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Temporal and Spatial Distribution of Concave Base Projectile Points from the North Coast Ranges, California[1]

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CONCAVE base projectile points have long been used as time markers in North Coast Ranges archaeology, beginning with Harrington's (1948) report on his excavation at LAK-36, the Borax Lake site. Harrington assigned both non-fluted and fluted concave base point forms from the site to the Paleo-Indian period. Based on investigations at NAP-131 and MEN-500, Meighan (1953, 1955) refuted Harrington's temporal assignment and associated concave base points in the North Coast Ranges with the Central California "Middle Horizon," although he also did not distinguish between fluted and non-fluted types. Extensive obsidian hydration studies of LAK-36 by Meighan and Haynes (1970) distinguished non-fluted points from the earlier, fluted points at the site. Orlins (1971) and Fredrickson (1973) presented relative and chronometric dating evidence that supported Meighan and Haynes' temporal placement of the non-fluted concave base point between 3000 and 5000 years B.P. Fredrickson (1973, 1974, 1981) established the non-fluted, non-sidenotched concave base as a "time-marker" of the Mendocino Aspect of the Borax Lake Pattern in the North Coast Ranges.

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An increase in contract archaeological projects since 1973 has significantly enlarged the sample of concave base points. The new data indicate greater morphological, temporal and spatial variability than was previously recognized. T. Jackson (1976) proposed that small concave base points weighing less than 3.5 g. probably represented arrow points and were more recent than the Borax Lake Pattern (cf. Fenenga 1953). Milburn (1977) separated the concave base points of the California North Coast Region from those of the North Coast Ranges Region, based on distinct differences in function and cultural affiliation between the two areas. He noted that concave base points of different sizes, that functioned as arrow and harpoon points, were common in late period Gunther Pattern assemblages.

Using the standard temporal and cultural assignment of the concave base point forms, Baumhoff (1980) and Whistler (1980) offer hypotheses associating the concave base point of the Borax Lake Pattern with the prehistoric population movements and culture change of the Hokan speaking "Proto-Pomo."

The present study proposes further subdivisions of North Coast Ranges concave base projectile points. Responding to the call for operational taxonomy (Thomas 1970), we adapted Whallon's (1971) method of mono-

thetic subdivisive classification and applied it to a sample of 123 concave base points. We felt this approach would produce a classification of concave base point types, similar to one generated for Great Basin projectile points (Thomas 1970), that would contribute to refining the cultural history of the North Coast Ranges.

Our sample consisted of all known concave base points in available collections from Marin, Sonoma, Napa, Lake, and Mendocino counties (see Table 1). Poorly represented in the sample are large areas of these counties where little archaeological work has been conducted. The sample was further biased by purposeful exclusion of Milburn's (1977) Patricks Point Triangular Series that occurs in Mendocino and Humboldt county coastal sites. This is due to the proposed temporal and functional distinctions of that series.

METHODS

Data for each specimen were recorded on file cards, and included provenience, a line drawing, material, various measurements, and presence or absence of reworking. Metrical dimensions recorded for each point are shown in Fig. 1. Cards were sorted into tentative groups based upon size and silhouette. Mathematical representation of those attributes in each group was then sought. Each group had to have a minimum of two distinct, covarying, measurements in order to be defined. Reexamination of sorted groups that did not qualify on this basis led to identification of new attributes or reclassification within established groups. A series of types was thus derived, each type characterized by two or more covarying dimensions. For each type, a single representative dimension was selected in order to construct a binary dendrogram with a minimum number of steps for identifying types.

The relative temporal relationships of the types were tested against obsidian hydration results and information from stratified sites, including NAP-131 (Meighan 1953; Fredrickson 1973), LAK-261 (Fredrickson 1961, 1973), MEN-500 (Meighan 1955), and LAK-510 (White and Fredrickson 1981). Although problematic in terms of absolute dating, obsidian hydration has proven useful as a relative dating technique in several North Coast Ranges regional and site-specific studies (Meighan and Haynes 1970; Kaufman 1980; Origer and Wickstrom 1981).

RESULTS

The concave base point sample was sorted on the basis of five criteria considered representative of the six types shown in our key (Fig. 2). The first dimension separated specimens into those weighing less than or equal to 3.5 g. and those weighing more than 3.5 g. Those weighing less than 3.5 g., possible arrow points, are identified as Small Concave Base and correspond with the Mendocino Concave Base defined by T. Jackson (1976). Points weighing more than 3.5 g. were further divided on the basis of width into two groups; those less than 25 mm. wide and those equal to or more than 25 mm. wide. The wider specimens are identified as Wide Concave Base. The Wide type occurs in serrated and non-serrated varieties; however, similarities in geographic distribution and obsidian hydration rim thicknesses did not warrant the establishment of separate types based on these variations. The narrower specimens were further subdivided according to the depth of the basal concavity. Specimens with basal depth greater than 5.5 mm. are identified as the Deep Base type. Shallow Base points were divided into three types: (1) specimens with a maximum width that is 190 percent or more of the basal width constitute the Shallow Base Hipped type; (2) those with shoulders comprised the Shallow Base Shouldered type; and (3) the remainder make up the Shallow Base type.

Table 1
THE SAMPLE

Provenience	Catalog No.	Curation[a]	Hydration Rim[a]	Source[a]	Material[a]	Reference
WIDE TYPE						
MRN-192	47-1165	SFSU	4.9	N	O	–
MRN-396	75-6-7-436	SSU	2.3	N	O	excavation
NAP-1	1-170462	LM	–	–	O	Heizer (1953)
NAP-32	1-126671	LM	–	–	O	Heizer (1953)
NAP-32	1-38543	LM	–	–	O	Heizer (1953)
NAP-37	1-79992	LM	–	–	O	Heizer (1953)
NAP-37	1-79993	LM	–	–	O	Heizer (1953)
NAP-37	1-79994	LM	–	–	O	Heizer (1953)
NAP-37	1-79995	LM	–	–	O	Heizer (1953)
NAP-74	1-52372	LM	–	–	O	Treganza and Elsasser (1955)
Napa County	1-1712	LM	–	–	O	survey
Napa County	1-1712	LM	–	–	O	survey
Napa County	1-72806	LM	–	–	O	survey
Napa County	1-16497	LM	–	–	O	survey
Napa County	1-7021	LM	–	–	O	survey
SON-159	75-28-175	SSU	NVH	N	O	excavation
SON-358	73-13-10	SSU	4.2	–	O	excavation
SON-358	73-13-11	SSU	NVH	A	O	excavation
SON-730	81-1-10	SSU	3.6	–	O	survey
SON-730	81-1-11	SSU	2.6	–	O	survey
SON-1082	80-1-4	SSU	1.4	A	O	survey
Sonoma County	73-31-28	SSU	3.9	A	O	survey
Sonoma County	72-2-267	SSU	3.2	N	O	survey
Sonoma County	72-2-543	SSU	NVH	N	O	survey
Sonoma County	72-2-240	SSU	NVH	N	O	survey
Sonoma County	72-2-481	SSU	NVH	A	O	survey
Sonoma County	72-2-488	SSU	NVH	A	O	survey
Sonoma County	72-2-489	SSU	NVH	N	O	survey
Sonoma County	77-3-467	SSU	6.4	N	O	survey
SMALL TYPE						
05-08-54-245		MNF	–	–	C	survey
MEN-500	1-131371	LM	–	–	C	Meighan (1955)
MEN-500	1-131368	LM	–	–	O	Meighan (1955)
MEN-500	1-131372	LM	–	–	C	Meighan (1955)
MEN-500	1-131005	LM	–	–	C	Meighan (1955)
MEN-500	1-131110	LM	–	–	C	Meighan (1955)
MEN-643	79-15-194	SSU	–	–	C	Holson & Fredrickson (1980)
MEN-643	79-15-186	SSU	–	–	C	Holson & Fredrickson (1980)
MEN-643	79-15-187	SSU	–	–	C	Holson & Fredrickson (1980)
MEN-643	79-15-827	SSU	–	–	C	Holson & Fredrickson (1980)
MEN-643	79-15-190	SSU	–	–	C	Holson & Fredrickson (1980)
MEN-912	74-12-862	SSU	–	–	C	T. Jackson (1976)
MEN-950	74-12-1080	SSU	–	–	C	T. Jackson (1976)
MEN-953	74-12-683	SSU	–	–	C	T. Jackson (1976)
MEN-953	74-12-684	SSU	–	–	C	T. Jackson (1976)
MEN-953	74-12-685	SSU	–	–	C	T. Jackson (1976)
MEN-960	81-1-38	SSU	4.0	*	O	T. Jackson (1976)
Mendocino County (Willits)	9300	MCM	–	–	C	T. Jackson (1976)
Mendocino County (Estel Ridge)	74-12-1100	SSU	–	–	C	T. Jackson (1976)

Table 1 (cont'd.)

Provenience	Catalog No.	Curation[a]	Hydration Rim[a]	Source[a]	Material[a]	Reference
SHALLOW BASE SHOULDERED TYPE						
MEN-500	1-131050	LM	–	–	C	Meighan (1955)
MEN-500	1-131634	LM	–	–	C	Meighan (1955)
NAP-1	1-170463	LM	–	–	O	Heizer (1953)
NAP-74	1-152380	LM	–	–	O	Treganza and Elsasser (1955)
Napa County	L-18370	LM	–	–	O	survey
SON-1048	79-4-160	SSU	2.0	N	O	R. Jackson and Fredrickson (1979)
Sonoma County	75-8-37	SSU	–	–	O	survey
Sonoma County	72-2-483	SSU	NVH	A	O	survey
Sonoma County	72-2-484	SSU	3.2	–	O	survey
Sonoma County	72-2-485	SSU	2.7	–	O	survey
Sonoma County	72-2-486	SSU	4.9	B	O	B
DEEP BASE TYPE						
LAK-30	74-15-2295	SSU	3.5	B	O	survey
LAK-36	80-3-120	SSU	6.7	B	O	survey
LAK-385	78-8-12	SSU	–	–	O	survey
LAK-523	74-15-1996	SSU	4.1	N	O	survey
Lake County	78-14-110	SSU	–	–	O	survey
Lake County	76-12-61	SSU	5.5	B	O	survey
SHALLOW BASE HIPPED						
LAK-30	74-15-2024	SSU	3.3	N	O	survey
LAK-30	74-15-2269	SSU	5.7	B	O	survey
LAK-641	74-15-2796	SSU	5.1	–	O	survey
LAK-893	78-8-87	SSU	–	–	C	survey
Lake County		MCM	–	–	O	survey
Lake County (Anderson Marsh)	81-1-39	SSU	two bands	B	O	survey
Lake County (Cache Creek)	74-14-109	SSU	4.8	B	O	survey
Lake County (Cache Creek)	74-15-1239	SSU	–	–	C	survey
MEN-500	1-131258	LM	–	–	C	Meighan (1955)
NAP-93	1-166867	LM	–	–	O	Treganza and Elsasser (1955)
SON-930	76-9-51	SSU	–	–	C	survey
SHALLOW BASE						
LAK-30	74-15-2284	SSU	–	–	C	survey
LAK-30	74-15-2292	SSU	–	–	C	survey
LAK-30	74-15-2298	SSU	–	–	C	survey
LAK-30	74-15-2299	SSU	–	–	C	survey
LAK-30	74-15-2023	SSU	6.2	A	O	survey
LAK-30	74-15-2302	SSU	–	–	C	survey
LAK-30	78-8-17	SSU	–	–	O	survey
LAK-30	74-15-2207	SSU	2.6	–	O	survey
LAK-261	70-1-253	SSU	4.6	B	O	Kaufman (1980)
LAK-261	70-1-620	SSU	5.3	B	O	Kaufman (1980)
LAK-510	78-11-649	SSU	–	–	C	White & Fredrickson (1981)
LAK-510	80-3-57	SSU	NVH	A	O	White & Fredrickson (1981)
LAK-536	77-10-21	SSU	4.3	B	O	survey
LAK-575	74-15-1804	SSU	3.8	K	O	survey
LAK-802	77-4-50	SSU	NVH	K	O	survey

Table 1 (cont'd.)

Provenience	Catalog No.	Curation[a]	Hydration Rim[a]	Source[a]	Material[a]	Reference
LAK-826	74-15-127	SSU	6.3	B	O	survey
Lake County	77-3-499	SSU	5.4	–	O	survey
Lake County	78-14-107	SSU	3.3	B	O	survey
Lake County	76-12-62	SSU	4.9	B	O	survey
Lake County	78-14-28	SSU	6.4	B	O	survey
Lake County	76-9-249	SSU	3.3	K	O	survey
Lake County	81-1-37	MCM	6.5	B	O	survey
Lake County	73-31-29	MCM	3.8	B	O	survey
MEN-483	1-131882	LM	–	–	C	survey
MEN-500	1-131201	LM	–	–	C	Meighan (1955)
MEN-500	1-131356	LM	–	–	C	Meighan (1955)
MEN-500	1-131632	LM	–	–	C	Meighan (1955)
MEN-500	1-131373	LM	–	–	C	Meighan (1955)
MEN-500	1-131033	LM	–	–	C	Meighan (1955)
MEN-500	1-131049	LM	–	–	C	Meighan (1955)
MEN-500	1-131363	LM	–	–	C	Meighan (1955)
MEN-500	no number	LM	–	–	C	Meighan (1955)
MEN-500	1-131354	LM	–	–	C	Meighan (1955)
MEN-500	1-130918	LM	–	–	C	Meighan (1955)
MEN-500	1-130947	LM	–	–	C	Meighan (1955)
MEN-861	74-12-563	SSU	–	–	C	survey
MEN-1425	78-5-102	SSU	–	–	C	T. Jackson (1976)
MRN-396	75-6-7-27	SSU	3.1	N	O	excavation
NAP-131	1-128532	LM	–	–	O	Heizer (1953)
NAP-131	1-203804	LM	–	–	O	Heizer (1953)
Napa County	1-24200	LM	–	–	O	survey
Napa County	1-72807	LM	–	–	O	survey
Napa County	1-7002	LM	–	–	O	survey
SON-299	1-114287	LM	–	–	O	excavation
SON-299	1-106089	LM	–	–	C	excavation
SON-556	70-556-2727	UCD	–	–	C	Baumhoff & Orlins (1979)
SON-556	70-556-3487	UCD	–	–	C	Baumhoff & Orlins (1979)
SON-1262	80-3-5	SSU	3.4	N	O	survey

[a]The following abbreviations are used on this table:

LM Lowie Museum, University of California, Berkeley
MCM Mendocino County Museum
MNF Mendocino National Forest, Supervisor's Office
SFSU San Francisco State University
SSU Sonoma State University
NVH no visible hydration
N Annadel
B Borax Lake
K Mt. Konocti
* unknown
O Obsidian
C Chert

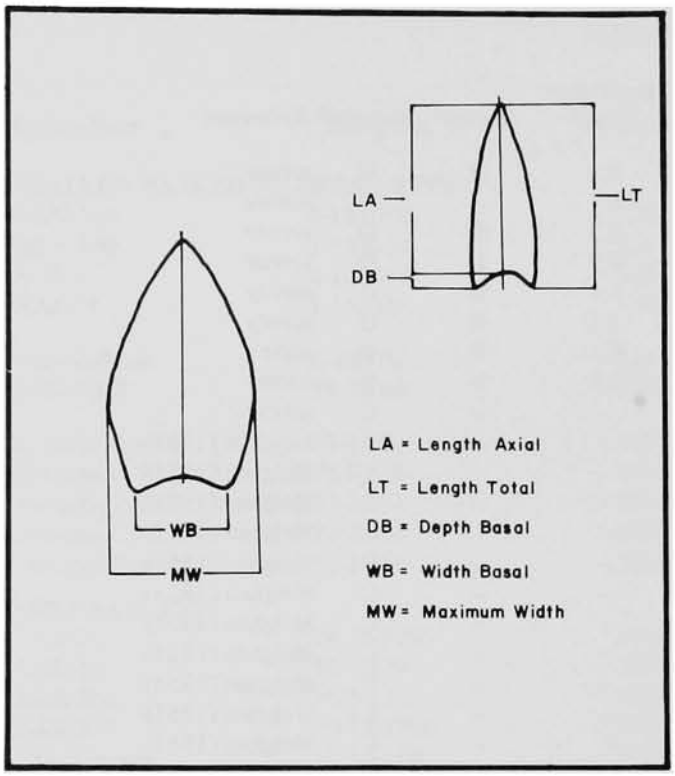

Fig. 1. Dimensions recorded for concave base projectile points.

The six types are therefore as follows:

Small
Wide
Deep Base
Shallow Base Shouldered
Shallow Based Hipped
Shallow Base

SPATIAL AND CHRONOLOGICAL DIMENSIONS

Each type has a distinctive distribution, although three general districts are identifiable: a southern district consisting of Marin, Napa, and Sonoma counties; a central district consisting of Napa, Sonoma, Lake, and southern Mendocino counties; and a northern district consisting of southern and northern Mendocino County. Fig. 3 shows the geographic distribution of the types.

A total of 49 obsidian specimens were analyzed for hydration rim measurements. Point types were ranked by average rim values, which are shown in Table 2 below. The Deep Base and Shallow Base Hipped point types have the greatest average rim thicknesses, followed by the Shallow Base,

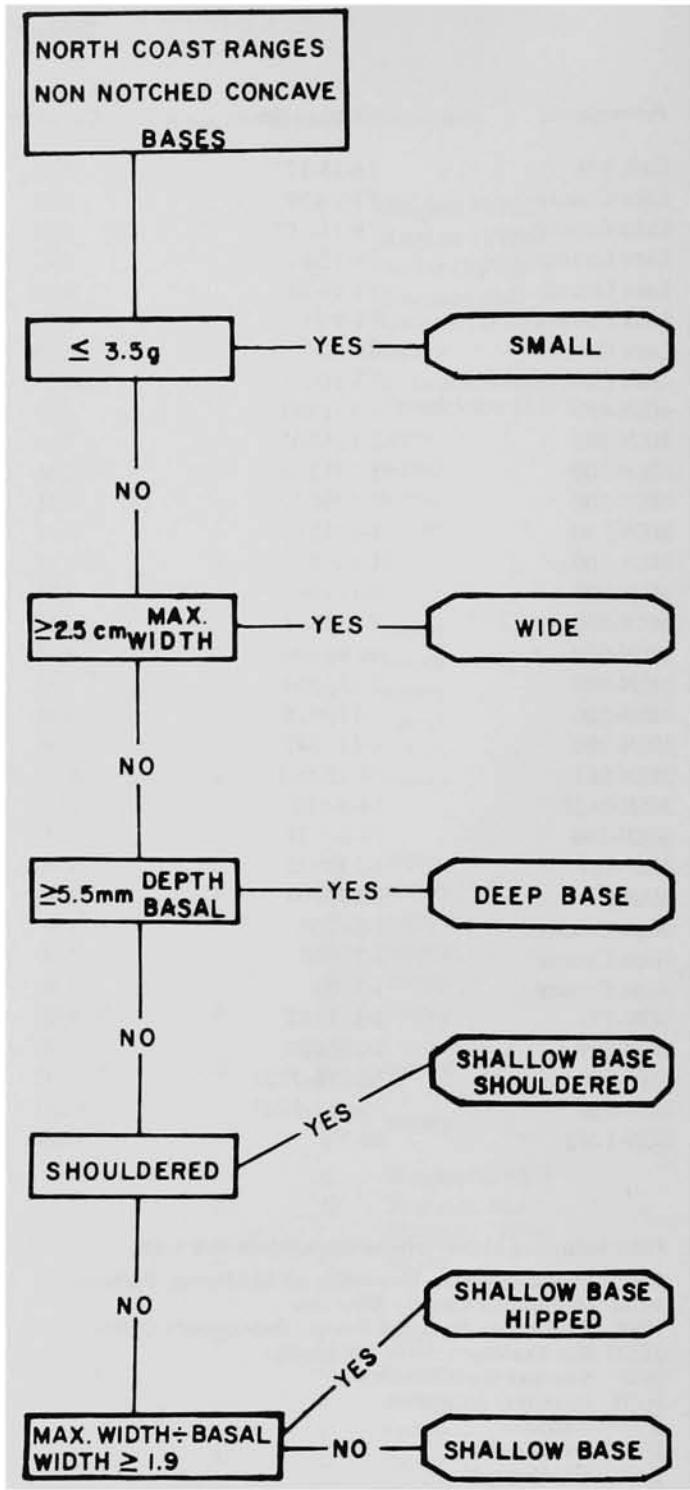

Fig. 2. Proposed key for concave base projectile points in the North Coast Ranges.

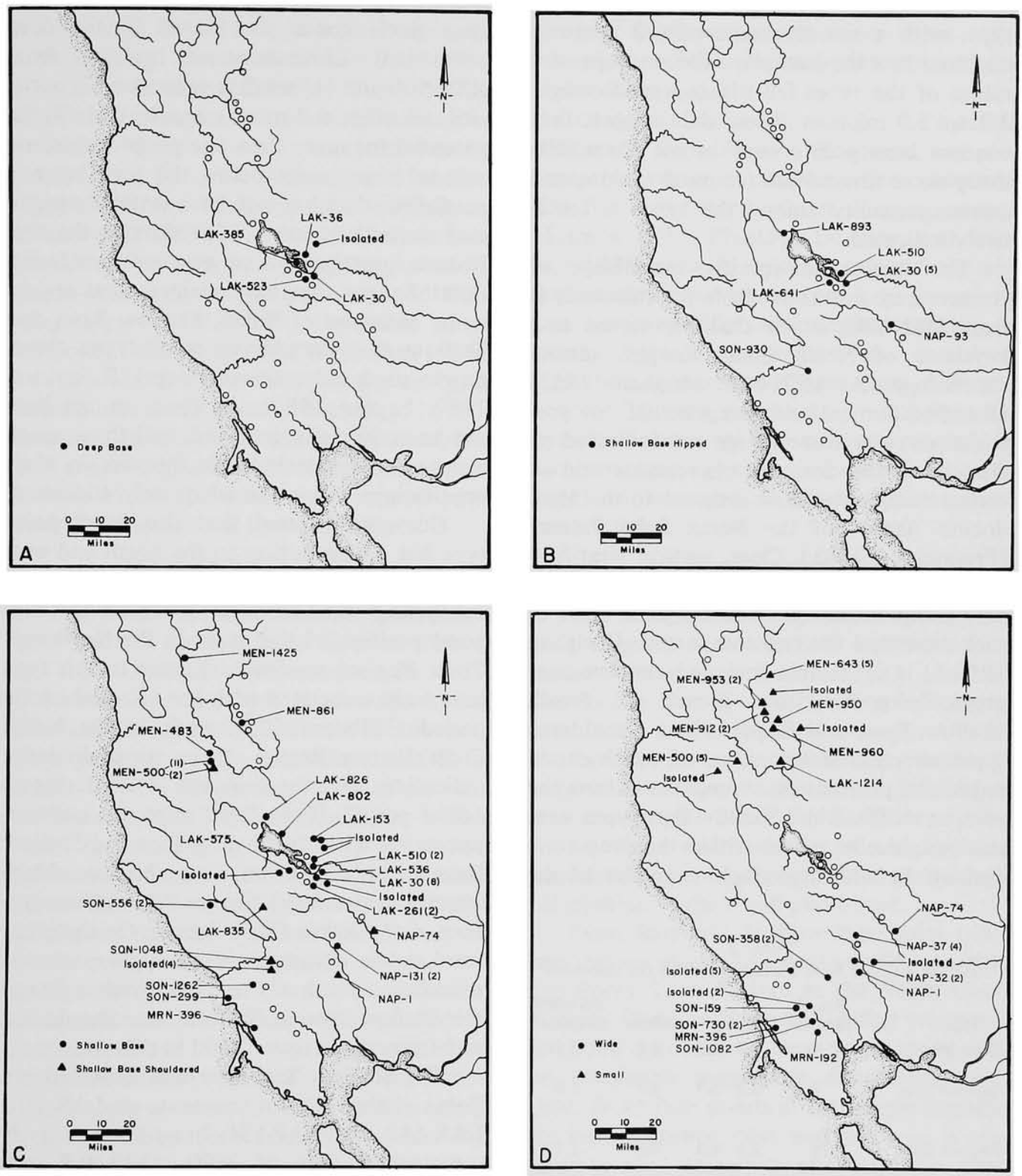

Fig. 3. Distribution of concave base projectile points in the North Coast Ranges.

Shallow Base Shouldered, and Wide types. Only one obsidian example of the Small point type, with a rim thickness of 4.0 microns, occurred in the sample. The average rim values of the types fell within a small range: 3.2 to 5.0 microns. These data suggest that concave base points were in use for a relatively short time, while temporal ranking and contemporaneity among the types is tentatively indicated.

The largest site-specific assemblage of concave base points available for this study is from MEN-500, a site that has served as a keystone of North Coast Ranges cultural chronology. At MEN-500, Meighan (1955) identified two cultural components: one protohistoric, whose recent age was indicated by glass beads and domestic pig remains; and an earlier component now assigned to the Mendocino Aspect of the Borax Lake Pattern (Fredrickson 1981). Clear, vertical stratification was observed in only one portion of the site, along Trench 43, where a thick layer of rock separated the two components (Meighan 1955:5). Our sample included concave base projectile points from Trench 43. Small, Shallow Base, and Shallow Base Shouldered types were found here, none of which occurred in the protohistoric component above the rock layer. Small and Shallow Base types were stratigraphically mixed within the deep component. In addition, single examples of the Shallow Base and Shallow Base Shouldered types were associated with two inhumations in a single grave, also found in the deep component. Limitations of the data from MEN-500 are: (1) small sample size; (2) burial pits and other soil mixing agents; and (3) the potential for more than one pre-protohistoric cultural component below the rock layer, a possibility that has not been critically evaluated since Meighan's (1955) work at the site. Recent investigations at two western North Coast Ranges sites have yielded what appear to be examples of Small, Shallow Base, and Shallow Base Shouldered point types occurring in single cultural assemblages (R. Jackson 1982; Layton 1982). As these studies have not been formally reported, and those specimens were not included in this sample, their implications cannot be adequately addressed.

Table 2
HYDRATION RIM THICKNESSES (in microns)

Type	No. of Samples	Range	Mean	Standard Deviation
Deep Base	4	3.5 - 6.7	5.0	2.1
Shallow Base Hipped	4	3.3 - 5.7	4.7	1.0
Shallow Base	16	2.6 - 6.5	4.6	1.7
Wide	9	1.4 - 6.4	3.6	2.2
Shallow Base Shouldered	4	2.0 - 4.9	3.2	1.5

Our study found that the Small point type has a distribution to the north and west of the Clear Lake basin; however, there is conflicting and limited evidence on the temporal position of this type. In the Northwest Coast Region, specimens similar to this type have been associated with the late prehistoric period (Milburn 1977), while in the North Coast Ranges Region, there are preliminary indications that the type was in use during an earlier period. If the Small type was contemporaneous with the Shallow Base and Shallow Base Shouldered types, then this assemblage appears to be restricted to the western portion of the North Coast Ranges. On the other hand, while numerous Small type specimens were found north of Clear Lake, only a few of the Shallow Base or Shallow Base Shouldered point specimens were found in this area.

The Shallow Base type was identified in a Borax Lake Pattern context at LAK-261, LAK-510, and NAP-131. In addition, a single radiocarbon date of 3690 ± 130 B.P. was stratigraphically associated with Shallow Base point specimens at LAK-261 (Fredrickson 1973). No other Shallow Base forms or Deep

Base specimens in our sample were recovered in stratigraphic contexts.

Although the Wide type is similar to large concave base forms from the Windmiller Pattern in Central California (Heizer 1949), insufficient comparative work has been done to assess their possible contemporaneity. North Coast Ranges obsidian hydration data suggest that the Wide type was contemporaneous with Shallow Base and Shallow Base Shouldered point types. This is supported by the co-occurrence of Shallow Base and Wide point types at SON-358, a possible single component site (Origer and Wickstrom 1981).

Although absolute dating of the six types defined here is not possible because of insufficient radiometric information and incomplete local chronologies, relative dating was accomplished. Fig. 4 illustrates our temporal positioning of the concave base point types.

OBSIDIAN SOURCING

Forty-two obsidian concave base points were sourced through trace element analysis by Trace Analysis Laboratories, Hayward. These results, in addition to obsidian hydration and sourcing information available from three previous studies (R. Jackson and Fredrickson 1979; Kaufman 1980; White and Fredrickson 1981) are given in Table 1. This study was undertaken to identify any correspondence between hydration rim thicknesses, types, and sources. All point types in the sample, except the Shallow Base, are from one or two sources. Projectile points were predominantly manufactured of obsidian from sources located within their geographic distribution. The Wide type is restricted to the southern North Coast Ranges, and points of this type were made with obsidian solely from the two southern sources (Annadel and Napa). Deep Base and Shallow Base Hipped point types in the sample, which occur primarily in the Clear Lake area were, with two exceptions, made with obsidian from the Clear Lake source (Borax Lake). Shallow Base and Shallow Base Shouldered point types that overlap northern and southern areas were manufactured of obsidian from both northern and southern sources.

Obsidian has been shown to hydrate differently depending on its source, and preliminary hydration rates have been proposed for the four North Coast Ranges sources (Ericson 1977; Findlow, DeAtley, and Ericson 1978). Our sample of points from any one source, however, was not large enough to test source-specific chronological ranking of point types. Consequently, we combined hydration rim measurements from different sources. This is a potential source of error for our conclusions, and it will deserve further scrutiny when the concave base point sample has been increased and hydration rates are more refined.

CONCLUSIONS

The integration of spatial and temporal data suggests three districts represented by distinct concave base point forms. In northern Mendocino County, the Small point type is interpreted as a later period arrowpoint form. Further to the south, preliminary evidence suggests contemporaneity of the Small type and the larger Borax Lake Pattern point forms. These data indicate an unanticipated complexity in the geographic and chronological position of the Small point type.

Deep Base and Shallow Base point types may represent part of a single tradition within the Borax Lake Pattern in the North Coast Ranges. Obsidian hydration dating suggests a temporal sequence of these types along with an increasing geographic distribution over time. Deep Base points in the sample have the thickest hydration rims, and this type is confined to the eastern arm of Clear Lake. Shallow Base Hipped points are concentrated near eastern Clear Lake, but also occur in northern Mendocino, Napa, and Sonoma counties.

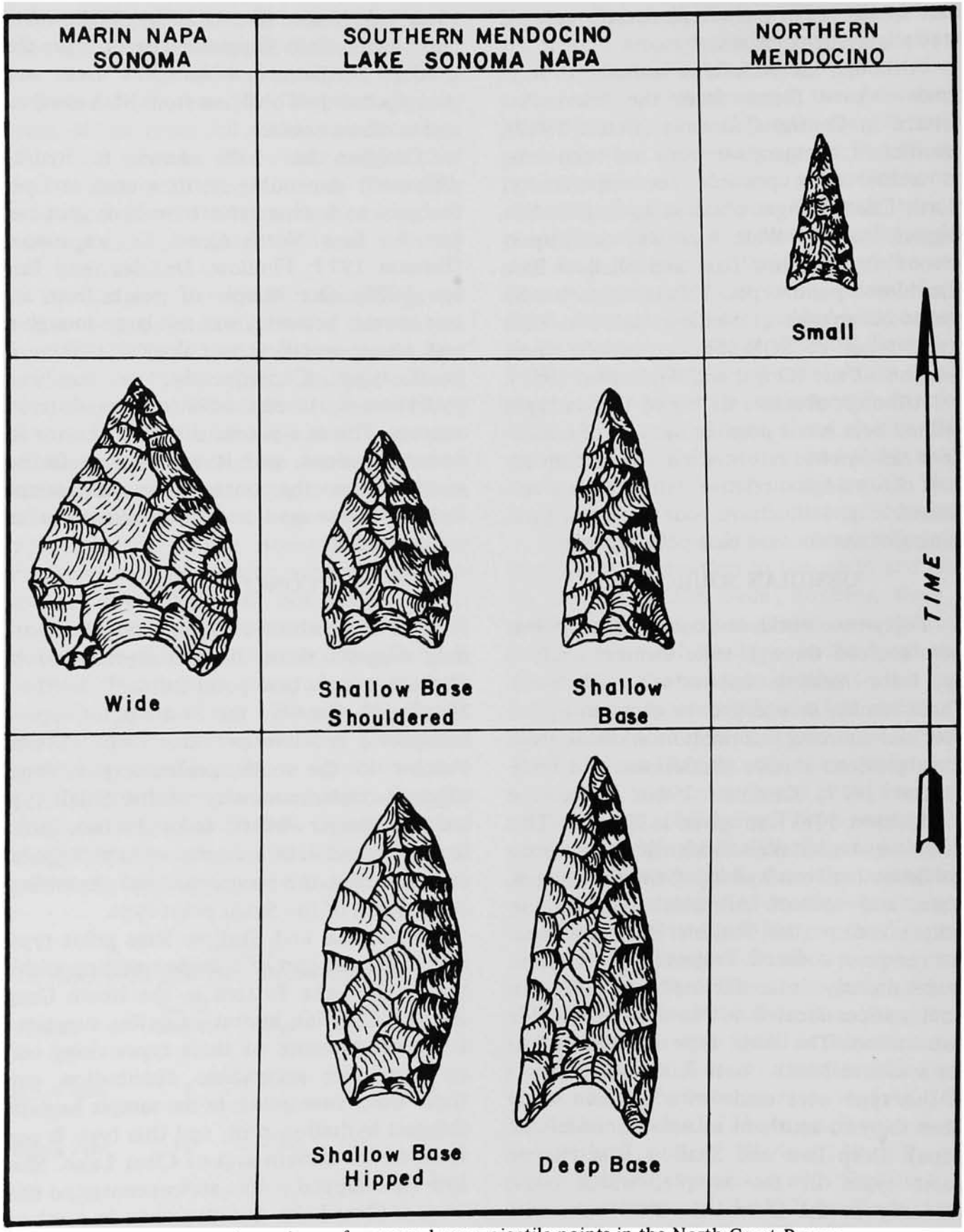

Fig. 4. Relative chronology of concave base projectile points in the North Coast Ranges.

The Shallow Base point type is the most widespread of all forms and, along with the Shallow Base Shouldered type, has relatively thin hydration rims. Although shouldering on some Shallow Base Shouldered specimens appears to be a product of reworking Shallow Base forms, the former type has no greater or lesser utility than other types, as it occurs in a distinct space-time pattern. Evidence for the co-existence of the Shallow Base Shouldered and Shallow Base point types in a single cultural assemblage was found at MEN-500. However, the Shallow Base Shouldered type was absent from Lake County collections that feature numerous Shallow Base specimens. Hydration rim readings for obsidian Shallow Base points occur in a bimodal distribution (Table 2). All specimens in the 6.0 to 6.5-micron group are from the eastern Clear Lake area, while those of the 2.5 to 5.0-micron group were found along eastern Clear Lake and in northern and southern Sonoma County. This may indicate that the Shallow Base form had greater longevity in the eastern Clear Lake area than elsewhere.

The Wide type occurs in Marin, Napa, and Sonoma counties. Obsidian hydration evidence indicates that this type was in part contemporaneous with the Borax Lake Pattern tradition, but its distinctive spatial distribution in the North Coast Ranges and the possible extra-regional affiliations of the type with the Windmiller Pattern in the Delta Region (Heizer 1949) suggest that it was part of a separate tradition.

We believe our analysis has shown the value of concave base projectile points as historical indices, yet we feel that there are additional implications still unexplored. We suggest that the spatial and temporal variability that we have been able to define can be useful in formulating hypotheses about human behavior. Such variability may relate to the movement of various cultural attributes within exchange systems including goods, stylistic behavior, and technological information (Deetz 1968; Fredrickson 1973; Kay 1975).

For example, present sampling suggests that a tradition of concave base dartpoints, associated with the Borax Lake Pattern, expanded from Clear Lake basin into the western and southern North Coast Ranges (see Fig. 3A-C). This can be viewed as potential support for the hypothesized Clear Lake homeland and later Russian River basin expansion of Pomo ancestors, as proposed by Halpern (1964), Baumhoff (1980), and Whistler (1980).

Our classification has posed solutions to some persistent archaeological problems. Conversely, the problem posed "is this classification meaningful in terms other than time and space?" is not resolved. A great deal more analysis of complete assemblages, and not just of single point types, needs to be done. However, since the classification offered here is replicable, we anticipate better communication on these North Coast Ranges archaeological problems.

ACKNOWLEDGEMENTS

Our study began as a seminar in North Coast Ranges archaeology taught by David A. Fredrickson, whose inspiration and encouragement made this paper possible. We also thank the many individuals and institutions who made collections available. Special thanks go to Nelson Thompson for his complementing graphics, Tom Origer for prompt obsidian hydration studies, and Richard Hughes and Jim Bennyhoff, whose incisive comments on an earlier version of the paper stimulated rethinking and rewriting. Any errors in analysis or presentation are the authors' responsibility.

NOTE

1. An earlier version of this paper was presented at the Annual Meeting of the Society for California Archaeology, Bakersfield, 1981.

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