two conclusions. As has conventionally been recognized, the Humboldt form is well attested for the Late Newberry (2300-1275 B.P.) and Early Haiwee (1275-1000 B.P.) Periods (ca. 1950-1150 rcybp, corresponding to about 5.4-6.8 microns of hydration for Coso obsidian in lowland settings according to Basgall's formula, or about 4.7-6.7 microns in Pearson's formula). However, about one-quarter to one third of the hydration readings point to an earlier phase of manufacture for the type, evidently falling within the Little Lake (5500-3500 B.P.), Early Newberry (3500-2800 B.P.) and Middle Newberry (2800-2300 B.P.) Periods in the local Owens Valley chronological sequence.

Formal and Functional Variation

Fortunately, the evidence not only extends the overall time range for the Humboldt Basal-notched type but also suggests that there was chronologically and perhaps functionally significant variability within the type. Metric data on the bifaces are summarized below for the Rose Spring Site (Table 2), Coso Volcanic Field (Table 3), Lubkin Creek Site (Table 4), Stahl Site (Table 5), Coso Pinyon Forest (Table 6), Mammoth Junction Site (Table 7) and Aberdeen-Blackrock (Table 8). Examination of the metric attributes for the sites indicates that the basal width or maximum width parameter of the Humboldt Basal–notched bifaces may be generally diagnostic of a temporal distinction (see Figure 2). That is to say, the narrowest bifaces are often the oldest forms (assessing this parameter using the smallest of either measure as an indication of the minimum) and the widest bifaces are frequently of more recent age.

Many of the bifaces with basal/maximum width measures of less than 23 (Lubkin Creek, Mammoth Junction) or 24 (Stahl, Coso Pinyon Forest and Aberdeen-Blackrock) millimeters show a distinctive trend towards significantly larger hydration rim values. Smaller rimmed and wider bifaces prominently occur at Rose Spring, Lubkin Creek and the Coso Volcanic Field.

To statistically evaluate this pattern, we can include, as a single sample, all specimens attributable to the Coso quarry and retrieved from a lowland setting with roughly equivalent effective hydration temperature. Using this combined sample of 38 lanceolate basal-notched bifaces and testing their association between rim readings and basal width/maximum width measurement minimums shows that the narrower bifaces are significantly more likely to have larger hydration rims greater than or equal to 7.8 microns.

(Chi-square p < .005 with 1 degree of freedom, see below and Figure 2).

Basal Width/Maximum Width Minimums**

	Measures in Millimeters		
	24 +	<24	Totals
Hydration Rim Readings			
7.8 or >	5	10	15
4.7 to 7.7	18	5	23
Totals*	23	15	38

p. <.005 df 1

Lowland Coso Glass Hydration Rim Readings from a Combined Sample of Lanceolate Basal-notched Bifaces from the Lubkin Creek, Rose Spring, Stahl and Coso Volcanic Field Sites.

** Only complete measurements tallied from the smaller of the two measures; either basal width or maximum width measurement metrics (whichever complete measure is available) are included – measures are all in millimeters. The measures included are only for the sites listed for Coso obsidian specimens either chemically characterized to source or presumed to have been manufactured of this obsidian. See Tables 1 through 5 for detailed identification of source determination methods.

For the higher elevation upland areas it can be recognized that the early and Narrow Humboldt Basal-notched bifaces have greater than 6.5 microns of Coso hydration for specimens recovered in the Coso pinyon forest. For Casa Diablo glass at the Mammoth Junction site the early Narrow Humboldt Basal-notched specimens fall into a group having rims greater than 6.5 microns. For the Aberdeen-Blackrock sites narrow-based, large rimmed specimens have 5.8 microns or larger hydration bands on Fish Springs obsidian.

From an examination of the source- and temperature-specific hydration dates, associated radiocarbon determinations, distribution studies of the rim readings by site and an analysis of their metric attributes, we would conclude the following.

Lanceolate basal-notched bifaces occur in the southwestern Great Basin from ca. 4000 B.C. to A.D. 800. Such occurrence is not uniform and two periods of popularity can be discerned. The first and earliest occurrence is characterized by lanceolate bifaces that are many times narrow-based (less than 23 or 24 millimeters in width), although wide-based variants are not unknown and do commonly occur especially at the Stahl site. This early variant does not appear to have served as a hafted knife since in the majority of cases it is recovered in a highly fragmentary state and on average weighs considerably less that its more recent counterpart. These early lanceolates functioned frequently as dart points tipping foreshafts as atlatl points or thrusting spears as demonstrated by impact fractures on a great number of specimens and by evidence of extensive in haft resharpening.

The Stahl site specimens exhibit just such a pattern (cf. Justice 2002:126, Figure 15.2, 15.4, 15.22, 15.26, Plate 2.14). Nearly all of the Stahl site Pinto specimens (over 400) were in some manner resharpened at the time of discard and Harrington himself suggested that these bifaces had been resharpened while in the haft, still secured to the tips of dart foreshafts (Harrington 1957:49).

These narrower lanceolate basally-notched bifaces, having distinctively more ancient hydration ranges, occur in small numbers at sites in the Inyo-Mono region including Lubkin Creek (1), the Coso Pinyon Forests (2), Mammoth Junction (5), and Aberdeen-Blackrock (5) but are most common and a characteristic feature at the Stahl Site at Little Lake (with perhaps upwards of 100 specimens of the "Pinto Shoulderless" and "Sloping-shouldered" subtype). Such an early occurrence was regionally not as widespread as the more recent expression. Nevertheless, the early forms can be found in association with Pinto/Little Lake aged materials dating from the Little Lake and Early Newberry Periods from about 4000 B.C. to 500 B.C. These forms might be differentiated from the more recent look-alike types and identified under a new designation as

"Narrow" Humboldt Basal-notched bifaces (Figure 3D, 3E, and 3F).

Beginning ca. 500 B.C. (using either the Pearson or Basgall rate, both are in general agreement) and based on radiocarbon determinations from Rose Spring and the Coso Volcanic Field sites, another expression of the lanceolate basal-notch form occurs. The form exhibits modest usage initially and grows in popularity quickly. Surprisingly, the form discontinues abruptly when in full popularity. The greatest usage of this form falls within the period from ca. 500 B.C. to A.D. 800 (Middle and Late Newberry Periods and the very earliest portion of the Haiwee Period in the Owens Valley sequence). This form is more robust having basal/maximum width measures most often ranging from a minimum of 23 or 24 millimeters to as great as 37 millimeters. These we refer to as **"Wide" Humboldt Basal-notched bifaces** (Figure 3A, 3B and 3C).

The wider variant appears to have served in many cases as hafted knives. Functional studies at Hidden Cave, where morphologically similar wide-based Humboldt Basal-notched forms were discovered, support just such an interpretation (Pendleton 1985); but they certainly also served as thrusting/dispatching spear points or atlatl dart points. Hafted examples of these atlatl dart points were recovered from Hidden Cave (Pendleton 1985) and would apparently date to a time synchronous with Elko series points in the area. These Wide Humboldt Basal-notched bifaces are also present at the Rose Spring, Lubkin Creek, at various Coso Volcanic Field Sites, in the Coso Pinyon Forest Sites, the Aberdeen-Blackrock Sites (1) and at the Mammoth Junction Site.

Other data suggests to us that the wide variant served as multi-purpose tools (butchering knives/ dart points/ thrusting and dispatching spears) used in great numbers during communal hunting. Such communal hunting sites are located along seasonal game trails crossing the winter and summer foraging range. A 2,000 year old pronghorn kill site in the Mono Basin contained many highly fragmented Humboldt Basal-notched bifaces exhibiting breakage patterns "entirely consistent with their use as projectile points" (Hall 1996:44). In Mineral County, Nevada (Nv-Mn-736) another site contained 182 "catastrophically fragmented" (impact-fractured) Humboldt and Elko points (Arkush 1995:25; Parr 1989:144-148, Figure 52; Parr and Newman 1992).

Hall (1990:702) shares a brief description of a rather remarkable site located in the Anchorite Hills between Mono and Walker Basin in southwestern Nevada. NV-Mn-715 contained 169 bifaces that were most likely Humboldt Basal-notched biface forms and also provided 24,150 skeletal items attributed to the pronghorn antelope (*Antilocapra americana*). The bifaces recovered there were overwhelmingly highly fragmented dart points - the product of impact shattering and extensive tool repair/replacement. The site apparently dates from 2000 to 1700 BP and as such would be dominated by our Wide Humboldt Basal-Notched variant.

Concluding Thoughts

This research paper has provided a first approximation of some rather interesting typological and chronological considerations for lanceolate basal-notched bifaces found in the southwestern corner of the Great Basin. Future studies will undoubtedly refine these conclusions and provide a greater interpretive framework in which to examine these trends.

One interesting research area that begs explanation is the seemingly abrupt discontinuation of the Wide Humboldt Basal-notched form while in full fluorescence (see Yohe 1998). Most other point and artifact forms have been found to follow a bell-shaped curve with respect to their popularity and are often replaced more gradually with temporally overlapping forms. Perhaps this discontinuation (Figure 2) relates to cultural, technological or sociopolitical factors affecting the southwestern Great Basin during the period consonant with the termination of the form.

A further question of significance relates to the possible reasons behind the production of narrower Humboldt Basal-notched bifaces earlier in the chronology of the region. A full technological analysis of both narrow and wide

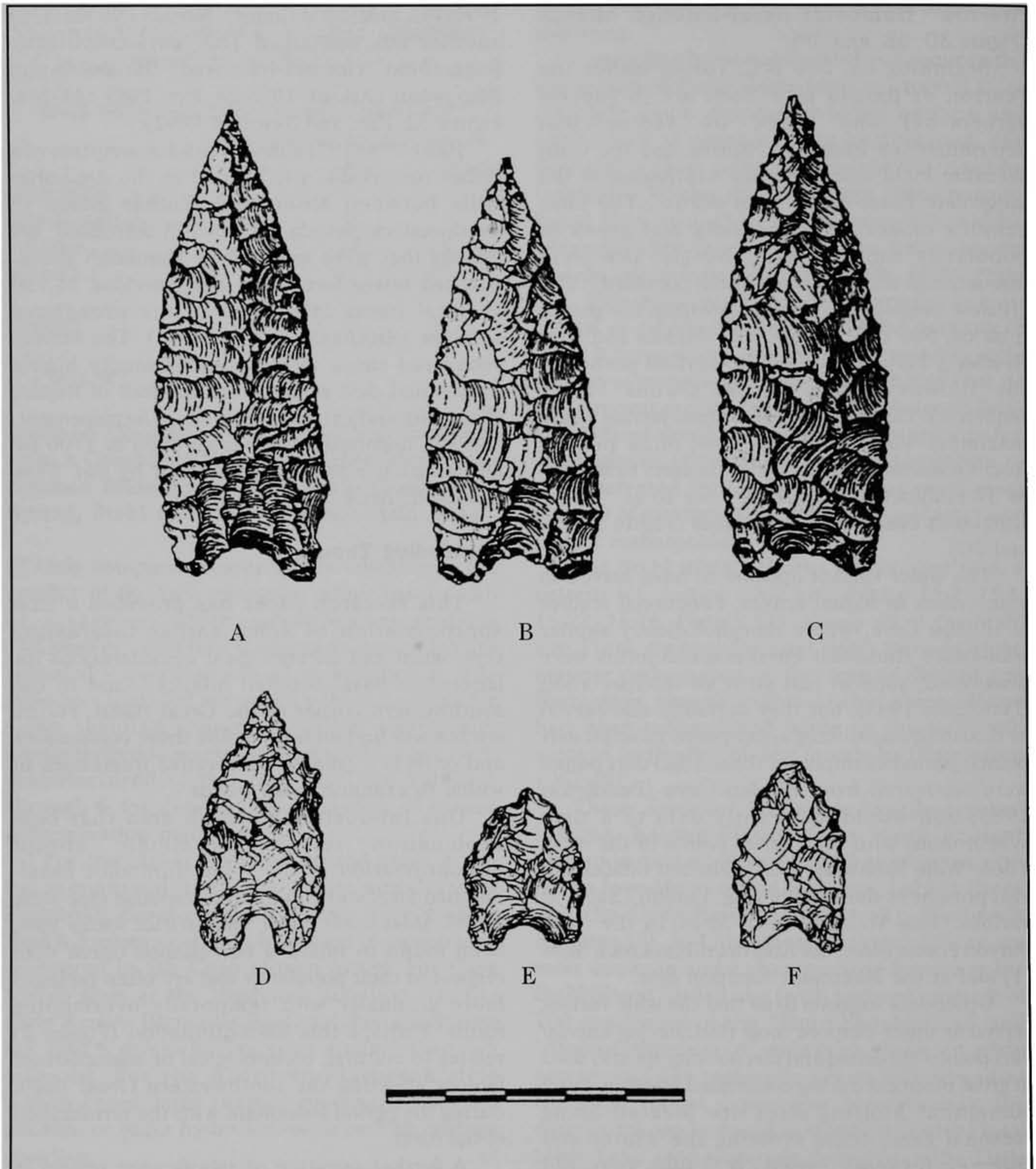

Figure 3. Examples of Humboldt Basal-notched Bifaces. Upper Row (left to right): a, b and c; "Wide" Humboldt Basal-notched Bifaces from the Lubkin Creek Site (CA-Iny-30) Lower Row (left to right): d, e, and f: "Narrow" Humboldt Basal-notched Bifaces from the Stahl Site (CA-Iny-182)

variants needs to be undertaken. Such an analysis would help to determine whether or not the observed variations are merely a product of a greater degree of resharpening/rejuvenation during this early period, or a distinct morphological attribute that is more cultural in nature.

Another research problem that deserves considerable attention is the distinction and relationship between Sierra Concave Base "points" (Moratto 1972) and the Humboldt Basal-notched forms. Michael Morratto (personal communication) indicated that he feels there is a basis for differentiating these forms and thought there has been considerable typological confusion with respect to the use of this appellation. Unfortunately such efforts are beyond the scope of this present study and hence await further research.

NOTES

*Alan Gold had formerly published under his given name Alan Garfinkel. His last name was legally changed from Garfinkel to Gold in 1989 for professional and business reasons. In order to avoid confusion and ensure consistency Alan Gold has chosen to continue to publish using his former name.

1. We recognize that variants of Humboldt Basal-notched bifaces are common to other parts of the Great Basin and American West, and that the morphological variability and temporal occurrences of those bifaces may differ from those described specifically for the southwestern Great Basin in this paper. The research presented here is an overview and analytical synthesis of data identified from the Mono Basin, southern Owens Valley, Rose Valley and Coso Range. The archaeological sites discussed in this research are located on Figure 1.

2. A brief presentation relating to a part of this analysis was provided in McGuire and Garfinkel1980:41-43. That research was supported by a small grant from the former Great Basin Foundation and the encouragement of the late Dr. Emma Lou Davis.

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Table 1
HYDRATION READINGS ON HUMBOLDT BASAL-NOTCHED BIFACES

Provenience	Obsidian Source	Number	Readings *	Mean	Range
Rose Spring Site	**Coso	12	4.8, 4.8, 5.7, 5.7, 5.9, 6.0, 6.0 6.2, 6.5, 6.6, 6.7, 7.0, 7.6	6.1	4.8 – 7.6
Coso Volcanic Field	#Coso	9	(2.3), 4.8, 5.7, 5.7, 5.9, 6.0, 6.8, 7.5, 7.7	6.3	4.8 – 7.7
Lubkin Creek Site	+Coso	12	4.7, 4.7, 4.9, 4.9, 5.3, 5.5, 5.8, 5.9, 6.0, 6.1, 6.9, (8.2)	5.6	4.7 – 6.9
Stahl Site	+Coso	14	6.4, 8.0, 9.0, 9.1, 9.6, 9.6, 9.8, 9.8, 10.0, 10.2 10.8, 10.8, 10.8, 11.8, 12.3, 16.0	10.1	6.4 – 16.0
Coso Range Pinyon Forest	#Coso	17	1.2, 1.6, 1.8, 2.8, 2.8, 3.0, 3.3, 3.5, 4.4, 4.5, 4.6, 4.9, 5.3, 5.5, 5.5, 6.9, 8.4	4.1	1.2 – 8.4
Aberdeen-Blackrock	+Fish Springs	7	(1.6), 3.9, 5.8, 6.0,6.3,6.3, 6.4	5.8	3.9 – 6.4
Mammoth Junction Site	#Casa Diablo	24	2.8, 3.0, 3.1, 3.1, 3.2, 3.3, 3.4, 3.4, 3.5, 3.5, 3.5, 3.6, 3.6, 3.7, 4.0, 4.0, 4.0, 4.1, 4.1, 5.7, 6.5, 6.9, 7.9, 7.9	4.1	2.9 – 7.9

*Readings in parentheses have not been included in the statistics for mean and range.
Not chemically sourced; inferred from location.
+Sources determined using x-ray fluorescence.
**See below Table 2 for which specimens were chemically characterized to source via x-ray fluorescence.

Table 2
HUMBOLDT BASAL-NOTCHED BIFACES FROM THE ROSE SPRING SITE (CA-INY-372)*

Specimen	Collection (microns)	Hydration (microns)	Maximum Length (mm)	Maximum Width (mm)	Basal Width (mm)	Thickness (mm)	Weight (g)
1-187809	Riddell	5.9	na	na	na	na	na
1-187891	Riddell	4.8	43.9	—	—	7.7	—
1-188045	Riddell	6.5	—	28.1	—	9.8	—
1-188213	Riddell	6.0	71.1	32.4	—	9.5	17.7
1-144808	Heizer and Davis	5.7	66.1	28.6	—	8.8	12.6
1-144838	Heizer and Davis	4.8	67.2	27.5	—	8.3	10.6
1-144849	Heizer and Davis	7.0	80.0	—	—	8.9	—
1-144901	Heizer and Davis	6.2	na	na	na	na	na
1-144911	Heizer and Davis	7.6	—	31.9	—	6.1	na
1-144915	Heizer and Davis	5.7	na	na	na	na	na
131-F536a	Yohe	6.7	—	27.6	25.2	9.0	—
131-W198a	Yohe	6.0	—	29.6	—	7.3	—
131-W198b	Yohe	6.0	no metrics available				
131-F536b	Yohe	6.6	no metrics available				

***Information obtained from Yohe 1998, pp. 200-202. na=no data available — = fragmentary specimens unable to provide this metric Riddell and Heizer & Davis specimens all determined to be Coso via x-ray fluorescence. Yohe samples not chemically characterized and assumed to be Coso obsidian because of the location of the Rose Spring Site.**

Table 3
HUMBOLDT BASAL-NOTCHED BIFACES FROM THE COSO VOLCANIC FIELD INVESTIGATIONS

Specimen	Hydration (microns)	Maximum Length (mm)	Axial Width (mm)	Maximum Width (mm)	Basal Width (mm)	Thickness (mm)	Weight (g)
987-067-1	5.7	-15.0	-15.0	-15.8	-	5.6	-.9
987-048-18	4.8	73.9	67.8	29.5	26.0	11.2	22.7
987-272-5	6.0	-38.4	-31.6	26.2	-	9.6	-9.8
987-263-8	7.7	53.6	45.0	28.3	22.7	8.4	9.8
987-157-16	5.9	-45.0	-28.0	32.7	14.9	9.0	-12.5
987-027-424	7.5	-23.0	-23.0	-25.5	-	8.0	-2.6
987-058-3	6.8	-51.5	-41.1	36.2	21.1	-16.1	9.0
987-103-70	5.7	-32.8	-29.0	25.7	13.8	6.2	-6.2
988-004-56	(2.3)	-23.2	-17.5	-25.7	-	7.0	-3.8
Statistical Summary							
number of cases	8	2	2	6	5	8	3
mean	6.3	63.8	56.4	29.8	28.2	8.2	13.8
standard deviation	1.0	10.2	11.4	3.7	na	1.7	6.4
maximum	7.7	73.9	67.8	36.2	26.0	11.2	22.7
minimum	4.8	53.6	45.0	25.7	13.8	5.6	9.0

Table 4
COSO HUMBOLDT BASAL-NOTCHED BIFACES FROM THE LUBKIN CREEK SITE (CA-INY-30)

Specimen	Hydration (microns)	Maximum Length (mm)	Axial Width (mm)	Maximum Width (mm)	Basal Width (mm)	Thickness (mm)	Weight (g)
7080/72-6937	8.2	-14.0	-11.6	19.3	19.3	6.4	-1.6
7080/51-3275	6.0	-17.9	-15.5	25.6	23.0	6.9	-3.8
7045/68-6637	5.5	86.0	79.2	30.5	25.8	7.4	16.5
7081/50-3189	4.7	—	—	—	24.1	—	-1.3
7034/55-3888	5.3	-35.0	-26.9	-24.8	-24.8	6.4	-5.8
7040/68-6632	5.8	86.6	82.3	31.3	24.9	6.6	15.9
7041/68-6633	6.1	76.5	71.5	31.7	27.8	6.4	13.8
7042/68-6634	4.9	65.9	61.6	27.9	25.6	6.5	10.0
7043/68-6635	5.9	78.4	72.8	30.7	27.8	7.9	15.3
7047/44-2739	4.7	69.2	58.3	28.8	26.5	8.7	12.3
7048/41-2451	6.9	76.5	72.6	25.6	25.1	6.3	10.2
7060/55-3994	4.9	-35.0	-30.5	26.0	20.9	9.0	-8.8
Statistical Summary *							
number of cases	12	7	7	10	11	11	7
mean	5.7	77.0	71.2	27.7	24.6	7.1	13.4
standard deviation	1.0	7.7	8.7	3.8	2.7	1.0	2.7
maximum	8.2	86.6	82.3	31.7	27.8	9.0	16.5
minimum	4.7	65.9	58.3	19.3	19.3	6.3	10.0

***Summary for complete specimens**

Table 5
HUMBOLDT BASAL-NOTCHED BIFACES FROM THE STAHL SITE (CA-INY-182)**

Specimen	Hydration (microns)	Maximum Length (mm)	Notch Depth (mm)	Maximum Width (mm)	Basal Width (mm)	Thickness (mm)	Weight (g)
554	9.6	-28.9	3.8	23.1	—	7.9	-6.4
538	10.0	-15.3	6.3	26.2	—	6.3	-2.2
213	10.2*	-15.3	6.3	26.2	26.2	6.3	-13.4
2602	10.8	-38.7	7.2	23.4	22.9	9.1	-8.0
3078	10.8	-53.6	7.7	26.9	26.1	8.6	-14.1
116	11.8	-28.5	4.8	24.6	22.0	7.9	-6.1
107	12.3#	-35.7	4.4	22.5	20.1	8.2	-6.7
3271	8.0	-19.8	6.3	21.9	19.0	6.2	-2.4
123	9.0	-43.5	9.2	37.5	28.5	8.1	-12.9
2998b	9.1	-12.2	3.9	24.5	23.0@	6.7	-1.9
206	9.8	-28.9	3.2	23.5	—	8.9	-5.8
547	10.8	-36.1	4.5	39.1	31.6	13.3	-21.0
553	16.0	-38.9	4.8	23.4	18.3	6.6	-5.6
488	12.3	—	—	—	28.0@	—	—
830G360	—	-45.3	4.5	22.0	—	7.1	-6.8
23F-3298	6.4	-60.1	9.5	37.4	30.1	18.5	-34.7
23F-206	9.8	-28.9	3.2	23.5	18.0	8.9	-5.8

*** Not Coso obsidian; possibly Truman/Queen source.**
 # Source unknown.
@ Estimated from photograph.
****All measurements taken on fragmentary specimens.**
-Estimated measure based on fragmentary specimen.

Table 6
HUMBOLDT BASAL-NOTCHED BIFACES FROM THE COSO PINYON FORESTS

Specimen	Hydration (microns)	Maximum Length (mm)	Axial Length (mm)	Maximum Width (mm)	Basal Width (mm)	Thickness (mm)	Weight (g)
742-42 T-6 ISOB	6.9	—	—	20.8	20.6	7.5	4.1
813-6 P154-75	8.4	—	—	23.1	—	8.5	—
742-3 P-120 ISOB	4.6	—	—	—	25.5	—	—
742-32 P-145 ISOI	3.3	—	—	26.1	—	8.5	—
822-3 P-190-103	5.5	—	—	26.1	—	8.1	—
839-1 T-16-3	2.8	—	—	26.8	25.1	9.0	—
815-1 P154-77	1.6	—	—	27.5	—	6.3	—
756-3 P-51-97	3.0	—	—	28.8	22.5	7.5	—
761-5 P-64-60	4.4	—	—	28.4	—	—	—
742-26 P-139 ISOD	5.2	—	—	29.3	—	6.3	10.5
853-1 T-20-1	3.5	—	—	30.0	29.0	8.8	—
807-1 P-143-63	4.9	—	54.5	30.5	—	9.0	15.6
742-39 T-3 ISOA	2.6	—	—	31.2	29.4	7.6	—
852-1 T-12-1	5.5	57.3	51.0	32.6	29.7	11.5	20.1
817-7 P-154-82	1.2	—	—	33.7	—	9.7	18.0
Statistical Summary							
number of cases	15	1	2	14	7	13	5
mean	4.0	57.3	52.7	28.2	26.0	8.3	13.7
standard deviation	1.9	—	2.5	3.5	3.5	1.4	6.4
maximum	8.4	57.3	54.5	33.7	29.7	11.5	20.1
minimum	1.2	57.3	51.0	20.8	20.6	5.3	4.1

—Measurement not provided in original research.

Table 7
FISH SPRINGS HUMBOLDT BASAL-NOTCHED BIFACES FROM THE ABERDEEN-BLACKROCK INVESTIGATIONS

Specimen	Hydration (microns)	Maximum Length (mm)	Axial Length (mm)	Maximum Width (mm)	Basal Width (mm)	Thickness (mm)	Weight (g)
81-242-136-001	6.4	33.3	25.8	19.2	19.2	4.8	2.3
81-241-123-001	3.9	-28.4	-23.1	25.1	25.1	6.9	5.1
227-1-242	6.0	-37.3	-32.3	-21.3	—	7.4	5.8
227-1-246	6.3	-28.6	-24.1	-27.2	18.8	5.0	4.2
81-240-10-542	6.3	-31.3	-26.6	-20.9	15.9	6.0	4.0
81-240-10-553	6.0	37.6	35.0	16.1	—	6.3	3.4
81-240-10-660	5.8	-22.2	-21.4	-20.8	—	-5.8	1.8
Statistical Summary							
number of cases	7	2	2	3	4	6	7
mean	5.7	35.4	30.4	19.7	19.7	6.1	3.8
standard deviation	.9	3.0	6.5	3.8	3.8	1.0	1.4
maximum	6.4	37.6	35.0	19.2	25.1	7.4	5.8
minimum	3.9	33.3	25.8	16.1	15.9	4.8	1.8

—Measurement not provided in original research.

Table 8
HUMBOLDT BASAL-NOTCHED BIFACES FROM THE MAMMOTH JUNCTION SITE (CA-MNO-382)*

Specimen	Michels' Type	Hydration (microns)	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)
839	A-1 knife	4.1	66	29	6	9
194	A-1 knife	4.1	65	25	9	13
612	A-1 knife	4.0	66	29	8	11
550	A-1 knife	4.0	72	26	8	15
317	A-1 knife	4.0	68	29	9	17
2435	A-1 knife	3.7	44	29	8	10
1785	A-1 knife	3.6	91	25	7	14
1198	A-1 knife	3.6	65	27	8	15
1787	A-1 knife	3.5	46	29	8	10
1199	A-1 knife	3.5	80	28	8	16
615	A-1 knife	3.5	74	32	9	21
1750	A-1 knife	3.4	64	27	9	16
775	A-1 knife	3.4	62	27	8	15
1446	A-1 knife	3.3	61	28	11	15
4556	A-1 knife	3.2	67	30	9	20
7116	A-1 knife	3.1	33	23	8	5
1790	A-1 knife	3.1	70	33	9	19
1074	A-1 knife	3.0	90	30	9	21
972	A-1 knife	2.8	49	26	7	8
541	O-1 point	7.9	40	20	8	5
994	O-1 point	6.9	26	18	5	4
132	O-1 point	5.7	30	17	7	4
678	R-1 point	7.9	38	19	6	4
539	R-1 point	6.5	36	25	6	5

***Information taken from Michels 1965, no data provided on completeness of specimens. Width measurements are presumed to be maximum width measurements and not basal width metrics and are interpreted as proxy measures for the basal/maximum width minima.**