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The Little Lake Site, Pinto Points, and Obsidian Dating in the Great Basin

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IN 1970, I obtained obsidian hydration measurements on a sample of the points excavated from the Little Lake (Stahl) site. The collection was made available to me through the courtesy of Bruce Bryan, Curator of the Southwest Museum, Los Angeles. The excavation of the site, located in Inyo County, California, was done by M. R. Harrington who published his site report in 1957.

A total of 65 points was examined.[1] Of these, 5 had no visible hydration band and apparently had been subject to abrasion, probably by wind-blown sand in this desert location (Fig. 1, *m-n*; Fig. 4, *k-m*). An additional 3 points had very small hydration bands (Fig. 4, *h-j*) and are presumed to be intrusive in the Little Lake site. This leaves 57 identifiable points of the Little Lake "Pinto" assemblage for which obsidian hydration measurements are available.

When the measurements were made in 1970, it was my intention to follow up on Michels' pioneering study of obsidian hydration in Mono County, to the north of the Little Lake site (Michels n.d.), and to make some age estimations for the latter site and for the various kinds of Pinto points found there. However, the hydration bands are far larger than most of Michels' Mono County obsidian readings, and I could not relate my data to his in any meaningful way. I therefore merely published the readings without analysis (Meighan, Findlow, and DeAtley 1974). It was clear that the obsidian used at Little Lake was forming its hydration bands at a much faster rate than that analyzed by Michels, and I assumed that two different obsidian sources were involved. However, this was before the extensive studies of California obsidian sources conducted by Ericson (n.d.). In addition, at that time there were virtually no firm dates (based on radiocarbon) for the point types at the Little Lake site.

Fortunately, in recent years a number of key studies have been completed that allow for a review of the Little Lake data and the drawing of meaningful conclusions. This is still a very important set of data, for it consists of a large number of obsidian hydration readings from a controlled excavation, and all of these are on artifact types rather than the more commonly used chipping waste. Except for the study of Michels, no other Great Basin collection has a published obsidian hydration sample with the coherence and size of the Little Lake sample. Larger numbers of specimens are discussed by some authors, but these collections include chipping waste and generally come from a number of sites distributed over a considerable area, and hence subject to variability in both obsidian sources and local temperatures.

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OBSIDIAN SOURCES

Tuohy (1980) provides a summary and evaluation of obsidian dating studies in the western Great Basin. His hydration data indicate that his obsidian sources are all "northern" (Mono Glass Mountain and other northern sources), with hydration similar to the specimens reported by Michels (n.d.). The Little Lake obsidian, on the other hand, is from a "southern" source, and although no sourcing studies have been done, it was certainly the Coso source since that source is immediately nearby and the hydration pattern of Little Lake specimens corresponds to the known rate for Coso obsidian. This source is quite rapid in its hydration and has estimated hydration rates of only 220-340 years per micron, well documented by evidence from several California locations (Ericson n.d.; Meighan 1978; Garfinkel and Schiffman 1981).

The result of the difference in obsidian sources is that Tuohy's "Pinto" points range from 3-10 microns in hydration, while the "Pinto" points from the Little Lake site range from 6.4 to over 17 microns and the *average* for Little Lake (over 11 microns) is greater than the maximum of any of Tuohy's specimens. Yet the two collections are from the same time span. This does not discredit the obsidian dating method, but it does emphasize the importance of knowing the obsidian sources in the Great Basin, and it should lead to extreme caution in estimating hydration ages for small numbers of isolated specimens.

Fortunately, a review of published obsidian data shows that Coso obsidian tended to be traded to the south and west and rarely went north or out into the Great Basin. Erickson (n.d.:236-238) points out that Coso obsidian was part of a major trading system, mostly to the south of the source area, which is on the China Lake Naval Weapons Center in southern Inyo County. This source is identified as providing 100 percent of the obsidian used by ethnographic Tübatulabal and Kawaiisu groups, who are geographically between the source and the Pacific Coast. As middlemen in trade to the west and south, their heavy use of Coso obsidian also explains the dominance of this source on the Pacific Coast in the Los Angeles area. Coso obsidian is also heavily represented in many sites in Kern County, west of the obsidian source. For example, 100 percent of the sourced obsidian from Ker-983 is identified as Coso (Garfinkel and Schiffman 1981; this site is about 50 miles from the Coso source).

The Coso source is the only identified quarry in southern Inyo County. Another source in the northern part of the county, Fish Springs, is identified by Ericson (n.d.) as having had very limited use. Hence, Coso obsidian is the most prominent variety in southern California and the extreme southwestern part of the Great Basin, but it is not an important component of most sites in the Great Basin. In the Great Basin, it is prominent in the Little Lake site and the Rose Spring site only 13 miles to the north; it is not documented as having significant presence for most of the Great Basin sites studied by Layton (1972) or Tuohy (1980).

TYPOLOGY

Because point types are the most common finds in shallow desert sites, the typology and dating of points has been a major preoccupation of Great Basin archaeologists, and nearly all of the archaeological reports for this region must deal with the recognition of diagnostic point forms. Some of the more detailed studies of regional characteristics include Clewlow (1967), Heizer and Hester (1978*a*, 1978*b*), Hester (1973), Lanning (1963), Layton (1972), Michels (n.d.), Tuohy (1980), and Warren (1980).

The definition of "Pinto" points has varied widely and is subject to much confu-

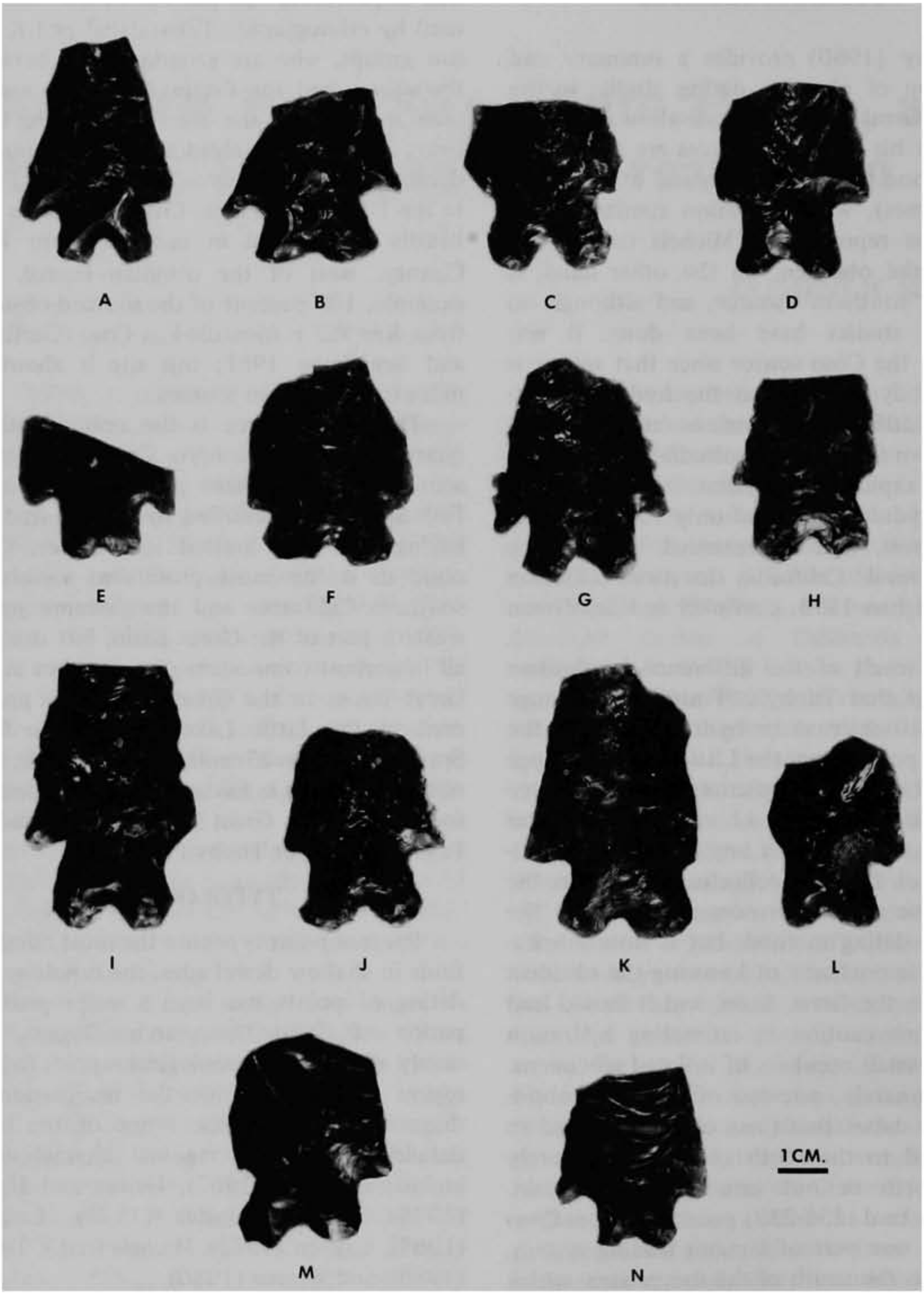

Fig. 1. Projectile points from Little Lake. Corner-notched, tangs visible, notched base.

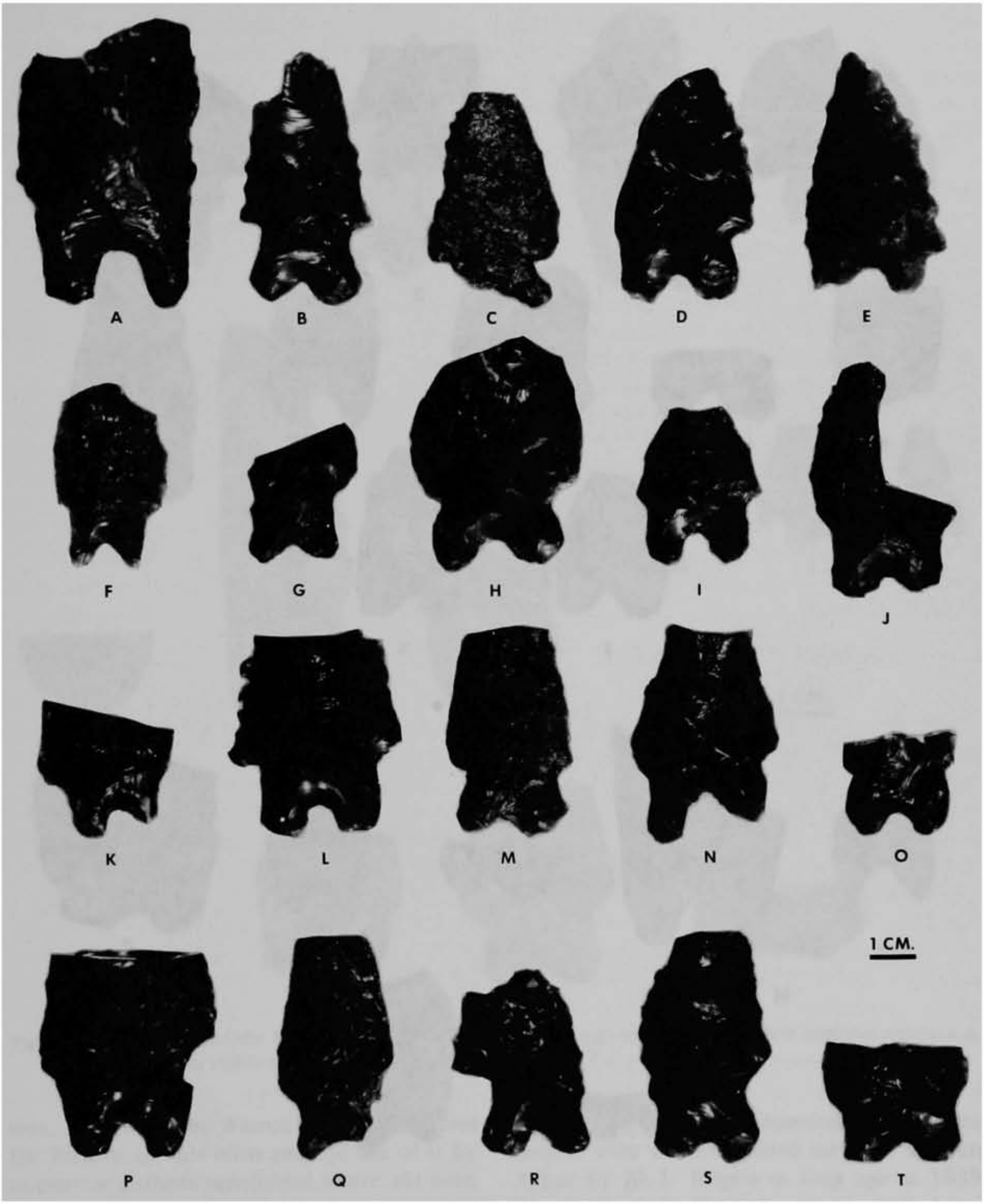

Fig. 2. Projectile points from Little Lake. Notched stem, open sides.

Fig. 3. Projectile points from Little Lake. *a-d*, side notches, slightly concave base without basal notch; *e-k*, basal notch, straight sides in lower portions; *l-r*, notched base, flaring sides.

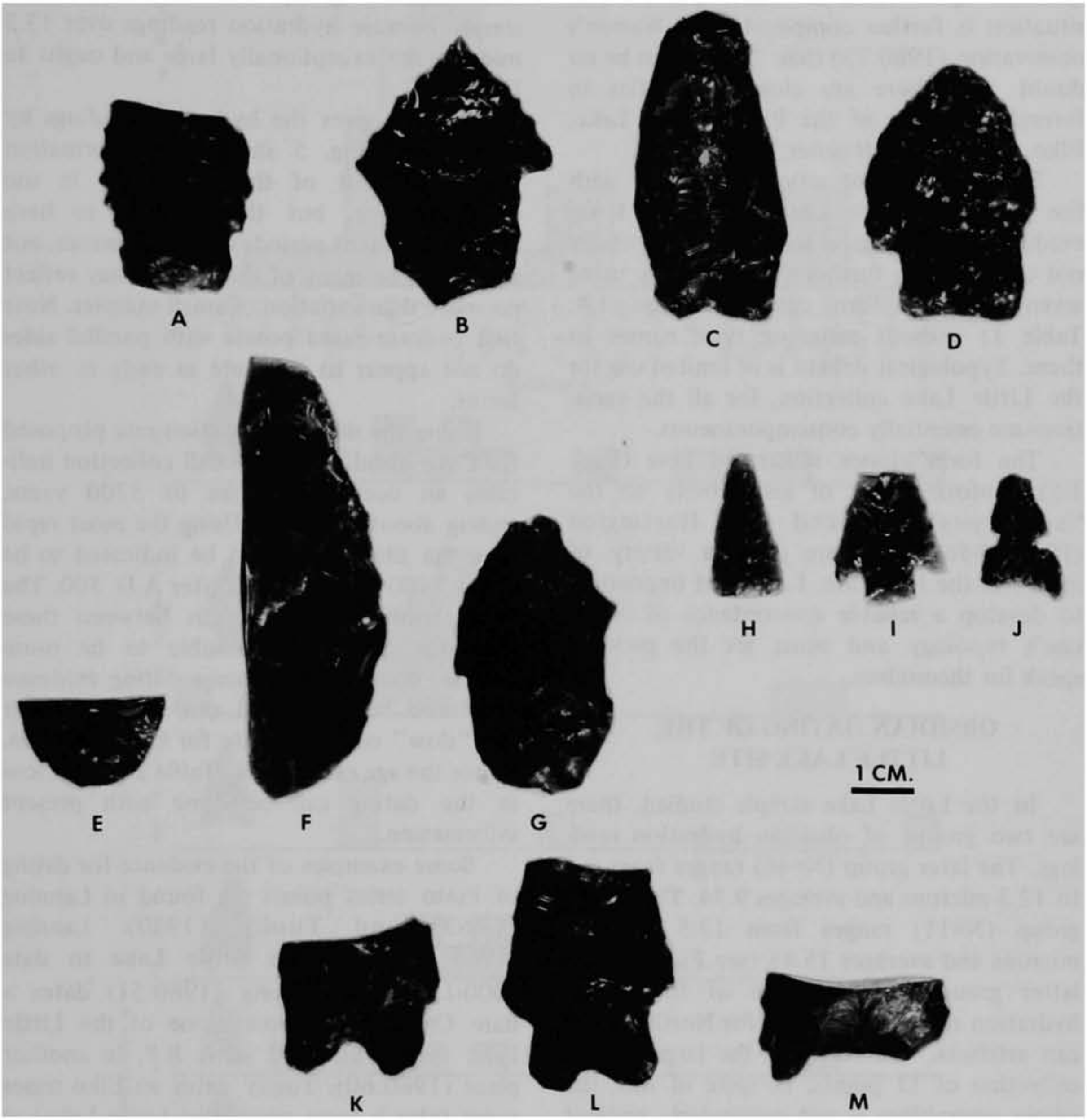

Fig. 4. Projectile points from Little Lake. *a-d*, wide, square stem; *e-g*, convex base; *h-j*, late intrusive points; *k-m*, points with no visible hydration.

sion, as reviewed by Warren (1980), who gives the history of this term and the use of it by numerous authors mentioned above. At best, one must refer to a Pinto *series* since there are numerous forms that would be classified as distinct types by all archaeologists, and these points were in fact divided into five separate types by M. J. Rogers as long ago as 1939. Hence the term Pinto cannot be applied to a specific point type of unique or distinctive qualities apart from all other points. The situation is further complicated by Warren's observation (1980:73) that: "There can be no doubt that there are close similarities in formal attributes of the Pinto, Little Lake, Elko, and Humboldt series."

Since the present article deals only with the points from the Little Lake site, I am evading the typological morass, and hopefully not contributing further confusion, by using seven illustrated form categories (Figs. 1-4, Table 1) without assigning type names to them. Typological debate is of limited use for the Little Lake collection, for all the variations are essentially contemporaneous.

The form classes illustrated here (Figs. 1-5) conform more or less closely to the "sub-types" defined by Harrington (1957:49-56); they are given a variety of names in the literature. I found it impossible to develop a reliable concordance of everyone's typology and must let the pictures speak for themselves.

OBSIDIAN DATING OF THE LITTLE LAKE SITE

In the Little Lake sample studied, there are two groups of obsidian hydration readings. The later group (N=46) ranges from 6.4 to 12.3 microns and averages 9.74. The earlier group (N=11) ranges from 13.5 to 17.3 microns and averages 15.45 (see Fig. 5). This latter group includes some of the largest hydration readings reported for North American artifacts, and certainly the largest for a collection of 11 points. In spite of this, the whole assemblage is not particularly ancient as discussed below.

Division into two groups does not indicate a two-period site at Little Lake since the point forms occur throughout the history of the site. There may have been a hiatus in occupation but it is equally likely that the apparent lack of readings between 12.3-13.5 microns is merely due to the small sample. The "earlier" group is defined arbitrarily simply because hydration readings over 13.5 microns are exceptionally large and ought to be noted.

Table 2 gives the hydration readings by point form; Fig. 5 shows this information graphically. All of the forms are in use simultaneously, but they appear to have slightly different periods of use. However, not much can be made of this and it may reflect no more than variation of small samples. Note that concave-based points with parallel sides do not appear to originate as early as other forms.

Using the slowest hydration rate proposed for Coso obsidian, the overall collection indicates an occupation span of 3700 years, ending about 200 B.C. Using the most rapid rate, the site span would be indicated to be about 2400 years, ending after A.D. 500. The exact truth is probably in between these estimates. It is not possible to be more precise, since there is some dating evidence (discussed below) which can support either the "slow" or "fast" rate for Coso obsidian. Hence the age estimates in Table 3 are as close as the dating can be done with present information.

Some examples of the evidence for dating of Pinto series points are found in Lanning (1963) and Tuohy (1980). Lanning (1963:281) estimates Little Lake to date 3000-1500 B.C. Tuohy (1980:51) dates a Bare Creek Eared point (one of the Little Lake forms) at 4310 years B.P. In another place (1980:60), Tuohy dates an Elko series point (also a form present at Little Lake) at 340 B.C., and (1980:63), Humboldt series points are dated at 1350 B.C. He further suggests ages for Pinto series points of 400 B.C. at Pyramid Lake and 430-790 B.C. on the basis of an associated radiocarbon date. Warren (1980:73) summarizes previous regional studies and site analyses, and he mentions radiocarbon dates associated with

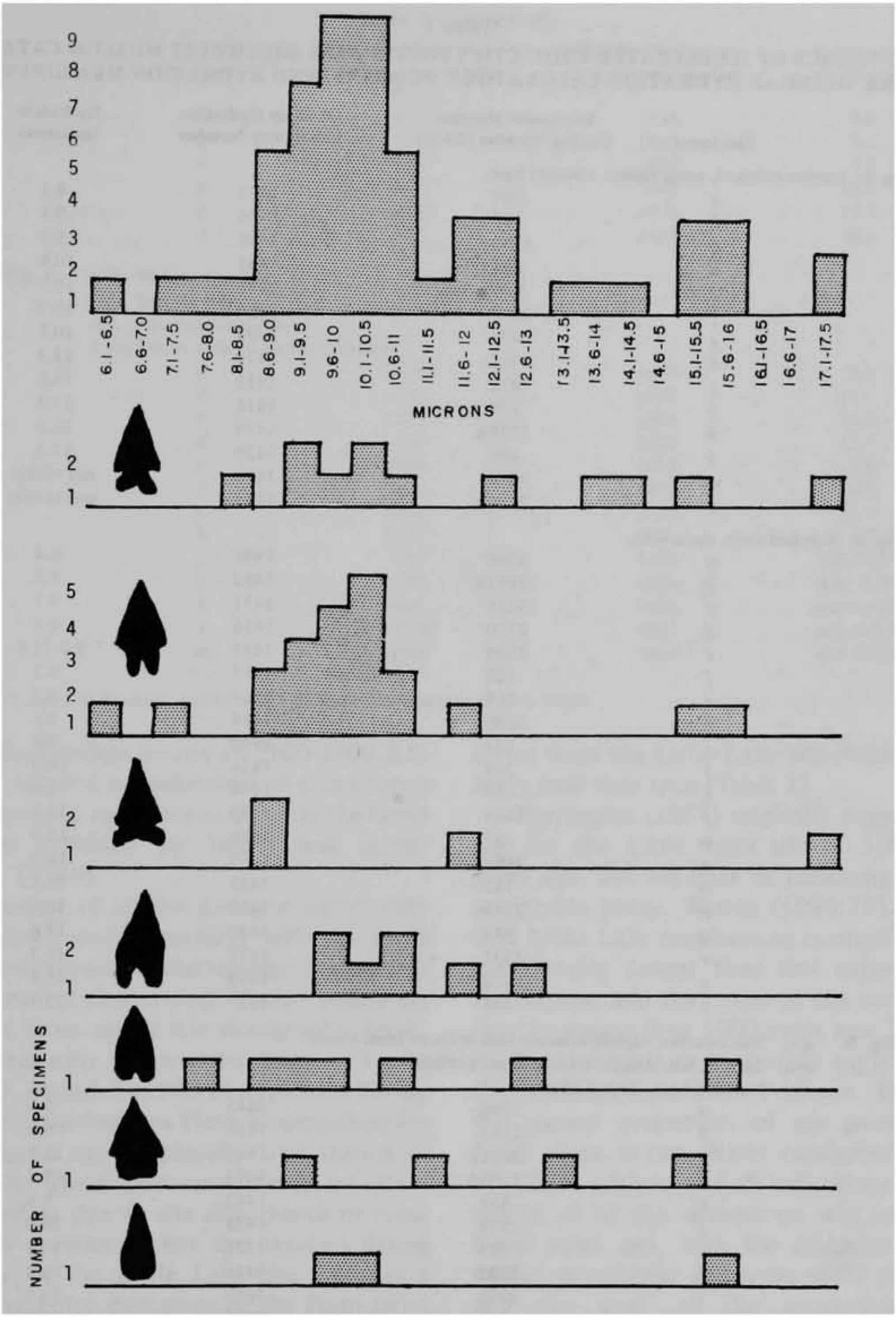

Fig. 5. Little Lake obsidian hydration readings. The top graph is for the entire point collection, the others are for the illustrated point forms.

Table 1

CONCORDANCE OF ILLUSTRATED PROJECTILE POINTS WITH SOUTHWEST MUSEUM CATALOG NUMBERS, OBSIDIAN HYDRATION LABORATORY NUMBERS, AND HYDRATION MEASUREMENTS

Specimen	Southwest Museum Catalog Number (23-F-)	Obsidian Hydration Laboratory Number	Hydration (microns)
Fig. 1: Corner-notched, tangs visible, notched base			
a	207	1423	8.1
b	156	1420	9.1
c	3330	1476	9.5
d	441	1431	10.0
e	544	1439	10.1
f	2806	1460	10.2
g	474	1433	10.9
h	3342	1479	12.3
i	472	1432	13.6
j	139	1416	14.5
k	2778A	1459	15.5
l	406	1429	17.3
m	3344	1478	not visible
n	2676A	1451	not visible
Fig. 2: Notched stem, open sides			
a	3298	1495	6.4
b	2997B	1462	7.3
c	3256	1471	8.7
d	2710	1456	9.0
e	2709	1455	9.2/11.6
f	125	1415	9.3
g	152	1418	9.3
h	2698	1454	9.6
i	153	1419	9.8
j	209	1424	10.0
k	483	1434	10.0
l	2647	1450	10.3
m	237	1426	10.3
n	2689	1453	10.3
o	162	1421	10.5
p	2685	1452	10.6
q	411	1430	10.6
r	3331	1477	11.7
s	2622	1449	15.3
t	145	1417	15.7
Fig. 3: *a-d,* **Side notches, slightly concave base without basal notch** *e-k,* **Basal notch, straight sides in lower portions** *l-r,* **Notched base, flaring sides**			
a	1946	1445	9.0
b	2745	1458	9.0
c	2621B	1448	11.7
d	2397A	1474	17.2
e	554	1442	9.6
f	538	1438	10.0
g	213	1425	10.2
h	2602	1446	10.8
i	3078	1469	10.8
j	116	1413	11.8
k	101	1412	12.3
l	3271	1472	8.0

Table 1 (continued)

Specimen	Southwest Museum Catalog Number (23-F-)	Obsidian Hydration Laboratory Number	Hydration (microns)
m	123	1414	9.0
n	2998B	1463	9.1
o	206	1422	9.8
p	547	1440	10.8
q	488E	1435	12.3
r	553	1441	16.0
Fig. 4: *a-d*, Wide square stem *e-g*, Convex base *h-j*, Late intrusive points *k-m*, Points with no visible hydration			
a	2575	1447	9.2
b	502	1436	11.3
c	1233	1444	13.5
d	248	1427	15.5
e	3050	1465	9.6
f	3161	1470	10.5
g	2720	1457	15.9
h	3276	1473	1.7
i	590	1443	3.2/10.3*
j	327	1428	4.6/ 6.9*
k	2963	1461	not visible
l	527C	1437	not visible
m	3054	1464	not visible

*Appear to be older points picked up and reworked into smaller forms

Pinto Shoulderless points of 1900-2700 B.C. A very detailed consideration of point forms and associated radiocarbon dates in the Great Basin is provided by Heizer and Hester (1978*a*, 1978*b*).

A review of all the dating evidence indicates pretty good agreement with the Little Lake obsidian-dating chronology. It may also be mentioned that several "Pinto" points are reported from rather late stratigraphic levels, associated with radiocarbon dates well into the A.D. period. For two examples see Tuohy (1980:62) (including a Pinto Sloping-shoulder form placed stratigraphically later than A.D. 500-730). These late associations are often explained as due to site disturbance or reuse of older specimens, but the obsidian dating evidence of the Little Lake site indicates a good possibility that some of the Pinto series points do in fact continue in use into the early A.D. period. In any event, the point forms from the Little Lake site clearly have a fairly long time span (Table 3).

Harrington (1957) originally suggested an age for the Little Lake site of 3000-4000 years ago, but his lines of reasoning are not acceptable today. Warren (1980:75) suggests that Little Lake may have an occupation span considerably longer than that suggested by Harrington, and that some of the occupation may be earlier than 5000 years ago. The first of these suggestions is strongly supported by the obsidian hydration evidence. However, the second suggestion, of age greater than 5000 years, is not clearly confirmed by the obsidian evidence, and all indications are that nearly all of the occupation was later than 5000 years ago, with the midpoint of the earlier occupation at maybe 4000 years ago and the peak of the occupation from 2100-3400 years ago. This answer is close to that reasoned out by Lanning (1963) and

Table 2
OBSIDIAN HYDRATION FOR LITTLE LAKE POINTS

Form	No. of Specimens	Range (microns)	Average (microns)
1. Corner-notched, tangs visible, notched base	12	8.1-17.3	11.76
2. Notched stem, open sides	20	6.4-15.7	10.20
3. Side notches, slightly concave base without basal notch	4	9.0-17.2	11.73
4. Basal notch, straight sides in lower portions	7	9.6-12.5	10.79
5. Notched base, flaring sides	7	8.0-16.0	10.71
6. Wide square stem	4	9.2-15.5	12.38
7. Convex base	3	9.6-15.9	12.00
Late intrusive points	3	1.7- 4.6	

[Points with no hydration visible: 5]

Table 3
OVERALL AGE ESTIMATES FOR THE LITTLE LAKE SITE, BASED ON OBSIDIAN HYDRATION DATA

Rate	Age estimate, major occupation, 6.4-12.3 microns	Age estimate, early occupation, 13.5-17.3 microns	Total time span of site
220 yrs/micron	1408-2706 B.P. A.D. 572-726 B.C.	2970-3806 B.P. 990-1826 B.C.	1408-3806 B.P. A.D. 572-1826 B.C.
340 yrs/micron	2176-4182 B.P. 196-2202 B.C.	4590-5882 B.P. 2611-3902 B.C.	2176-5882 B.P. 196-3902 B.C.

(Late intrusive points of the last few centuries are not included.)

discussed by Clewlow, Heizer, and Berger (1970: Table II) in their evaluation of radiocarbon dates from the Rose Spring site:

> Lanning (1963, p. 268) believes the culture preceding Early Rose Spring to be the Pinto, known primarily from the Little Lake Site 13.5 miles to the south. UCLA 1093C-E may refer to this supposedly pre-Early Rose Spring cultural manifestation. [Clewlow, Heizer, and Berger 1970:21].

The radiocarbon dates referred to range from 3520-3900 years ago, close to the obsidian dating estimates for the peak of the occupation at Little Lake.

Harrington (1957) clearly stated his age estimate at 3000-4000 years ago, but in an unfortunate typographical error this is referred to by Hester (1973:71) as an estimate of 3000-4000 *B.C.*, which adds 2000 years to the age of the site and some confusion to the literature.

It appears that Harrington, in a remarkable parallel to the way he dated the Borax Lake site, came up with the right answer for all the wrong reasons. His error here, as with Borax Lake, was in assuming too short a span of occupation, but his estimate of the age of the site is close enough to be humbling to those of us equipped with contemporary knowledge and refined dating methods.

It is to be remembered that not all Pinto points are of the same age as the Little Lake site, for there is some evidence that these point types occur in both earlier and later contexts–indeed, it is this mixed bag of associational evidence that prevents refined and precise obsidian hydration rates for the Little Lake site. The varying ages suggested for Pinto points throughout the Great Basin are not examined in the present paper. However, Hester (1973:31) points to age estimates of 6000 B.C. to A.D. 1350 for Elko points and notes comments that these points may be useless as time markers. Obsidian dating can reduce this apparently lengthy time span, however, by allowing recognition of specimens out of context (site disturbance) and also cases in which early points are picked up and reused by later peoples. I am sure that Elko points and other Little Lake types *are* diagnostic of age, but without obsidian dating information we can often be misled by confusing stratigraphic associations.

OBSIDIAN HYDRATION RATES IN THE GREAT BASIN

As previously discussed, it is important to recognize the large variation in the rate of obsidian hydration depending on the obsidian source. It appears, however, that not all western sources were widely used in the Great Basin and most of the identified obsidian is from limited locations on the west edge of the Basin. We may in fact be able to generalize for most Great Basin obsidian and use two basic rates: a northern rate of 800-1200 years per micron, and a southern rate of 220-340 years per micron. The southern rate (Coso) is four to five times faster than the northern rate, so it is possible (although not yet shown in any individual site collection) to have specimens with 3 microns of hydration that are the same age as specimens with 12 microns of hydration!

Fortunately for the applied use of obsidian dating, there is very limited mixing of sources in individual sites, and if a reasonable sample (12-15 pieces) of obsidian is analyzed, the anomalous readings may be detected and either explained or put to one side so that they do not confuse the interpretation. However, it is clearly of questionable reliability to attempt dating on one or two surface finds of obsidian, or to construct an obsidian chronology based on small samples from large numbers of sites spread over a large area. Results of such regional studies are at most suggestions of chronological answers and cannot be taken very seriously unless analyses of the specimens have been done so that the obsidian source is objectively identified.

A further complexity is that the rate of hydration varies with temperature, which has been known from the beginning to affect hydration rates (Friedman and Smith 1960). In the Great Basin, the temperature variable means that hydration rates will be affected primarily by altitude since annual mean temperature is largely a function of altitude in this mountainous region. Some preliminary studies (Gehr *et al.* n.d.; Russell n.d.; see also discussion in Ericson n.d.) have documented a marked slowing of obsidian hydration in high-altitude locations.

While the temperature variable appears to be of considerably smaller magnitude than the variable of the chemical composition of obsidian from different sources, it may be that the temperature variable is the primary reason for the variations in hydration rates determined for specific site collections where samples of obsidian are associated with radiocarbon dates. For both Coso and "northern" sources, individual investigators have determined somewhat different answers for empirically derived hydration rates based on their evidence from specific sites. This does not mean that one answer is correct and another wrong —it may mean that the varying results are due to variables such as temperature that cannot at present be precisely evaluated. Indeed, since there is as yet no formula that is universally applicable to all obsidian hydration (i.e., the process is not fully understood), the only way to *use* obsidian dating for archaeological purposes is through empirical determination of the rate (Meighan 1976).

Proposed obsidian hydration rates are subject to considerable debate both as to the nature of the rate and its magnitude (Michels and Tsong 1980). Adequate recognition of the uncertainty of hydration rates has not been expressed by most authors. Thus, while I may "know" that the rate for Coso obsidian is 220 years per micron for the Malibu site on the Pacific Coast (Meighan 1978), this does not prove by any means that all Coso obsidian from all locations will form its hydration band at this rate. Other investigators (Ericson n.d.) have evidence that the rate can be slower (*ca.* 340 years per micron), and still others find it to be in between. Hence, the best way to define the *general* Coso rate at present is: 280 ± 60 years per micron. This indicates slightly over 20 percent uncertainty for the general rate, although with individual sites and collections there is sometimes considerable evidence to reduce this uncertainty.

In practical terms, use of the general rate may be very beneficial to archaeological study and may provide more exact and reliable chronological placement than any other dating method. Indeed, in an increasing number of collections, obsidian dating may be the only available dating method. For a site with 5-6 microns of hydration, the age would be correctly determined within 400 years. For the Little Lake site, there is greater uncertainty because the hydration bands are much larger. Even so, obsidian dating provides a better chronological fix than mere comparison of artifact styles, which has been the sole basis for dating the site previously.

For what I have referred to as the northern rate, the situation is more confusing because this no doubt includes a number of different obsidian sources. However, one can use pragmatically a rate of 1000 ±200 years per micron for nearly all of the obsidian in the northern Great Basin and be close to the truth. Since this rate is so much slower than the Coso rate, the micron readings are all fairly small and therefore the uncertainty about the chronological age is about the same as with the Coso rate. For example, a "Pinto" point with 3.5 microns of hydration would date 2800-4200 years ago. The same point of Coso obsidian might have 12.5 microns of hydration and be dated at 2750-4250 years ago, essentially the same answer.

CONCLUSIONS

Analysis of obsidian dating for 60 points from Harrington's excavations at Little Lake (Stahl site), yields the following conclusions:

(1) Obsidian in the southwestern part of the Great Basin has a quite different (and faster) hydration rate than obsidian from the northern and eastern parts of the Great Basin.

(2) The cultural assemblage at the Little Lake site is essentially uniform; while the site was used for at least 2000 years, there is no detectable culture change so far as the point types are concerned.

(3) The major occupation of the Little Lake site was not far from Harrington's original estimate of 3000-4000 years ago.

(4) Based on the variability of contemporaneous points in the Pinto assemblage at Little Lake (in size, form, and workmanship), overly refined point typologies in the Great Basin may prove to have descriptive value only, and may not have as much cultural significance as the archaeologists would hope for.

ACKNOWLEDGMENTS

I am particularly indebted to the Southwest Museum and Curator Bruce Bryan for permission to study the Little Lake points and to cut pieces from them for the obsidian hydration determinations. The hydration readings were done by Paul Aiello, who also took the photographs used in the figures; his careful laboratory work was essential to the results reported here.

NOTES

1. The illustrated projectile points (Figs. 1-4) do not duplicate the ones in the site report (Harrington 1957: Figs. 39-41). Harrington states that over 500 points were found, but he illustrated only 47 of them, selected for being complete specimens of "ideal" forms in his typology. This report illustrates 65 points, more than the site report, and there is overlap for only one specimen (here Fig. 4*i*, Harrington's Fig. 41, bottom row). The two reports together therefore illustrate 111 of the points from Little Lake. The lack of overlap is because Harrington selected his most perfect points and I deliberately selected broken specimens to avoid cutting notches out of display pieces. Our one overlap specimen is the sole broken point illustrated by Harrington.

Harrington commented (1957:49) on the presence of ". . .many projectile points that had evidently been resharpened, in many cases down to a useless stub." The present figures show that the site contains plenty of broken points that could have been resharpened but were not. A number of these broken points have fractures indicating that they broke from a blow at the tip, probably in use when missing an animal and striking a rock (see Figs. 1*i*, 1*n*; Fig. 3*r*).

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