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Archaeology and Linguistics: Pomoan Prehistory as Viewed from Northern Sonoma County, California

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RECENTLY California linguists and archaeologists have entered into a somewhat uneasy, yet provocative liaison and together have begun modeling prehistoric language movements within the state to the extent that these shifts may be correlated with archaeology (e.g., Bright 1976; Levy 1979; Whistler 1977, 1979, 1980). On the one hand, this cooperative effort is adding much to an understanding of California prehistory, providing insight into the processes which gave the state its archaeological and ethnographic configuration. Equally important, however, are the contributions "linguistic archaeology" makes to the general problem of population shifts and ethnic migration. As archaeologists venture beyond establishing baseline chronologies and formulating static reconstructions of past lifeways—and into the realm of culture process—they must deal, among other things, with the problems of direct and stimulus diffusion. Though earlier "archaeological ethnographers" were apt to posit massive migration of people and/or diffusion to explain similarities between geographically distant assemblages (cf. Brew 1968; Trigger 1980; Willey and Sabloff 1974), with the onset of the 'New' or processual approach such arguments virtually dissipated, becoming almost entirely replaced by models of *in situ* development and transformation. Recently, Krantz (1976, 1977) has gone so far as to claim that hunter-gatherers cannot migrate into areas already occupied by "similarly" adapted peoples. Both extremes certainly obscure a basic issue. Human populations, hunter-gatherer and otherwise, do move and have often migrated into areas already occupied by peoples at similar techno-environmental levels. This is documented, if indirectly, by the contemporary distribution of languages within aboriginal California. It is also apparent, however, that all similarities seen in the archaeological record cannot be explained through reference to ethnic movement. Only empirical investigation and documentation can delimit the significance of one or both of these processual categories in any given situation.

Several hypotheses that have been proposed directly address certain aspects of Pomoan linguistic prehistory (Baumhoff 1980; Elmendorf 1980; Levy 1979; McCarthy 1981; Olmsted 1981; Oswalt 1962; Whistler 1980). These discussions have suggested various and alternative linguistic homelands, hypothetical population/language movements, time depth estimates for linguistic divergence, and even archaeological correlates, to explain the history and contemporary distribution of the Pomoan languages.

In establishing the dynamics of Pomoan prehistory the disparities between such proposals can be examined in one of two ways.

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The data can be reinterpreted by linguists themselves. For example, Whistler (1980:22) has criticized Levy's (1979) time depth estimates for Pomoan as being too recent because the latter fails to account for "the homogenizing effect of linguistic divergence within a small, compact family, where contact, mutual borrowing and cultural and environmental similarity would probably result in less apparent lexical change than in a far-flung linguistic family of comparable absolute time depth" (see also Crapo and Spykerman 1979). Thus, while there is room aplenty for infighting among the linguistic community, especially as a function of the approximate nature of historical reconstructions (homeland areas or time-depth estimates), an alternative approach is provided through substantiation or refutation based on archaeological evidence (e.g., Ehret 1976; Kinkade and Powell 1976; Swadesh 1959; Whistler 1979, 1980). In addition, such an approach provides a method for dealing with the role of ethnic movement in causing culture change.

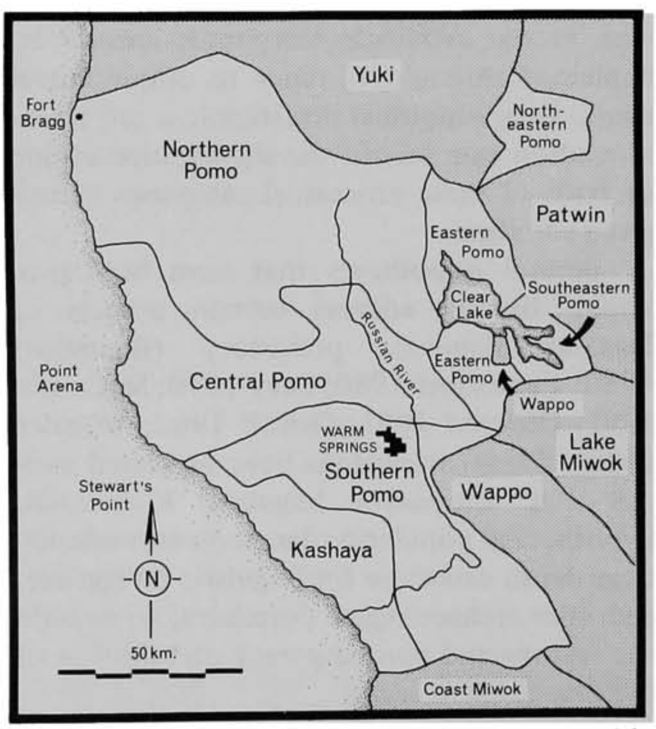

Fig. 1. Map of the Warm Springs project area with Ethnolinguistic groups and Notable physiographic features of interest.

The present paper, then, compares archaeological data from the Warm Springs Dam Project in northern Sonoma County (Fig. 1) with various linguistically derived reconstructions of Pomoan prehistory in an attempt to determine the time-depth of Pomoan presence in the area. The paper argues for the necessity of such a "combined approach" and examines the requirements and assumptions inherent in it. In so doing, what follows can be seen as a test case of at least one way in which culture process may be elaborated. Two cultural breaks are present in the Warm Springs sequence, one of which seems best explained by the influx or impingement of Pomoan-speaking peoples and one which can be explained in terms of *in situ* functional reorientation, perhaps linked with social intensification.

ESTABLISHING ETHNICITY

If population/linguistic replacement or ethnic spread is, as has been claimed, one stimulus to culture change, it becomes necessary to isolate cultural affinity or ethnicity in the past. This being so, to what extent can ethnic and/or linguistic units[1] be correlated with material culture—indeed, can such correspondences be expected at all?

Anthropological evidence seems equivocal in answering this question. On the one hand, Barth (1969) has argued that ethnic units persist only if they imply marked differences in behavior. This statement does not, however, coincide with a view that such units need be culturally or geographically isolated from one another. In fact, "ethnic distinctions do not depend upon an absence of social interaction . . . but are quite to the contrary often the very foundations on which embracing social systems are built" (Barth 1969:10). Therefore, both commonality and diversification can be expected between differing social or ethnic units depending upon the cultural "element" being considered. Such cultural elements include aspects of belief, behavior, and technology, although attributes of material culture are of principal interest to archaeologists. As a consequence, it is necessary to isolate attributes of material culture possessing high "ethnic resolution."

Since artifact assemblages often covary significantly between two proximal or geographically distant site loci purely as a result of differing subsistence-settlement adaptations (within or between groups)(Binford 1978; Gould 1980; Thomson 1939), attributes with stylistic rather than purely functional overtones are probably more susceptable to ethnic identification. Functionally significant categories or features are more prone to rapid diffusion and generally evidence greater spatial distribution (e.g., the ubiquitous mano/metate or mortar/pestle ground-stone technologies; see White and O'Connell 1979).

Ethnic identification using stylistic elements remains, however, problematic. Stylistic elements can be more culture-bound and reflect discrete social units (Cannon and Hayden 1981; Hodder 1977), serving, perhaps, as information transmission devices (Hodder 1979; Wobst 1977), but such cannot be assumed *a priori* (Plog 1980; Wobst 1974). The problems involved, all of which are interrelated, include:

1. Determination of those attributes which might or do reflect ethnic distinctions (e.g., pottery motifs, projectile point types, dress forms, or a combination thereof);
2. Determination of the level of cultural distinction (assuming such is present) that such attributes correspond with (e.g., to the family, clan, lineage, village, tribelet, or ethnolinguistic group);
3. Proper "weighting" of the effects of exchange or other social interactions that could skew patterning (e.g., what is the relationship of the production sphere to the use sphere?);
4. Proper "weighting" of the effects of historical processes in determining patterning (e.g., the effects of trait diffusion across ethnic boundaries); and finally,
5. Determination of the degree to which differentiation is or should be reflected (e.g., do single traits, trait clusters, or entire shared assemblages constitute meaningful ethnic distinctions?).

Such requirements and assumptions preclude the simple use of material culture in defining ethnic units or boundaries. Certain items and/or attributes no doubt do possess capabilities of this sort, but it is not possible to determine beforehand which these may be, what level of differentiation they may represent, or what social and historical processes may be "polluting" the ethnic resolution.

For these reasons, and probably others, ethnic differentiation using material culture directly cannot be operationalized. Since archaeologists interested in the interplay of ethnic movement and culture change work primarily with material items, some other approach is essential to examining such problems. One solution to the dilemma lies in the use of data from comparative and historical linguistics. This approach, which can be termed "linguistic archaeology," compares data derived through independent linguistic analysis with archaeological assemblages in an attempt to ascertain prehistoric language movements. An underlying concept of this approach is that distributional changes are probably concomitant with population shifts.

LINGUISTIC ARCHAEOLOGY

Linguistic archaeology can be grossly defined as an anthropological enterprise in which data generated by historical and comparative linguistics, and by archaeology, are compared and contrasted. Of special interest to the present study is an approach that compares linguistically based homeland reconstructions, propositions of language dispersals, and time depth estimates for such, with archaeological assemblages.

This approach is, of course, not entirely new nor endemic to California, although the region provides great potential for such study given its notable variation in environment, culture, and language. Similar approaches have, for example, been used to examine the so-called Numic spread in the Great Basin (Bettinger and Baumhoff n.d.; Fowler 1972; Madsen 1975) and the Bantu expansion in central Africa (Phillipson 1976; von Bakel 1980). The Numic example deals with a seemingly rapid spread of related languages through a region of minimal environmental and sociocultural diversity (cf. Crapo and Spykerman 1979; Goss 1977). The Bantu case is correlated with the diffusion of Iron Age technology, material innovations almost without parallel in the prehistoric world. These factors make explanation of these movements more directly accessible: the Numic case with regard to a more generalized "umbrella-like" model, and the Bantu case with respect to an obvious inequality in technology. In California by contrast, there is a combination of high diversity and less extreme technological differentiation, set against a backdrop of multiple linguistic/population intrusions (Baumhoff and Olmsted 1963, 1964; Levy 1979; Whistler 1977, 1979, 1980). The California situation demands a careful, case-by-case, examination.

While the basic procedure involved in comparing linguistic and archaeological data is straightforward, there are several critical assumptions and requirements involved.

1. Language movement and displacement is accompanied by concomitant changes in population. The historical record is firm in supporting the observation that language spread generally occurs through physical population movement. Exceptions, where they occur, are almost always accompanied by "economic or political superordination by the speakers of the successor language" (Bettinger and Baumhoff n.d.:3; see also Ehret 1976);
2. The initial influx of the successor language will be archaeologically visible. Its arrival may be marked by a dramatic shift from the previous pattern or may be evidenced by a more gradual, less extreme assemblage change; however, it will not be associated with the relative stability characteristic during the duration of a cultural period;
3. Archaeological assemblages can, but need not, contain or be comprised of elements which serve as ethnic markers for the preceding and/or incoming peoples. Occurrence of similar (though probably not isomorphic) assemblages can be associated with differing ethnolinguistic units elsewhere without compromising the model. Stimulus diffusion and exchange are, therefore, accounted for;
4. Such linguistic/population replacements need to be explained, not simply proposed *in vacuo*. An impingement of one population is concomitant with the retraction or elimination of that preceding it. In accounting for this, some adaptive advantage for the successor, technological and/or strategic, must be delineated.

These tenets are central to the approach outlined in this study. Prior to consideration of the Pomoan problem, relevant archaeological and linguistic data are discussed.

WARM SPRINGS ARCHAEOLOGY

The Warm Springs Dam/Lake Sonoma locale, situated in northern Sonoma County (Fig. 1), is within the region ascribed to speakers of the Southern Pomo language (McClendon and Oswalt 1978). A detailed discussion of the Warm Springs cultural sequence is clearly beyond the scope of this paper,[2] however, an outline is presented below.

Three cultural patterns are clearly discernable at Warm Springs; from earliest to latest these are designated the Skaggs period, the Dry Creek period, and the Smith period.[3]

Skaggs Period

The earliest recognizable cultural manifestation at Warms Springs, the Skaggs period, is dated prior to about 2500 B.P. on the basis of radiocarbon determinations from three sites: CA-SON-547 (Bouey 1981*a*), CA-SON-556 (Baumhoff, personal communication; Hayes 1982), and CA-SON-593-II (Baumhoff and Orlins 1979). The basal date for the period has not been determined, but dates of approximately 5000 years B.P. are available. Projectile points consist of large chert side-notch (Willits Side-notch, Baumhoff 1981) and concave base forms (White *et al.*, this issue) in the dartpoint size range. Other aspects of the assemblage indicate a mano/metate grinding technology, heavy reliance on chert in manufacturing flaked-stone items (almost to the exclusion of obsidian) and, in general, little variability in the kinds of tool types present (Basgall 1981*a*; Bouey 1981*a*; Baumhoff 1980). During this period evidence is lacking for what Binford (1962) terms ideo-technic artifacts, i.e., beads, pendants, rock art, etc.

Sites with Skaggs period components are relatively rare in the project area and, when present, show a low density of cultural material per volume of deposit. Both alluvial and colluvial agents have contributed much of the deposit, suggesting an extensive and/or episodic nature for the occupational pattern. Sites may have been occupied frequently but for short duration (Basgall 1981*a*; Baumhoff 1980).

Dry Creek Period

The Dry Creek period, the intermediate cultural pattern at Warm Springs, dates between approximately 2500 B.P. and 500 B.P. Temporal evidence is provided by radiocarbon determinations at four sites: CA-SON-547 (Bouey 1981*a*), CA-SON-551 (Basgall 1981*a*), CA-SON-556 (Baumhoff, personal communication; Hayes 1982), and CA-SON-608 (Bouey 1981*b*). Amino acid racemization dates from CA-SON-556 corroborate the radiocarbon chronology (Skelton 1981). The diagnostic point forms are the Excelsior (Baumhoff 1981; Baumhoff and Orlins 1979; Fredrickson 1974; White and Fredrickson 1981) and general leaf-shape lanceolate forms. Most are large, though some may overlap with an arrow-point size range. In contrast to the dominance of chert during the preceeding Skaggs period, obsidian was apparently the preferred flaked-stone material during this period. Especially significant in this regard is the presence of an elaborate, obsidian-biface-reworking industry (Baumhoff and Orlins 1979; Hayes 1982). Mano/metate grinding technology is replaced by bowl mortars and pestles, perhaps indicative of the shift to acorn leaching and a greater dependency on nuts.

It is during the Dry Creek period that recognizable non-utilitarian artifacts appear. Globular steatite beads and steatite (and other stone) pendants appear, as well as cupule rocks (Baumhoff 1980; Clewlow 1978; Heizer 1953). This rock art, also termed the pit-and-groove petroglyph style (Heizer and Baumhoff 1962), is recorded ethnographically for only the Pomo (as "baby rocks," see Barrett 1952; Loeb 1926; Aginsky 1939) and for certain Northwestern California groups (as "rain rocks," see Driver 1939; Heizer 1953). At least two Dry Creek period sites are associated with surface boulders containing multiple cupule elements, but more significant is the recovery of a cupule rock from the base of a deep, well-developed Dry Creek component at CA-SON-571. This provenience provides a minimal date for the artifact style.

Most Dry Creek period components are relatively thin, though rich in cultural materials (Basgall 1981*a*; Baumhoff and Orlins 1979; Bouey 1981*a*). Only two sites (CA-SON-556 and CA-SON-571) contain well-developed and well-differentiated Dry Creek strata (Basgall n.d.*a*; Hayes 1982). In all instances, however, the midden deposition is indicative of more intense occupation: artifact categories tend to be broader, frequencies higher, and naturally deposited material less of a constituent.

Smith Period

The latest cultural period at Warm Springs is designated the Smith period, extending from approximately 500 B.P. until the historic period. Dating comes from five sites: CA-SON-547 (Bouey 1981*a*), CA-SON-556 (Baumhoff, personal communication; Hayes 1982; Skelton 1981), CA-SON-568 (Basgall 1981*a*), CA-SON-577 (Baumhoff, personal communication; Basgall 1981*c*), and CA-SON-597 (Baumhoff, personal communication; Bouey 1981*c*). Points from the period are typically small, corner-notched forms (Rattlesnake Island Corner-notch, Baumhoff 1981) in the arrowpoint size range. Obsidian use in general, while continuing to be relatively well represented, is less emphasized during this period. Mortar and pestle, groundstone technology continues, as does the presence of cupule rocks. While tool-kit variability is similar to that evident during the Dry Creek period, the obsidian biface-reworking industry apparently ceases (though see Hayes [1982] for an alternate view) and a specialized drill/bead industry appears at some sites. These drills, small and bipointed, were almost certainly hafted in the ethnographic fashion (Hudson 1897; Loeb 1926) and are associated with shell material (e.g., clam-shell disk beads, bead blanks, and general refuse) in a statistically meaningful way (Basgall 1981*a*, 1981*d*). The co-occurrence of these two elements suggests a functional relationship (Heizer and Kelley 1962; King 1971); that is, the manufacture of shell beads or currency at these locales (Chagnon 1970; Loeb 1926; Vayda 1967). Further, the fact that sites bearing drills are limited in occurrence and internally differentiated suggests the presence of site-specific and perhaps individual-specific craft specialization.

Sites with Smith period components are the most prevalent at Warm Springs, are typically the largest in areal extent, and generally display well-developed deposits. This pattern suggests intensive use of both the sites proper and the overall region during the late prehistoric period.

Summary and Implications

The preceding synopsis outlines, albeit in a gross fashion, the changes in material culture evident in the Warm Springs sequence. While the inception of the Skaggs period is ill-defined, it extends to at least 500 B.P. Between the Skaggs and Dry Creek periods there is little overlap in cultural patterning: projectile-point forms and ground-stone technology change, lithic raw materials shift from chert to obsidian, general tool-kit variability increases markedly, non-utilitarian artifacts emerge, and occupational intensity increases (Table 1). The transition between the Dry Creek and Smith periods is apparent, yet not so abrupt: projectile points change in both form and apparent function, non-utilitarian artifact styles shift somewhat, and occupational intensity continues to increase by both

Table 1

CHARACTERISTICS OF WARM SPRINGS CULTURAL PATTERNS

Attribute	Skaggs Period	Dry Creek Period	Smith Period
Dating (B.P.)	(5000?)-2500	2500-500	500-Historic
Projectile Points (morphological)	Large Concave Base Willits Side-Notch	Excelsior Leaf-Shaped	Small Corner-Notch (Rattlesnake Island)
Projectile Points (functional)	Atlatl	Atlatl (arrow ?)	Arrow
Dominant Ground Stone Form	Mano/Metate	Bowl Mortar/Pestle	Bowl Mortar/Pestle
Dominant Flaked Stone Material	Chert	Obsidian	Obsidian/Chert (Co-Dominant)
General Tool-Kit Variability	Low	High	High
Frequency and Kinds, Ideotechnic Artifacts	None Recognizable	Moderate: Steatite Beads, Stone Pendants, Cupule Rocks	Moderate: Clam Shell Disks, Glass Trade, Cupules
Site Density	Low	Moderate	High
Component Configuration	Moderate Deposit; High Natural Constituents	Generally Thin Deposit; Low Natural Constituents	Well-developed Deposit; Low Natural Constituents

site and region. Continuity is evident, however, in the mortar/pestle, ground-stone technology, high tool-kit variability, cupule rocks, and in the continuance of a relatively high preference for obsidian (Table 1). In sum, while period characteristics differ substantially, the earlier (Skaggs-Dry Creek) transition is the more dramatic and discontinuous.

If it can be assumed that these archaeological shifts or transitions are real and that they may possess cultural or linguistic meaning, the dates of 2400-2600 and 400-600 B.P. should be examined as periods of sociocultural turmoil or flux. And while these archaeological "breaks" may reflect *in situ* adaptive responses, equally possible are concomitant changes in population/linguistic affiliation and distribution. In attempting to differentiate between these two potential transformational processes it is necessary to examine ancillary archaeological, ethnographic, and most importantly, linguistic, data.

POMOAN LINGUISTICS

The Pomoan language family is comprised of seven distinct languages (Northeastern [NE], Eastern [E], Southeastern [SE], Northern [N], Central [C], Southern [S], and Kashaya or Southwestern [K]), all of which show different degrees of relatedness (Halpern 1964; Oswalt 1962; McClendon and Oswalt 1978). The Pomoan family is thought to be a component of the still hypothetical Hokan language stock or phylum (Dixon and Kroeber 1913). Certain hypotheses regarding historical relationships within Pomoan are discussed below.

Genetic Relationships

The genetic relationships of the Pomoan languages have been outlined variously (i.e., Powers 1877; Barrett 1908; Kroeber 1925; Halpern 1964; Oswalt 1962). Oswalt (1962), in a generally accepted classification, determined the internal relationships of Pomoan using lexicostatistical data. According to his proposal, the most divergent languages were NE, SE, and E, each of which show as much differentiation between one another as to other Pomo languages. More closely affiliated were the N, C, S, and K languages, which were placed within a common "Western Branch" of the family. Finally, these four languages were separated into northern and southern groupings (N versus C, S, and K, respectively). These relationships are illustrated in Fig. 2.

Using data on phonetic change, Halpern (1964) proposed two alternative possibilities. Both models are in accord with Oswalt in suggesting the SE, E, and NE languages to be the most divergent; however, the phylogenies are somewhat different. Following separation of the SE and E languages, Halpern suggests a stage characterized by Proto-Russian River Pomoan, from which the remaining languages (including NE) diverged. In one scheme, NE is hypothesized to have split first, followed by the differentiation of N and C from a common ancestral form, and completed by the divergence of S and K. The alternative proposal has NE and N separating first from a common ancestral form, followed by the divergence of C, S, and K. These relationships are diagramed in Fig. 2.

Although these alternative schemes differ, both Oswalt (1962) and Halpern (1964) are in general agreement. The Western Branch languages possess the greatest commonality; disagreement is focused primarily on the relative position of NE and on the closeness of N to the group C, S, and K.

Homeland Reconstructions

Whereas all investigators seem assured that the original Pomoan homeland, or *Urheimat*, was located in the general zone occupied by its ethnographic speakers, its exact location is controversial. Webb (1971) has proposed the Russian River drainage as the most likely locale, a suggestion in opposition to several others who propose a Clear Lake homeland. Based upon the area of "greatest linguistic diversity," Oswalt (1962) argues for the Clear Lake region; based on lexical reconstruction of plant and animal nomenclature (particularly fish terms), Whistler (1980) suggests a Clear Lake *Urheimat* (but see Olmsted [1981] who suggests Whistler's data are too meager to allow fine-grained locational determination); and although not stated explicitly, Halpern (1964) seems also to hint at a homeland at or around the Lake.

Webb's (1971) reconstruction aside, most data point to the general Clear Lake area as the Pomoan homeland. Subsequent language/population movements should probably be seen as expanding from this location.

Population/Language Movements

Hypothetical population movements, associated with the differentiation and expansion of Pomoan, have been proposed by Oswalt (1962), Halpern (1964), and Webb (1971). Oswalt suggests that from Clear Lake, the Western Branch proto-language "migrated across the range of mountains just to the west of Clear Lake over to the Russian River. There they spread north and south through the string of valleys along the course of the River so that its drainage system came almost entirely into Pomo hands" (1962: 419-420). The NE Pomo moved to the northeast, while E and SE peoples became situated in their ethnographic locations. Halpern (1964:91) is in agreement, suggesting that the differentiation of Western Branch languages (as per Oswalt) was accompanied by a "fanlike migration to the north, west and south," originating between the Russian River drainage and Clear Lake.

On the basis of her Russian River homeland reconstruction, Webb (1971) posits a more localized dispersal of Western Branch languages. Speakers of SE, E, and NE moved

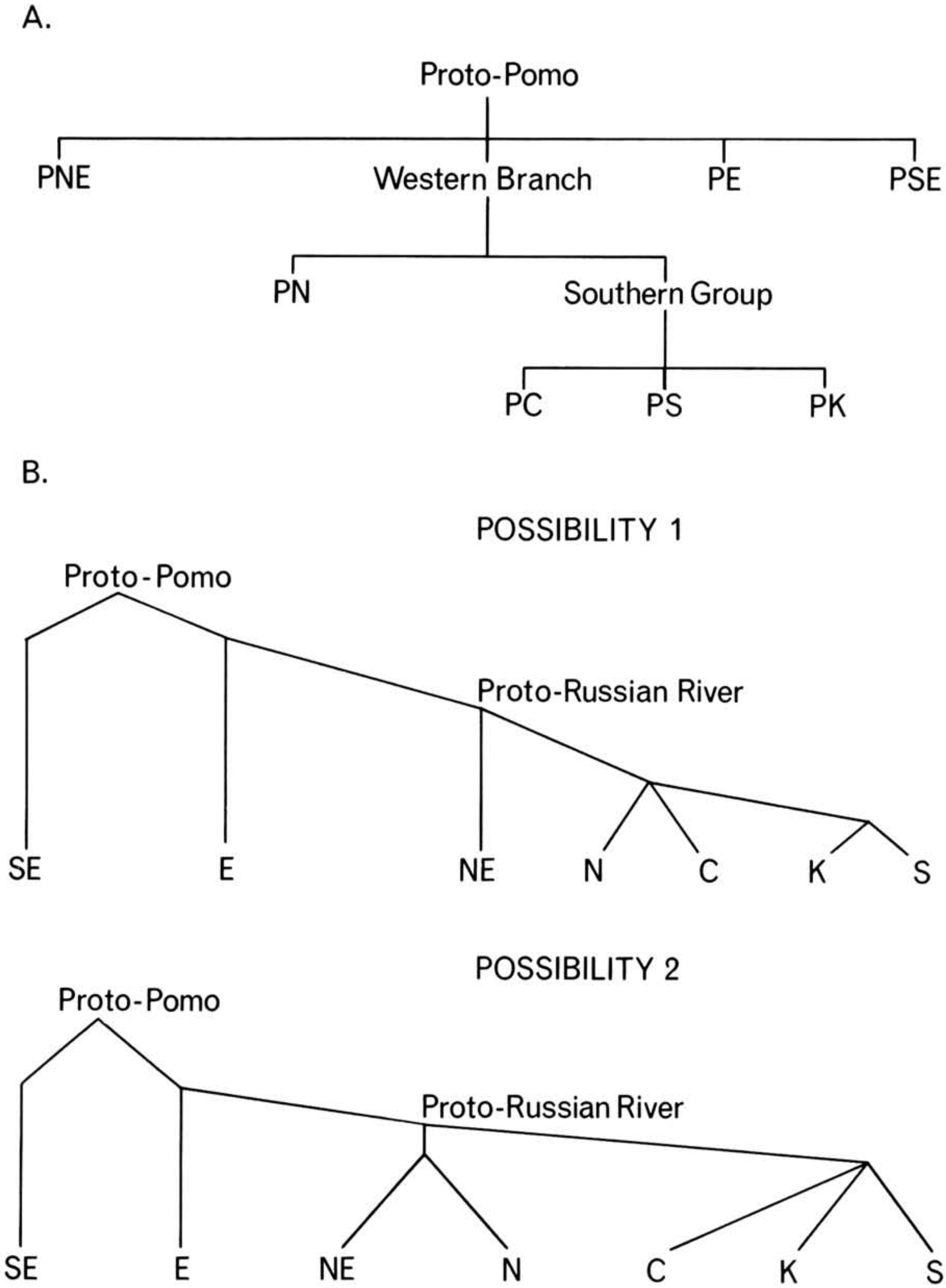

Fig. 2. Diagramatic representations of Pomoan internal relationships. A. Oswalt's (1962) scheme; B. two alternatives proposed by Halpern (1964).

further to the east and northeast.

With respect to the Western Branch languages, proposed migration patterns are more or less analogous, though based upon differing assumptions. From an initial focus within the Russian River drainage, N, C, S, and K languages differentiated and spread.

Time Depth Estimates for Pomoan Languages

Accepting Oswalt's (1962) classification of Pomoan, time depth estimates for divergence of the various languages can be examined. But first a caveat is necessary. Languages diverge at greater or lesser rates according to the extent of cultural interaction between speakers and to their geographic proximity (Crapo and Spykerman 1979; Swadesh 1959). For this reason it is difficult to assign absolute time-depth estimates for the differentiation of daughter languages, and indeed, Oswalt (1962) refused to discuss glottochronological determinations on this basis. When utilized, such derivations should be viewed as very approximate.

Limitations aside, chronological estimates have either been proposed for Pomoan (Levy 1979; Whistler 1980) or can be inferred from published lexicostatistical information (Oswalt 1962). Further, independently derived (i.e., linguistically based) time depth determinations are necesssary to this study.

Although refusing to discuss "absolute estimates" of time depth, Oswalt (1962) suggests a degree of divergence between the seven Pomoan languages which can, on the basis of analogy with Indo-European, be assigned a date of 2500-3500 years for all of the family. Glottochronological determinations based on his lexicostatistical data, using the 86 percent retention rate, (Swadesh 1955), provide the following estimates: for initial separation of the Pomoan family, 2570 years B.P.; for the age of the Western Branch, 2160 B.P.; for the split between the northern and southern groups within Western, 1380 B.P.; and for differentiation of the southern group, 910 B.P.

Levy's (1979) glottochronological estimates, based upon 15 languages and dialects, are different. For the divergence of Proto-Pomo a date of 1464 B.P. is suggested; for the Proto-Western Branch language, 976 B.P.; and for the Proto-Southern language, 586 B.P.

Estimates made by Whistler (1980) are of interest, but are not directly comparable. Whistler does not specify the phylogenetic node to which a date corresponds with any precision, prefering instead to make more sweeping statements about general population movements. Additionally, he fails to elaborate the source of his estimates and seems to base them on both linguistic and archaeological data. That is, Whistler's (1980) time-depth estimates are not independently derived.

The Proto-Pomo language Whistler (1980) dates to at least 5000 B.P., correlating it with Late Borax Lake pattern archaeological assemblages (i.e., Fredrickson 1973, 1974). Prior to 4000 years ago, a Pomoan movement into the Russian River drainage is proposed, followed by a further expansion south and southwest at approximately 1500 B.P.

Finally, it should be noted that in referring to the physical separation of Wappo from the northern Yukian[4] languages (Coast Yuki, Yuki, and Huchnom), Elmendorf (1980) is in agreement with Oswalt (1962) in suggesting a date of approximately 2500 years B.P. for the Pomoan movement which isolated the northern and southern Yukian speakers.

Summary and Implications

This set of linguistic data suggests a more or less consistent scenario to describe the history and ethnographic distribution of the Pomoan languages. The N, C, S, and K languages all appear closely related and diverged from a common ancestor that can be termed Proto-Western (Oswalt 1962) or Proto-Russian River (Halpern 1964). These languages appear to have differentiated and expanded geographically from a point in the Russian River drainage, either from a homeland in that area, or as seems more likely, after moving there from an original *Urheimat* at Clear Lake.

Only with respect to relative time-depth estimates for these divergences does there appear substantial disagreement.

THE PROBLEM

Archaeological data from Warm Springs document three periods of general stasis and two "breaks" or transitions. There are, thus, three potential times for initial Pomoan presence in the area: (1) the earliest, Skaggs period, represents Pomoan presence, a pattern lacking in any recognizable predecessor; (2) the Skaggs-Dry Creek transition documents the Pomoan replacement of a previous language/population; or, (3) the late, Dry Creek-Smith shift reflects the initial influx of Pomoan speakers.

Realizing that various "nodes of linguistic differentiation can be tied only loosely to initial cultural presence within a region (e.g., the Western Branch languages could have been in the Russian River drainage for either a long or relatively brief time prior to differentiation), it is to the broader phylogenetic picture that comparisons must be made.

It is assumed, therefore, that Pomoan presence in the Warm Springs area could correspond anywhere between the initial split of Proto-Pomo and the later differentiation of the southern group (C, S, and K) languages. By this rationale, Oswalt's (1962) lexicostatistical data suggest a "window" between about 2600 and 900 years B.P.; Levy's (1979) data suggest a period between 1464 and 586 B.P.; and Whistler's (1980) estimates, to the extent that they are usable, place it from before 4000 years until about 1500 years B.P. Elmendorf's (1980) estimate, based upon the Yukian languages, is about 2500 years.

On the surface these linguistic data are equivocal. Whistler's (1980) proposals are in line with either Skaggs or Dry Creek assemblages being Pomoan; Oswalt's (1962) data with only the Dry Creek assemblage marking intrusion; and Levy's (1979) dates with only the late, Smith Period materials. More careful scrutiny, however, suggests that only the Skaggs-Dry Creek transition probably reflects Pomoan influx into the Warm Springs area. Discussions of each of the three possibilities are presented below.

DISCUSSION

Skaggs Period

Although Whistler's (1980) time-depth estimates seem derived through a "mix and match" approach to the archaeological and linguistic data, if used they are in agreement with a recent proposal by White, Jones, Roscoe, and Weigel (this issue). These authors have posited a serial expansion of Shallow Base Concave Base projectile points[5] from the Clear Lake area into Sonoma County, and have suggested this temporal/spatial pattern corresponds with the expansion of Pomoan speakers from a homeland into their ethnographic range.

The Shallow Base Concave Base type, a dominant point form in Skaggs period components at Warm Springs, is generally dated between 5000 and 3000 B.P. and associated with the Late Borax Lake pattern (Fredrickson 1973, 1974; White and Fredrickson 1981). Since Whistler (1980) has hypothesized a relationship between such assemblages and Proto-Pomo, the proposal of White *et al.*, in conjunction with dates available from Warm Springs, rejects such a Clear Lake-focused expansion. There are no statistically meaningful differences in mean hydration rim values from the various areas and hence no evidence for the type "expanding." Further, as has already been discussed, there is reason to suspect any one-to-one relationship between a single artifact type and an ethnic or linguistic unit.

Other problems with a Skaggs-Pomoan correspondence exist as well. All time-depth estimates based upon independent linguistic data place the time of Proto-Pomoan differentiation after the earliest dates for Skaggs components at Warm Springs. Neither Oswalt (1962) or Levy (1979) give 5000 years of time depth for all of Pomoan, let alone the differentiation that occurred following the proposed migration to the Russian River.

Elmendorf (1980) has proposed a Yukian continuum from southern Wiyot territory south to Wappo country, a distribution which was split (at some point) by the expansion of Pomoan speakers (see also Halpern 1964). The disjunction between northern and southern Yukian is a pattern which cannot even be documented if the first archaeologically recognizable occupants in the intervening geographic zone are Pomoan.

Finally, tantalizing data are provided by McClendon's (1973) reconstruction of Proto-Pomo. If her reconstructed lexical items are used to infer past cultural practices (cf. Ehret 1976; Thieme 1957), there is a suite of terms for items or behavioral patterns associated with acorn exploitation. Terms for acorn, acorn bread, acorn mush, leaching, and mortar all reconstruct, perhaps suggesting the importance of balanophagy to Proto-Pomoans.[6] Were this the case, it is hard to fathom that Skaggs period sites at Warm Springs, being derivative of Proto-Pomoan, would be without mortar/pestle technology.

These lines of evidence serve to lower, if not negate, any Skaggs Period-Pomoan correspondence. Given the proposals of Elmendorf (1980) and Halpern (1964), a plausible alternative candidate would be Yukian speakers, however, this cannot be ascertained with available data.

Dry Creek Period

The perspective that the Dry Creek period represents initial Pomoan occupancy at Warm Springs is in best agreement with available information. If Skaggs period assemblages are non-Pomoan, then on the basis of the two remaining choices the Skaggs-Dry Creek transition is the most likely, if only based on the abruptness and dramatic nature of it. It is this shift that shows the most significant change in material culture and subsistence-settlement adaptation. Other data, however, also support such a reconstruction.

The approximate 2400-2600 B.P. date for this "break" agrees with independently derived linguistic information. Glottochronology based on Oswalt's (1962) lexical comparisons supports well such a time depth, as does the latter end of Whistler's (1980) "archaeolinguistic" estimate and Elmendorf's (1980) proposal. Only Levy's (1979) dates are too recent, for reasons perhaps stemming from his not considering pertinent homogenizing factors (cf. Crapo and Spykerman 1979; Whistler 1980). Also significant are McClendon's (1973) lexical reconstructions that coincide with the full-blown presence of mortar/pestle technology during the Dry Creek period.

Rock art within the project area is also suggestive of Pomoan presence, with the Dry Creek period marking the appearance of cupule rocks or pit-and-groove petroglyphs.[7] Already noted is the correspondence between cupule or "baby" rocks and the ethnographic Pomo (Aginsky 1939; Heizer 1953; Loeb 1926), in itself suggestive of historical continuity. Also important, however, is a proposal by Baumhoff (1980; True and Baumhoff 1982) positing a relationship between such petroglyphs and Hokan languages. Noting the persistence of the petroglyph style in areas occupied by Hokan-related peoples, and the similarity of its "function" within these cultures, Baumhoff suggests a possible basal Hokan culture associated with a religious system founded on world renewal. Both arguments, historical continuity and a Hokan relation, point to Dry Creek components as being Pomoan.

Smith Period

Although really later than even the upper extreme of Levy's (1979) time-depth estimate (ca. 586 B.P.), with slight modification Smith period assemblages could reflect the basic Pomoan intrusion. It does not, however, fit well with the bulk of linguistic data (e.g., Elmendorf 1980; Oswalt 1962; Whistler 1980), nor does it correspond well with other evidence.

The shift represented by the Dry Creek-Smith transition is more of degree than kind. Material culture changes only slightly (clamshell disks replace steatite objects and a drill/bead industry replaces biface reworking) and there is no extreme reorientation in the subsistence-settlement system. The data suggest a shift toward intensification, rather than replacement, of a previous adaptive pattern.

Finally, evidence provided by rock art argues continuity between the Dry Creek and Smith periods. If cupule rocks can be associated with Hokan languages (Baumhoff 1980), no other Hokan language and/or people seem likely to precede Pomoan at Warm Springs.

Summary and Implications

Upon weighing the available evidence, the best fit between the archaeology of Warm Springs and reconstructions of Pomoan history lies in assigning Dry Creek assemblages to the initial Pomoan presence in the area. This being so, Skaggs period assemblages must represent some non-Pomoan, perhaps Yukian, language/population. In contrast, Smith period assemblages and the shift accompanying their appearance seem best explained in terms of reorganization and intensification of a continuing Pomoan pattern.

Assuming that a Dry Creek-Pomoan correspondence is correct, what remains to be accomplished is delineation of the factors that allowed the intruders to achieve priority over their Warm Springs predecessors. Krantz (1976, 1977) has stressed the need to explain such population impingements and has argued that under normal circumstances, hunter-gatherers cannot gain such priority. Bettinger and Baumhoff (n.d.) have, however, proposed a model which would allow for just such population movements, and have applied it to the spread of Numic speakers in the Great Basin. Suggesting that the Numics were more seed-focused and less mobile than the generalist, more mobile, large-game oriented pre-Numic peoples, they have shown how one adaptation can have a selective advantage over another. Using basically an optimization argument (Bettinger 1980; Winterhalder 1981), Bettinger and Baumhoff recognize a distinction between a processor strategy and a traveller strategy. Travellers (pre-Numics) were reliant on resources that are highly ranked, involve greater travel/search costs, and cost less in extraction and processing. Conversely, processors (Numics) relied more heavily on low-ranked resources, or those incurring less cost in travel/search time and a greater expenditure in extraction and processing. By noting the interdependence of subsistence adaptations with other elements of the social system, Bettinger and Baumhoff (n.d.) argue that one strategy cannot easily shift from one to the other, each being seen as an adaptive peak. By depending upon resources that are lower in rank but more localized in distribution, processors can achieve priority over travellers, due both to more "efficient" use of the environment and to the greater population density implied by such an adaptation (see Bettinger [1980] and Winterhalder [1981] for detailed discussion of the tenets of optimal foraging theory).

Acorn dependency seems to represent an adaptation that can be termed a processor strategy. It represents a resource, surely a staple in much of ethnographic California (Baumhoff 1963; Kroeber 1925), that was abundant, predictable, and locally available—a distribution that would not necessitate great mobility. Its major drawback was the high cost of processing (in particular, leaching) necessary prior to consumption (DuBois 1935; Gifford 1936; Mayer 1976). Because of the immense processing cost involved, acorns would be ranked low in any optimal diet (cf. Bettinger 1980).

The general shift to intensive balanophagy in aboriginal California can (and has) been explained variously: (1) as resulting from a technological innovation (presumably knowledge of leaching), allowing exploitation of a previously unavailable resource; (2) as emerging due to changes in climate and/or environment that increased oak density, and hence acorn potential, in key areas; or, (3) as representing a shift to a high cost—but extremely productive—resource that could support greater population density and/or increasing appropriation by a segment of that population. Space limitations preclude detailed discussion of these alternatives, but several comments are in order. If California populations did not initially exploit acorns due to a lack of either appropriate knowledge or substantial density (the latter a position difficult to fathom in montane regions), once the resource became "available" one would expect a near synchronous diffusion of the adaptation throughout regions where acorns existed. This is clearly not the case. Mortar and pestle associations are present in Bay Area components at least 3200 years ago (Fredrickson 1974; Gerow with Force 1968), a period considerably antedating their 2500 B.P. appearance at Warm Springs.

In explaining this lack of synchrony, reference might be made to some "socially generated conservatism," but such a proposal is unfocused and non-explanatory. An approach based on optimization models is more insightful, arguing that populations can be characterized by the kinds of resources they exploit (e.g., the dichotomy between travellers and processors). These patterns result from both the requirements of internal organization and relative population density, such that groups with a given adaptation are, by their structure, more predisposed and/or preadapted to certain kinds of functional reorientation. This being the case, and because acorns are an exceedingly high-cost resource, only those groups that need to adopt the resource would be expected to do so, and then only if the overall structure is present to allow it (i.e., the importance of adaptive peaks). This need might result from, among other things, increasing intergroup competition, increasing population density, or a need for increased production generated by differential social appropriation.

This model suggests that acorn exploitation might be viewed as analogous to agriculture—both being high in cost and unlikely to be adopted except by necessity—and not as a subsistence adaptation possessing inherent or attractive benefits. It provides insight into the apparent nonsynchronous appearance of intensive balanophagy in various regions and, in particular, may explain the adaptive priority achieved by Pomoan intruders at Warm Springs. If Pomoans brought with them a processor strategy focused on the acorn, as the archaeological and perhaps linguistic data suggest, such an adaptation provided a significant selective advantage over their predecessors. By all counts preceding populations, Yukian or otherwise, possessed a more mobile, less dense population, and a more archaic adaptation. These attributes correspond well to Bettinger and Baumhoff's (n.d.) traveller strategy. The concept of adaptive peaks, in conjunction with the overall structure of a social system, explains the inability and/or unwillingness of earlier populations to rapidly adopt the incoming strategy and perhaps prevent Pomoan encroachment.

IMPLICATIONS AND CONCLUSIONS

Evaluation of archaeological data from the Warm Springs Dam Project, coupled with linguistic information on the Pomoan language family, have resulted in the proposal that Pomoan occupancy of northern Sonoma County began at approximately 2500 B.P. This conclusion has been placed within an interpretive framework that may have explanatory potential for broader questions of archaeological interest—within California and elsewhere.

The approach outlined in this study has, however, provided insight into problems extending beyond these. Ethnographic and archaeological evidence suggest that while correspondences between socially meaningful units and material culture may exist, these are difficult to determine and are probably impossible to ascertain without ancillary information. Therefore, correlations made using isolated artifact attributes or types should be even more suspect, particularly when these have gross functional overtones (i.e., projectile points). This is not to say that such ethnic/material culture correspondences are impossible, or that their potential presence should be left unexplored (e.g., proposals like Whistler's [1980] study), only that caution must be exercised in formulating any such reconstructions.

These difficulties suggest even deeper problems in any attempt to establish ethnic affinity archaeologically. For example, the proposed correspondence between Late Borax Lake/Concave Base materials (e.g., Whistler 1980; White *et al.*, this issue) has been rejected because the posited serial expansion lacks support and the proposal has a poor fit with both independently derived linguistic data and the archaeology at Warm Springs. Although this seems to be the case at Warm Springs, it does not prove that Late Borax Lake pattern materials in other areas do not correlate with Pomoan peoples. Neither potentially important cultural differences within Pomoan nor the effects of diffusion and exchange can be ignored.

As one solution to some of these problems in "ethnic resolution," an approach keyed to comparing archaeological and linguistic data, each as independent criteria, has been suggested. It sidesteps obvious problems in resolution and still allows archaeologists to address the problem of ethnic movement and population change, a necessity especially in California. What remains to be done, of course, is the systematic and detailed comparison of archaeological data from other North Coast Range site locales (those which were presumably Pomoan at a relatively early date) with the same linguistic data used in this study. Only in this way will the proposals advanced on the basis of the Warm Springs sequence be corroborated or rejected. Additionally, this approach may isolate any assemblage differences that still correspond with common ethnic and/or language units, and hence provide insight into the effects of diffusion, exchange, and other consequences of social interaction.

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NOTES

1. Since the "ethnolinguistic" groupings constructed for California were primarily based on language distributions (i.e., Heizer 1966; Kroeber 1925, 1962), and because the approach taken in this paper makes use of linguistic data, the degree to which such "units" correspond with actual ethnic groups, tribelets, sociopolitical groups, socioceremonial units, etc., is a serious consideration. The answer remains somewhat equivocal. While Kroeber (1962) pointed out that there was no common, politically discrete entity called "Pomo" and that villages and/or tribelets comprised the basic integrative political unit within aboriginal California, the real situation may lay somewhere between these viewpoints. Some ethnolinguistic groups were composed (so far as can be known) of single dialects and small numbers of tribelets, suggesting that in some cases, ethnolinguistic boundaries were socially and politically meaningful. Further, the fact that many ethnographic and linguistic data were recovered from but one or a few consultants, all speaking the same dialect, makes difficult the consideration of variability.

As a result of these factors, the present discussion makes no attempt to deal with either semantic or structurally meaningful distinctions between levels or categories of social units. Since the patterns discussed are, in fact, quite gross, this lack of distinction should pose minimal problems.

2. A detailed discussion of the Warm Springs sequence, presenting quantitative data for sites and cultural periods, will be offered elsewhere (Baumhoff *et al.*, n.d.).

3. No attempt is made here to integrate Warm Springs data with the taxonomic scheme proposed by Fredrickson (1973, 1974). The latter suffers from several problems: (1) It is too unwieldly and likely to result in different names for each valley system; (2) it makes often unverifiable assumptions about cultural relationships; and (3) it is dangerous in that it introduces terms that imply cultural connections which are difficult to reverse once implanted in the literature. By using designations with purely descriptive meanings, comparisons can be made while avoiding these drawbacks.

4. Sawyer (1980) has argued that relationships between Wappo and Yuki are nongenetic. This paper, however, operates under the view of other linguists (Dixon and Kroeber 1913; Elmendorf 1968, 1980) that they do have genetic relations, though these are obviously distant.

5. See White *et al.* (this issue) for the defining characteristics of this point from their concave base point subtypes.

6. Evidence that McLendon's (1973) reconstructions may have culture historical meaning is reflected by her difficulty in reconstructing the term for bow. Whistler (1980) suggests that this may be the result of lexical innovations and/or semantic shifts (perhaps from atlatl to bow) that were borrowed from group to group. In any event, such irregularities are expectable given the recent appearance of the bow and arrow.

7. The minimal dating of cupule rocks at Warm Springs shows Clewlow's (1978) "guesstimate" for the inception of such rock art (post A.D. 1600) to be in error.

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