CA-MNO-574 AND -833: A LOOK AT CASA DIABLO OBSIDIAN PRODUCTION AT STONEWORKING SITES IN LONG VALLEY, MONO COUNTY

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ABSTRACT

Limited test excavations at two stoneworking camps in Long Valley, Mono County, resulted in a large collection of Casa Diablo obsidian debitage. The investigation focused on obsidian hydration analysis, since obsidian production and exchange networks constitute a major research issue on both sides of the Sierran crest. Obsidian hydration data from several stoneworking sites in the Mammoth area have been used to identify changes through time in the production of Casa Diablo obsidian; various environmental and social factors have been offered as possible explanations for the observed fluctuations. Our research corroborates previous findings for the eastern Sierra region as a whole, but documents potentially meaningful variability in production within the region. Inter-site differences may result from localized effects of volcanism on prehistoric lifeways or may reflect use by different producer groups.

INTRODUCTION

In the spring of 1985, Caltrans conducted small scale investigations at two stoneworking sites, Mno-574 and -833, in Long Valley, Mono County (Figure 1). Mno-574 is an extremely large, discontinuous lithic scatter of variable density, situated on large, open pumice flats and the adjacent Jeffrey pine forest (Mone 1986). Mno-833, a half kilometer to the south, is a large lithic scatter of moderate density (Adams 1986). It, too, lies on an open pumice flat. Vegetation on both sites consists primarily of a low, scattered stand of big sage and bitterbrush interspersed with lupines and a variety of grasses.

BACKGROUND

The sites are located at the base of the eastern scarp of the Sierra Nevada within the Long Valley Caldera. The caldera is a huge elliptical depression created through the catastrophic eruption of the Bishop Tuff approximately 0.7 million years ago. The caldera resurgent dome contains a variety of rhyolites comprised, in part, of obsidian. It is this obsidian that forms the Casa Diablo obsidian source, widely used as a quarry for tool stone by aboriginal peoples (Hall 1984).

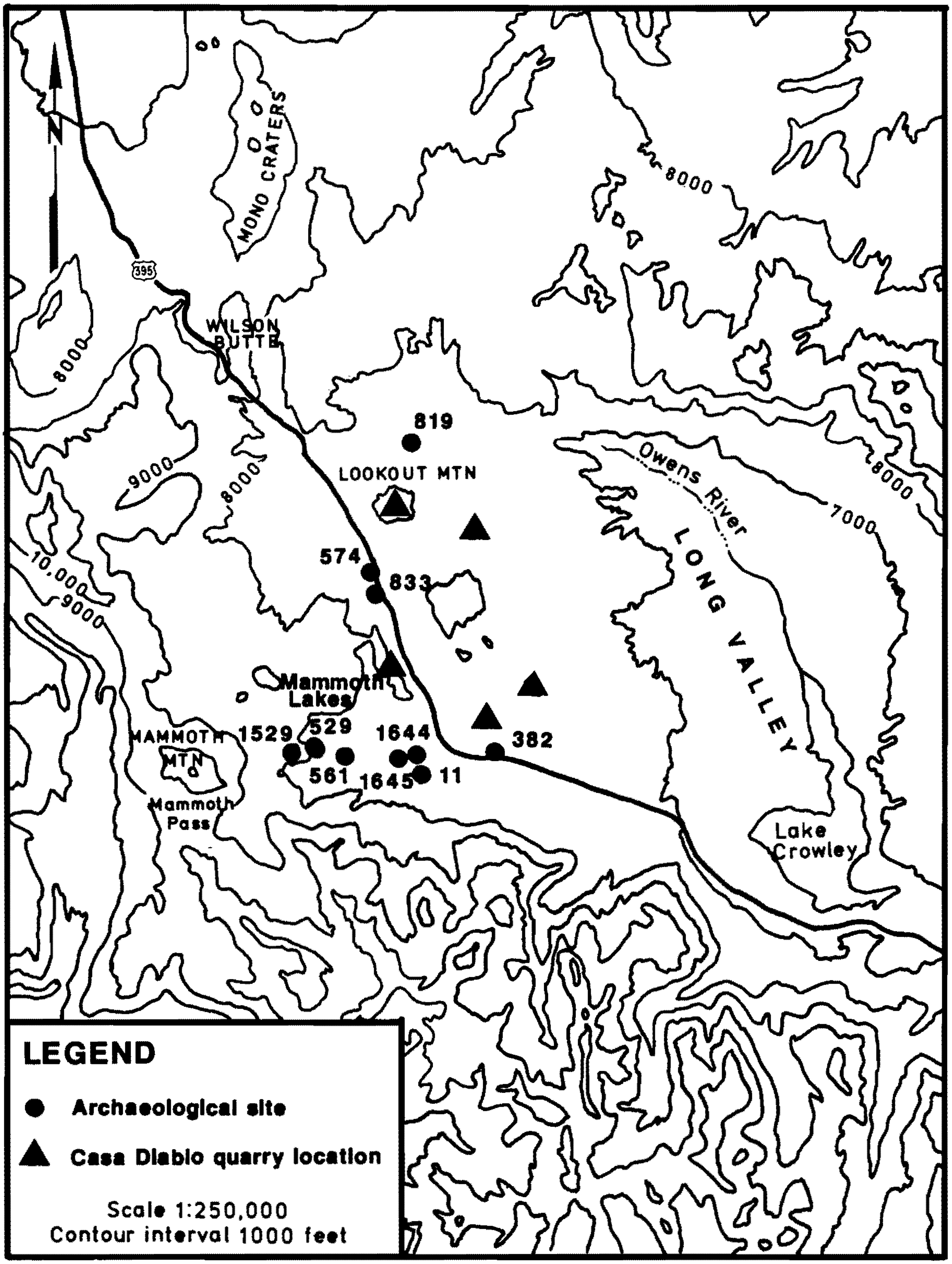

FIGURE 1. Archaeological sites and Casa Diablo quarry locations, Long Valley Caldera.

Volcanic activity has punctuated the subsequent geologic history of the region, depositing much of the locally observable rock, ash, and pumice lapilli. Frequent Holocene eruptions along the Inyo and Mono volcanic chains formed the distinctive Mono Craters and Inyo Craters and Domes. A minimum of eighteen events took place within the last 2000 years (Kilbourne et al. 1980:Table 2). Consequences of individual eruptions ranged from the excavation of small craters to the ejection of massive quantities of pumice bombs and lapilli accumulating within several kilometers of the vent, accompanied by ash and pumice lapilli that dispersed 110 kilometers or more from the source.

A major focus of recent archaeological research in the region has been on the nature and timing of aboriginal obsidian production and exchange networks. Toward this end, a large number of secondary reduction sites or stoneworking camps in the area have been studied. These include Mno-714 (Bettinger 1980), Mno-529 (Basgall 1983), Mno-1529 (Basgall 1984), Mno-561 (Hall 1983), Mno-1654 (Weaver et al. 1984), Mno-819 (reported on in Hall 1984; Jackson 1985), Mno-382 Michels 1964), and Mno-11, -823, -1644, and 1645 (Bouscaren et al. 1982).

Based on an examination of a large number of obsidian hydration values from stoneworking sites in the region, Hall (1983, 1984) has documented the gradual intensification of Casa Diablo obsidian production after 3500 radiocarbon years B.P. Production was at its height 2000 to 1000 years ago, and dramatically and permanently declined after 1000 B.P. (Hall 1984:15). Regional short term production falloffs occurred at approximately 2000-1800, 1700-1600, and 1400-1300 B.P. (Figure 2). These short term production declines appear to coincide with episodes of volcanic activity in the Long Valley/Mono Basin region (Table 1), and may have resulted from temporary source inaccessibility. The permanent decline in production may have been linked with perceived instability in Casa Diablo obsidian availability, combined with the growth of other obsidian networks (Hall 1983, 1984; see also Bouey and Basgall 1984).

Bouey and Basgall (1984) suggest alternative explanations for the decline in Casa Diablo obsidian production. Arguing that groups west of the Sierra were the actual "producers" of the obsidian, possible explanations include environmental collapse in the western Sierra, increasing social complexity east of the Sierra curtailing free access to the source, and population intrusion or replacement in the western Sierra, dramatically disrupting the system (Bouey and Basgall 1984:149).

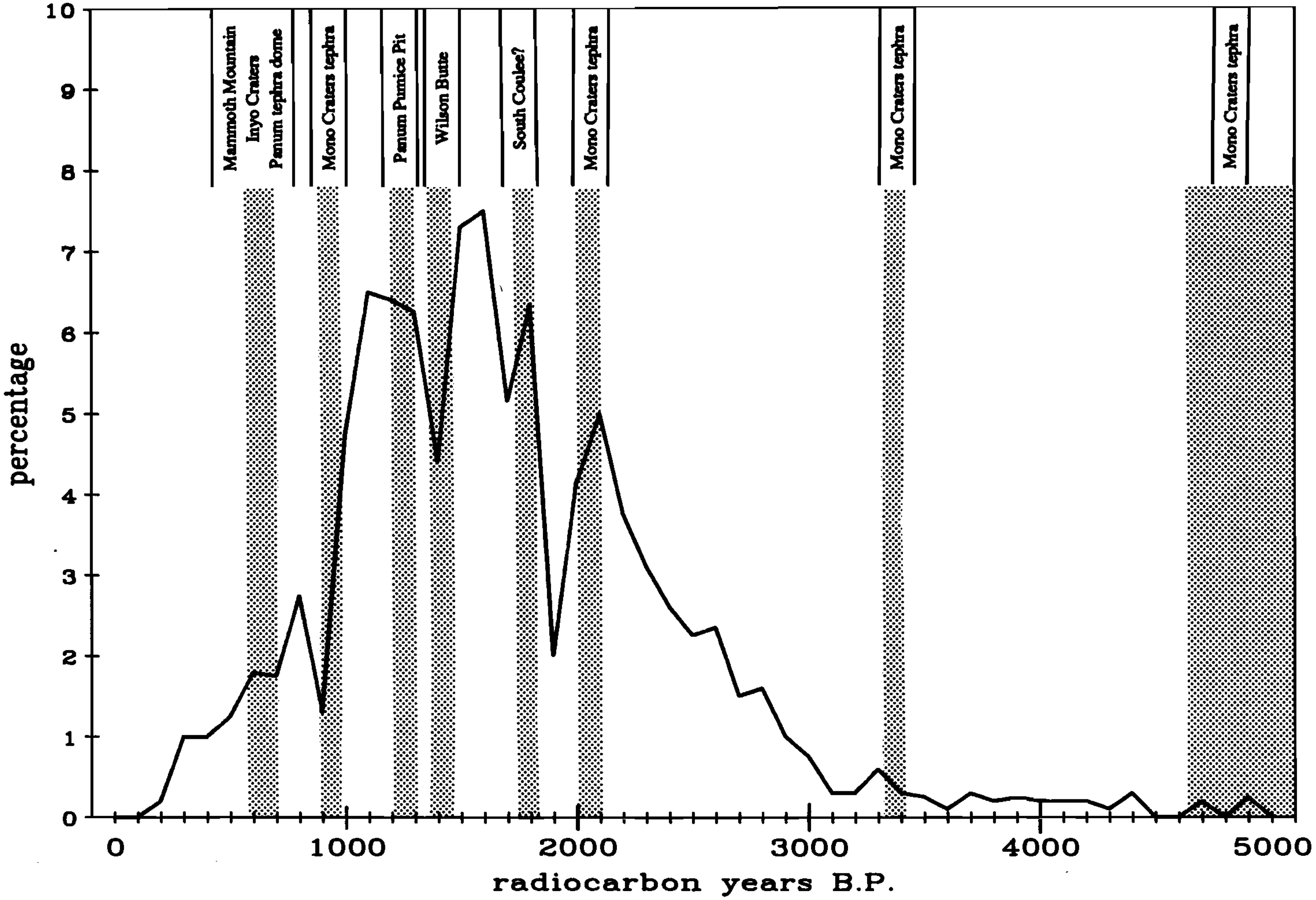

FIGURE 2. Weighted regional hydration curve and eastern Sierra volcanic eruptions.

TABLE 1

DATED HOLOCENE VOLCANIC EPISODES, INYO AND MONO CRATERS

Radiocarbon Age	Vent	Source
1990 +/- 200 B.P.	South Coulee (?)	Wood (1977b:31)
1380 +/- 70 B.P. 1330 +/- 50 B.P.	Wilson Butte pyroclastic flow	Miller (1985:14)
1190 +/- 80 B.P.	Panum Pumice Pit (tephra 2)	Wood (1977a:89) Wood & Brooks (1979)
770 +/- 120 B.P. 750 +/- 60 B.P. 740 +/- 70 B.P. 670 +/- 60 B.P. 655 +/- 120 B.P. 510 +/- 100 B.P.	South Deadman Vent (two eruptive episodes)	Miller (1985:15)
720 +/- 60 B.P. 650 +/- 100 B.P. 530 +/- 50 B.P.	Glass Creek Vent (tephra 1 or Glass Creek tephra)	Wood (1977a:89) Miller (1985:16)
640 +/- 40 B.P.	Panum Crater	Wood & Brooks (1979)
550 +/- 60 B.P.	South Inyo Crater phreatic explosion	Wood (1977a:92)
500 +/- 200 B.P.	Mammoth Mountain	Miller (1985:16)

THE INVESTIGATION

CA-Mno-574 and -833 lie within the corridor for proposed widening of a segment of Highway 395, necessitating evaluation of their eligibility for the National Register of Historic Places. At the outset of the investigation, both Mno-574 and -833 were considered potentially eligible for the National Register because of their size and relative abundance of surface artifacts. Test excavations were undertaken in order to obtain additional information on site characteristics, function, and occupation span, so that the sites' research potential could be evaluated in a regional context. Surface evidence indicated that tool manufacturing, specifically biface reduction, was the primary activity represented at each site, but this assessment could not be supported without more rigorous analysis of the site assemblages.

Fieldwork at each site consisted of reconnaissance and mapping, surface collection of formed tools, excavation of surface scrapes, and unit excavation. At Mno-833, 1x3 meter surface scrapes were excavated to a depth of two centimeters at 100-foot intervals along the centerline of the planned new lanes, in order to assess variations in cultural material distribution. Two 1x1 meter test units were excavated to depths of 90 and 100 cm.

Procedures at Mno-574 were essentially the same, except that the surface scrape transect was placed across the center of the site, rather than along the proposed alignment. Of the three 1x1 meter units excavated, two were located in the main site area on the upper sage flat; the third, Unit 2, was in the Jeffrey pine forest at the site's northern end.

The artifact assemblage at both sites was dominated by obsidian debitage. More than 2900 flakes were recovered from the units at Mno-833, and almost 33,000 flakes from Units 1 and 3 at Mno-574. In addition, 25 bifaces or biface fragments were collected; all but one of these were classified as blanks or preforms, representative of intermediate stages of biface reduction. The only other tools recovered were surface finds: a Humboldt Series point and a Silver Lake point at Mno-574 and a Little Lake series point from Mno-833. Of these, none is clearly associated with other aspects of site use.

Several lines of evidence indicated that the sites functioned primarily, if not exclusively, as obsidian stoneworking camps. Not only was there a large quantity of obsidian debitage, but there was also a near absence of formed or casual tools that could be attributed to activities other than stone tool manufacture. Because almost all of the formed tools are bifaces in intermediate production stages, we concluded that obsidian probably arrived at the sites in the form of crude, bifacial blanks, and subsequently was reduced to preforms. The extremely low frequency of finished tools suggested that most obsidian was transported from the site before reaching final form.

Debitage analysis, which included both flake size classification and flake categorization, supported our assessment of site function. Flake size distributions were characteristic of biface reduction (Patterson 1983; Stahle and Dunn 1983), and high percentages of biface thinning flakes clearly indicated the importance of biface reduction at the two sites (see Adams [1986] and Mone [1986] for further discussion of the debitage analyses).

Having established that biface reduction was the dominant activity at Mno-574 and -833, we compared these sites to others in the Long Valley area where similar biface and debitage assemblages had been documented and which had also been characterized as biface reduction sites. We were particularly interested in examining the temporal aspects of production, to see if the regional trends identified by Hall (1983, 1984) could be seen at Mno-574 and -833. Obsidian hydration analyses were used to establish a chronological framework.

OBSIDIAN SOURCING

All specimens submitted for obsidian hydration analysis were visually identified to obsidian source by Michael Delacorte of the University of California, Davis, following criteria developed by Bettinger et al. (1984). Specimens that lacked clear distinguishing traits of Casa Diablo obsidian were submitted to Paul Bouey, University of California, Davis, for trace element analysis.

With the exception of two projectile points that are probably unassociated with other aspects of site use, all of the sourced specimens were identified as deriving from the Casa Diablo obsidian source. The overwhelming predominance of Casa Diablo glass at Mno-574 and -833 is typical for sites in the region, and is to be expected given the proximity of several major quarries (see Figure 1) and the sites' function as production localities.

OBSIDIAN HYDRATION

Obsidian hydration rim readings were taken on 85 specimens from Mno-574 and 41 specimens from Mno-833. The sample included 120 pieces of debitage, two blank fragments, one preform fragment, and the only projectile points recovered from the sites. At Mno-574, the hydration sample consisted of five flakes from each of three levels in Unit 1 (10-20 cm, 50-60 cm, 80-90 cm) and from each level of Unit 3, from the surface to 120 cm. Five flakes from each level of Unit 2 to 80 cm at Mno-833 were selected for analysis. Because larger flakes are less subject to vertical displacement through processes of soil mechanics (Weaver and Hall 1984) debitage specimens were selected from the largest size classes represented in a given level. The obsidian analysis was performed by Matthew Hall of the Obsidian Hydration Laboratory, University of California, Riverside. Results of the analysis appear in Appendix 1, Tables A through C.

For all Casa Diablo specimens, hydration values were converted into radiocarbon years B.P. using Hall's (1984) hydration rate of 129.656 microns$^{1.826}$ = radiocarbon years B.P. (see Appendix 1).

Site Chronology

Temporal spans of site use were established using the entire suite of debitage hydration dates from Mno-574 and Mno-833, irrespective of stratigraphic position. Relative frequency curves were created by grouping dates into 100-year intervals, and then plotting the percentage of the sample within each 100-year period against the beginning of that interval on a temporal scale (cf. Hall 1984:14).

As illustrated by the hydration curve (Figure 3), Mno-574 was occupied from about 3000 to 600 radiocarbon years B.P. Within this period, the most intense activity appears to have occurred between 1400 and 800 B.P. One production peak is indicated between 1200 and 1100 B.P.; a second, absolute peak appears between 1000 and 900 B.P., with a slight decline between 1100 and 1000 B.P. intervening.

The period of use at Mno-833 ranges from approximately 3000 to 300 B.P. (Figure 3). The most intense activity at the site took place between 1900 and 800 B.P., with a production peak between 1400 and 900 B.P. and an absolute peak between 1300 and 1200 B.P. The lesser peaks at both sites are based on only one to three dates, and probably reflect generally less intense use from 3000 to 1400 B.P. rather than alternating periods of use and abandonment.

The lone projectile point of Casa Diablo obsidian, a Humboldt series point recovered from Mno-574, is dated by hydration to 1023 B.P., firmly within the period of maximum site use. Dates on the three biface fragments from Unit 3 of Mno-574 are generally consistent with debitage dates in the same levels and clearly correspond with the site's most intensive period of use (Appendix 1, Table B).

Discussion

A comparison between the temporal frequency curves from our sites and Hall's (1984) weighted regional curve highlights both similarities and differences (Figure 3). All indicate a general production peak circa 1300-1000 B.P. as well as a significant decline in production beginning around 1000 B.P. Additionally, all curves display a decline between 1700 and 1600 B.P. which is then followed by an increase from 1600 to 1500 B.P.

However, while this latter peak represents the region's most intense production, only limited use is indicated for Mno-574 and -833. There also appears to have been a general decline in regional production from about 1400 to 1300 B.P., whereas Mno-574 and -833 witnessed the beginning of a significant production increase during this period. The most notable contrast is that the period before 1400 B.P. is barely represented at Mno-574 and -833, whereas about 60 per cent of the region's hydration dates are older than 1400 years B.P.

One inference to be made from these comparisons is that obsidian production at our sites did not mirror that of the eastern Sierra as a whole. However, the fact that some

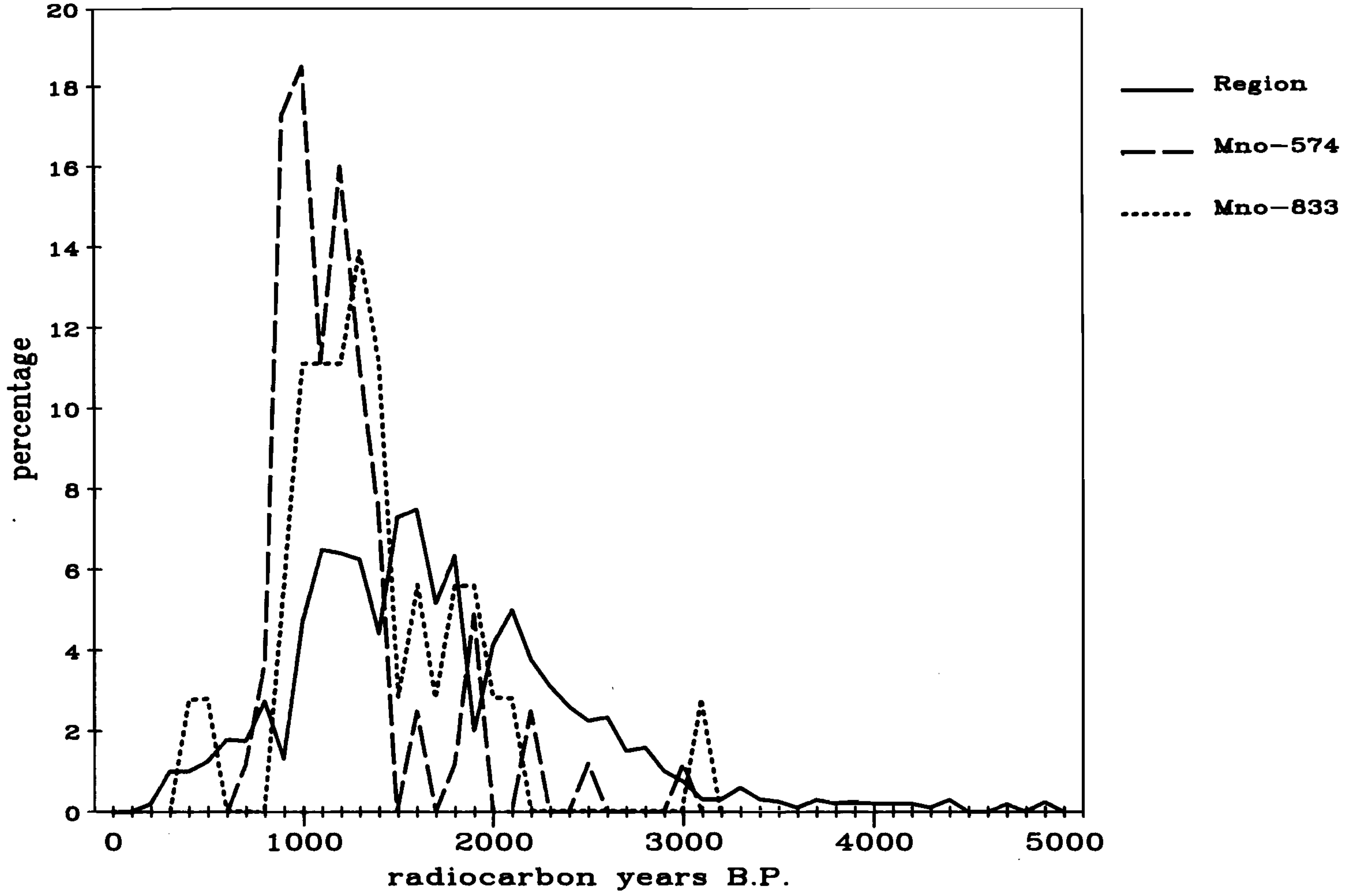

FIGURE 3. Comparison of hydration curves from Mno—574 and Mno—833 with weighted regional curve.

episodes of production increase and decline were essentially synchronic suggests that factors influencing the region's production also affected use of Mno-574 and -833.

In order to identify intra-regional or inter-site differences that would be obscured by the weighted regional curve, which is a composite of hydration readings from 11 geographically dispersed sites, the temporal curves from Mno-574 and -833 were compared to curves from other sites in the Mammoth/Long Valley area. In most respects, curves from these sites reflect the trends depicted in the regional curve including several declines in production that have been correlated with Holocene volcanism in the Inyo-Mono-chain (Hall 1983, 1984; see Figure 2 and Table 1).

However, at least two groups of sites emerge from these comparisons. Traits shared by the first group, which includes Mno-574, Mno-11, Mno-833, -819, and -1645 (see Figure 1), are similarly timed production peaks as well as a paucity of hydration dates earlier than 2000 years B.P. (Figure 4). At all of these sites, the most intense production appears to have occurred between about 1300 and 900 years B.P.; absolute peaks at four of the five sites occurred between 1200 and 900 years B.P.

In contrast, production at sites Mno-529, -1644, -382, -561, and -1529 (see Figure 1) spanned a much longer period (Figure 5). Although the hydration curves indicate greater variation among the sites in this group, all have a larger relative percentage of hydration dates that are earlier than 2000 years B.P. Other notable similarities include generalized production peaks in the periods 2400-2100, 1600-1400, and 1300-1200 B.P., as well as declines circa 2000-1800 and 1400-1300 B.P. All of the sites except Mno-561 experienced production declines from 1200-1100 B.P.

Two of the sites in this second group, Mno-382 and Mno-1529, display strikingly similar hydration curves. These sites also are characterized by more intense production after 1500 B.P. than at the other three sites.

Hall (1984:27) notes that the single exception to correlations between volcanic episodes and decreased obsidian production in the eastern Sierra occurs ca. 1200-1000 B.P., following eruption of Panum Pumice Pit at the north end of the Mono Craters chain (ca. 1190 +/- 80 B.P.; Wood 1977a:89). The hydration curve for sites west of the Sierran crest indicates an appropriate dip in Casa Diablo tool use between 1200 and 1100 B.P., but there is no corresponding reduction in the eastern Sierra (Hall 1984:22,27).

At Mno-574 and -833, as at the other sites in the first group (Mno-11, -819, and -1645), the Panum eruption is followed by a major peak in production. If Hall's (1983, 1984) assessment of the effects of volcanism on obsidian produc-

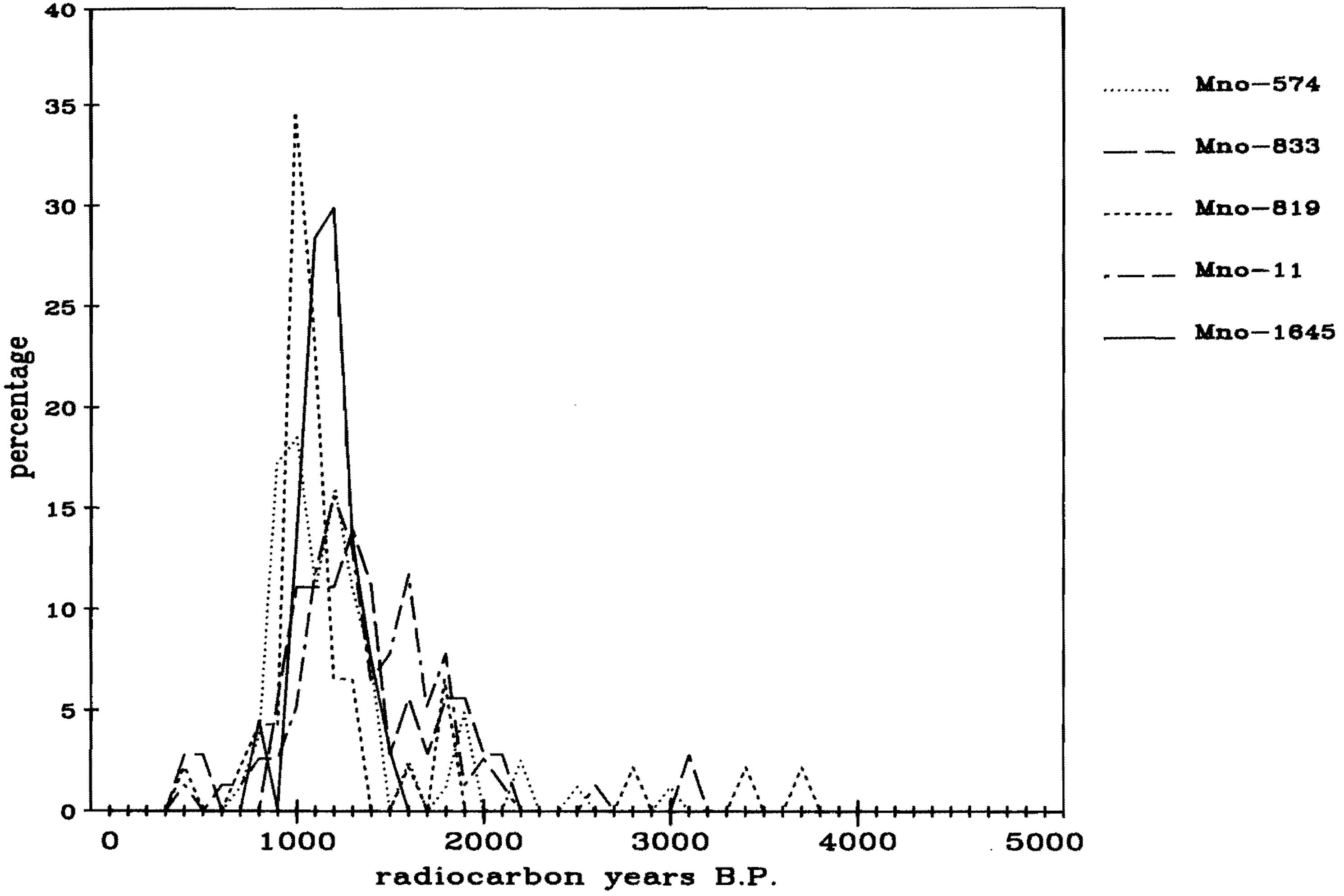

FIGURE 4. Comparison of hydration curves from Mno−574, −833, −819, −11 and −1645.

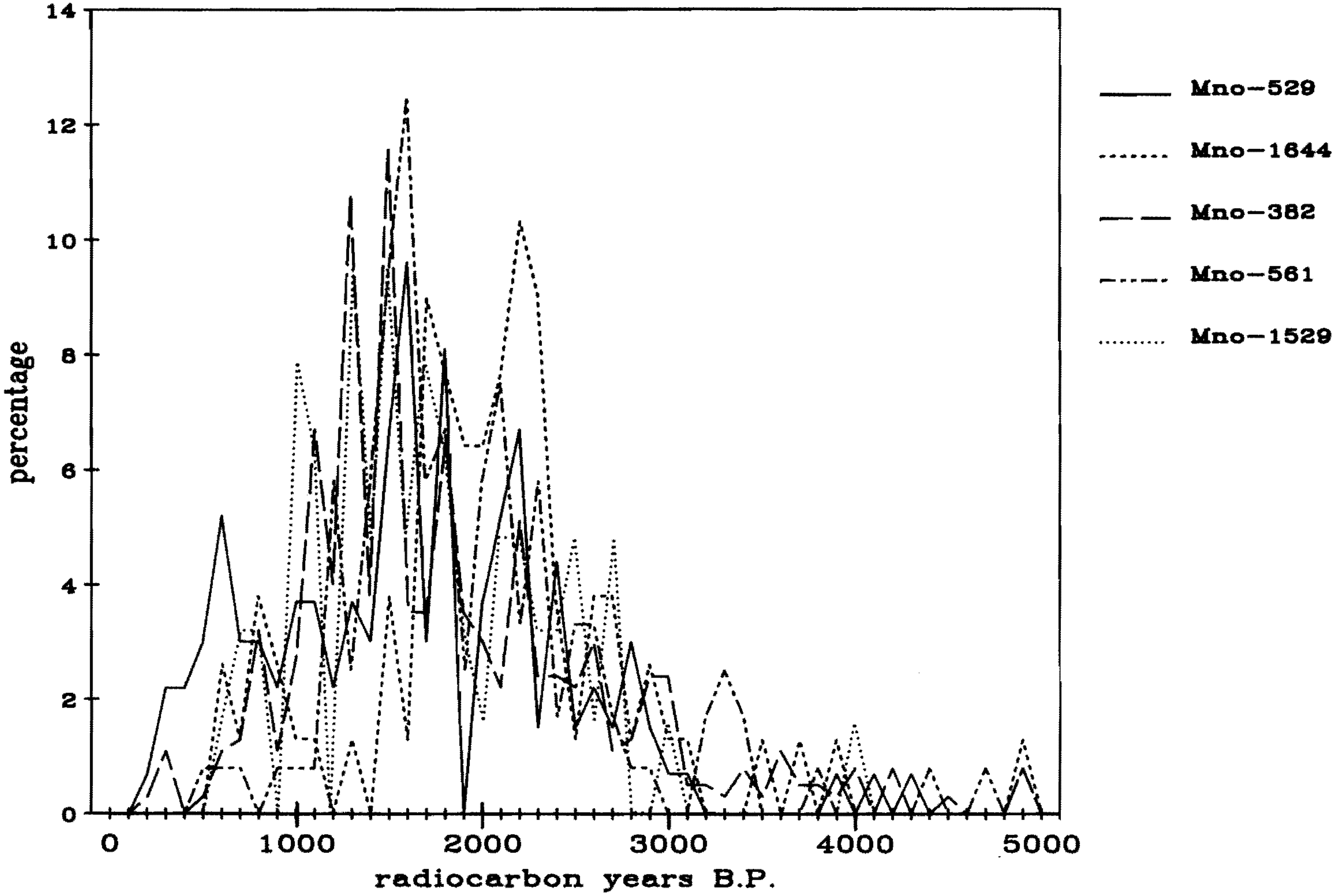

FIGURE 5. Comparison of hydration curves from Mno-529, -1644, -382, -561 and -1529.

tion is correct and if the Panum episode has been correctly dated, these production peaks indicate that its effects may have been quite localized. According to Miller et al. (1982:7, Figure 2) eruptions that are comparable in magnitude to Panum Pumice Pit (about 0.2 cubic kilometers of magma) are associated with "flowage hazard zones" that extend approximately 20 kilometers from the subject vent. Mno-819, the closest of the sites under consideration, is about 21 kilometers south of Panum, just outside the hypothesized flowage hazard zone. In addition, Wood (1977a:95) suggests that the entire eruptive sequence at Panum may have occurred within a few years to a few decades. If this is true, the pyroclastic eruptions that deposited the widespread ash of Tephra 2 would probably have been even briefer, and may have had only short term effects on Long Valley. Yet some of the sites under consideration did experience reduced production between 1200 and 1100 B.P., and they are all much farther from Panum Pumice Pit than the sites characterized by production peaks during this period.

One of the authors (Adams 1986:40) suggested that these local anomalies in obsidian production might be explained if the site groups were used by two different populations. It was argued that sites in the second group, where obsidian production was significantly affected by the eruptions of Wilson Butte and Panum Pumice Pit, may have been used by western Sierran peoples who crossed Mammoth Pass to procure Casa Diablo obsidian.

Real (or assumed) source inaccessibility during the volcanic episodes between about 1400 and 1100 B.P. is a logical explanation for the falloff in production at these sites. In contrast, the 1400-1100 B.P. eruptive episodes had little or no effect on sites in the first group. These sites may have been used by local, eastern Sierran populations who were in a better position to assess the dangers and effects of these volcanic events and may, as Weaver and Hall (1984) suggested, have made a concerted effort to renew obsidian production about 1100 B.P.

The fact that four of the five sites in the second group (CA-Mno-382, -529, -1529, and -1644) experienced a production decline that is correlated with the regional curve for the western, rather than eastern, Sierra (see Hall 1984:Figure 2) indicates that there may be a link between these sites and consumers west of the Sierra.

If these site groups were used by western and eastern Sierran peoples, environmental factors may not have been the sole, or even primary, reason for reduced production at sites in the former group. As suggested by Basgall and Bouey (1984:147), increased territoriality and sociopolitical elaboration in central eastern California from about 1350 B.P. to the historic era, could have resulted in restricted source access for western Sierran groups and the development of a new exchange network organized by eastern Sierran peoples (Adams 1986:40).

At present, obsidian hydration data comprise the only line of evidence that sites in the Mammoth Embayment may have been used by western Sierran populations. Ethnic distinctions would be difficult to make on typological grounds, since the same suite of diagnostic Great Basin point forms characterizes sites in both regions. Additional data from sites on both sides of the Sierran crest, particularly from sites in Long Valley, may help to resolve the issue.

In conclusion, Caltrans' investigation of Mno-574 and -833, while limited in scope, has demonstrated that the research value of these sites is clearly linked to their role in obsidian production and exchange networks. More importantly, some potentially significant intra-regional variations in production have been identified that may reflect site use by two different populations or the localized effects of catastrophic volcanic events. The results are intriguing, if not conclusive, and certainly merit further testing.

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APPENDIX 1

OBSIDIAN HYDRATION RESULTS*

TABLE A

CA-MNO-574, DEBITAGE

UCR OHL No.	Catalog No.	Location	Depth	Micron Measurement	Radiocarbon Age
2330	574 1002 C-1	Unit 1	10-20 cm	3.54 +/- 0.22	1304
2331	574 1002 C-2	Unit 1	10-20 cm	3.19 +/- 0.20	1078
2332	574 1002 C-3	Unit 1	10-20 cm	3.60 +/- 0.20	1345
2333	574 1002 D-1	Unit 1	10-20 cm	3.29 +/- 0.20	1141
2334	574 1002 D-2	Unit 1	10-20 cm	3.47 +/- 0.20	1257
2335	574 1006 C-1	Unit 1	50-60 cm	2.92 +/- 0.20	917
2336	574 1006 C-2	Unit 1	50-60 cm	2.86 +/- 0.20	883
2337	574 1006 C-3	Unit 1	50-60 cm	2.83 +/- 0.20	866
2338	574 1006 D-1	Unit 1	50-60 cm	2.81 +/- 0.20	855
2339	574 1006 D-2	Unit 1	50-60 cm	3.43 +/- 0.20	1231
2340	574 1009 E-1	Unit 1	80-90 cm	2.96 +/- 0.20	941
2341	574 1009 E-2	Unit 1	80-90 cm	3.27 +/- 0.20	1128
2342	574 1009 E-3	Unit 1	80-90 cm	2.90 +/- 0.20	906
2343	574 1009 E-4	Unit 1	80-90 cm	3.15 +/- 0.20	1054
2344	574 1009 E-5	Unit 1	80-90 cm	2.99 +/- 0.20	958
2345	574 3000 C-1	Unit 3	surface	5.54 +/- 0.40	2952
2346	574 3000 C-2	Unit 3	surface	5.01 +/- 0.32	2457
2347	574 3000 C-3	Unit 3	surface	4.30 +/- 0.20	1859
2348	574 3000 D-1	Unit 3	surface	4.30 +/- 0.20	1859
2349	574 3000 D-2	Unit 3	surface	4.19 +/- 0.20	1773
2350	574 3001 C-1	Unit 3	0-10 cm	4.33 +/- 0.20	1882
2351	574 3001 C-2	Unit 3	0-10 cm	3.85 +/- 0.20	1519
2352-1	574 3001 C-3	Unit 3	0-10 cm	4.64 +/- 0.20	2136
2352-2	574 3001 C-3	Unit 3	0-10 cm	3.65 +/- 0.20	1378
2353	574 3001 C-4	Unit 3	0-10 cm	3.26 +/- 0.20	1121
2354	574 3001 D-1	Unit 3	0-10 cm	4.26 +/- 0.20	1827
2355	574 3002 C-1	Unit 3	10-20 cm	3.52 +/- 0.20	1290
2356	574 3002 C-2	Unit 3	10-20 cm	3.02 +/- 0.20	975
2357	574 3002 C-3	Unit 3	10-20 cm	3.33 +/- 0.20	1165
2358	574 3002 C-4	Unit 3	10-20 cm	4.71 +/- 0.20	2195
2359	574 3002 C-5	Unit 3	10-20 cm	2.42 +/- 0.20	651

*hydration rate: 129.656 microns$^{1.826}$ = radiocarbon years B.P. (Hall 1984)

TABLE A: CA-MNO-574, DEBITAGE (continued)

UCR OHL No.	Catalog No.	Location	Depth	Micron Measurement	Radiocarbon Age
2360	574 3003 C-1	Unit 3	20-30 cm	3.87 +/- 0.20	1533
2361	574 3003 C-2	Unit 3	20-30 cm	3.05 +/- 0.20	993
2362	574 3003 C-3	Unit 3	20-30 cm	3.46 +/- 0.20	1250
2363	574 3003 C-4	Unit 3	20-30 cm	3.40 +/- 0.20	1210
2364	574 3003 C-5	Unit 3	20-30 cm	3.01 +/- 0.20	969
2365	574 3004 C-1	Unit 3	30-40 cm	3.28 +/- 0.20	1134
2366	574 3004 C-2	Unit 3	30-40 cm	3.45 +/- 0.20	1243
2367	574 3004 C-3	Unit 3	30-40 cm	3.00 +/- 0.20	963
2368	574 3004 C-4	Unit 3	30-40 cm	3.36 +/- 0.20	1185
2369	574 3004 C-5	Unit 3	30-40 cm	3.50 +/- 0.20	1276
2370	574 3005 C-1	Unit 3	40-50 cm	2.94 +/- 0.20	928
2371	574 3005 C-2	Unit 3	40-50 cm	3.48 +/- 0.20	1263
2372	574 3005 C-3	Unit 3	40-50 cm	2.89 +/- 0.20	900
2373	574 3005 C-4	Unit 3	40-50 cm	3.17 +/- 0.20	1065
2374	574 3005 C-5	Unit 3	40-50 cm	3.66 +/- 0.20	1385
2375	574 3006 B-1	Unit 3	50-60 cm	3.31 +/- 0.20	1153
2376	574 3006 B-2	Unit 3	50-60 cm	2.57 +/- 0.20	726
2377	574 3006 B-3	Unit 3	50-60 cm	3.57 +/- 0.20	1323
2378	574 3006 C-1	Unit 3	50-60 cm	3.26 +/- 0.20	1121
2379	574 3006 C-2	Unit 3	50-60 cm	2.84 +/- 0.20	871
2380	574 3007 C-1	Unit 3	60-70 cm	3.30 +/- 0.20	1146
2381	574 3007 C-2	Unit 3	60-70 cm	3.02 +/- 0.20	975
2382	574 3007 C-3	Unit 3	60-70 cm	3.00 +/- 0.20	963
2383	574 3007 D-1	Unit 3	60-70 cm	3.45 +/- 0.20	1243
2384	574 3007 D-2	Unit 3	60-70 cm	3.32 +/- 0.20	1159
2385	574 3008 C-1	Unit 3	70-80 cm	3.23 +/- 0.20	1102
2386	574 3008 C-2	Unit 3	70-80 cm	2.88 +/- 0.20	894
2387	574 3008 C-3	Unit 3	70-80 cm	2.99 +/- 0.20	957
2388	574 3008 C-4	Unit 3	70-80 cm	3.21 +/- 0.20	1090
2389	574 3008 C-5	Unit 3	70-80 cm	2.82 +/- 0.20	860
2390	574 3009 C-1	Unit 3	80-90 cm	2.88 +/- 0.20	894
2391	574 3009 C-2	Unit 3	80-90 cm	3.03 +/- 0.20	981
2392	574 3009 D-1	Unit 3	80-90 cm	3.25 +/- 0.20	1115
2393	574 3009 D-2	Unit 3	80-90 cm	3.11 +/- 0.20	1029
2394	574 3009 D-3	Unit 3	80-90 cm	2.70 +/- 0.20	795
2395	574 3010 C-1	Unit 3	90-100 cm	2.76 +/- 0.20	827
2396	574 3010 E-1	Unit 3	90-100 cm	2.62 +/- 0.20	752
2397	574 3010 E-2	Unit 3	90-100 cm	3.54 +/- 0.20	1303
2398	574 3010 E-3	Unit 3	90-100 cm	3.27 +/- 0.20	1127
2399	574 3010 E-4	Unit 3	90-100 cm	2.73 +/- 0.20	811

TABLE A: CA-MNO-574, DEBITAGE (continued)

UCR OHL No.	Catalog No.	Location	Depth	Micron Measurement	Radiocarbon Age
2400	574 3011 E-1	Unit 3	100-110 cm	2.90 +/- 0.20	905
2401	574 3011 E-2	Unit 3	100-110 cm	2.81 +/- 0.20	855
2402	574 3011 E-3	Unit 3	100-110 cm	3.10 +/- 0.20	1023
2403	574 3011 E-4	Unit 3	100-110 cm	2.85 +/- 0.20	877
2404	574 3011 E-5	Unit 3	100-110 cm	3.00 +/- 0.20	963
2405	574 3012 D-1	Unit 3	110-120 cm	3.10 +/- 0.20	1023
2406	574 3012 D-2	Unit 3	110-120 cm	3.16 +/- 0.20	1059
2407	574 3012 E-1	Unit 3	110-120 cm	2.82 +/- 0.20	860
2408	574 3012 E-2	Unit 3	110-120 cm	2.73 +/- 0.22	811
2409	574 3012 E-3	Unit 3	110-120 cm	3.07 +/- 0.20	1005

TABLE B

CA-MNO-574 AND CA-MNO-833 TOOLS

UCR OHL#	Cat. No.	Description	Location	Micron Measurement	Radiocarbon Age
2410	574 2	P. point*	general surface	3.10 +/- 0.20	1023
2411	574 8	P. point**	general surface	7.07 +/- 0.21	---
2412	574 3018	Blank	Unit 3, 40-50 cm	2.70 +/- 0.20	795
2413	574 3019	Blank	Unit 3, 40-50 cm	3.39 +/- 0.20	1205
2414	574 3020	Preform	Unit 3, 60-70 cm	2.91 +/- 0.20	912
2475	833 8	P. point***	general surface	5.62 +/- 0.20	3033

*Humboldt series (concave base).
**Great Basin stemmed series (Silver Lake); not Casa Diablo obsidian.
***Little Lake series; Fish Springs obsidian

TABLE C

CA-MNO-833, DEBITAGE

UCR OHL No.	Catalog No.	Location	Depth	Micron Measurement	Radiocarbon Age
2435	833 2001 C-1	Unit 2	0-10 cm	4.10 +/- 0.20	1705
2436	833 2001 C-2	Unit 2	0-10 cm	3.66 +/- 0.20	1386
2437	833 2001 D-1	Unit 2	0-10 cm	4.15 +/- 0.20	1743
2438	833 2001 D-2	Unit 2	0-10 cm	4.39 +/- 0.20	1932
2439	833 2001 D-3	Unit 2	0-10 cm	5.63 +/- 0.20	3042
2440	833 2002 D-1	Unit 2	10-20 cm	3.67 +/- 0.20	1393
2441	833 2002 D-2	Unit 2	10-20 cm	1.64 +/- 0.20	320
2442	833 2002 E-1	Unit 2	10-20 cm	2.03 +/- 0.20	472
2443	833 2002 E-2	Unit 2	10-20 cm	NOH	
2444	833 2002 E-3	Unit 2	10-20 cm	3.69 +/- 0.20	1407
2445	833 2003 C-1	Unit 2	20-30 cm	3.60 +/- 0.20	1345
2446	833 2003 D-1	Unit 2	20-30 cm	3.19 +/- 0.20	1078
2447	833 2003 D-2	Unit 2	20-30 cm	NOH	
2448	833 2003 D-3	Unit 2	20-30 cm	4.56 +/- 0.20	2070
2449	833 2003 D-4	Unit 2	20-30 cm	2.85 +/- 0.20	878
2450	833 2004 C-1	Unit 2	30-40 cm	3.27 +/- 0.20	1128
2451	833 2004 C-2	Unit 2	30-40 cm	3.51 +/- 0.20	1284
2452	833 2004 C-3	Unit 2	30-40 cm	2.83 +/- 0.20	866
2453	833 2004 D-1	Unit 2	30-40 cm	3.00 +/- 0.20	964
2454	833 2004 D-2	Unit 2	30-40 cm	4.02 +/- 0.20	1645
2455	833 2005 D-1	Unit 2	40-50 cm	4.28 +/- 0.20	1844
2456	833 2005 E-1	Unit 2	40-50 cm	3.86 +/- 0.20	1527
2457	833 2005 E-2	Unit 2	40-50 cm	3.26 +/- 0.20	1122
2458	833 2005 E-3	Unit 2	30-50 cm	NOH	
2459	833 2005 E-4	Unit 2	40-50 cm	2.91 +/- 0.20	912
2460	833 2006 D-1	Unit 2	50-60 cm	3.22 +/- 0.20	1097
2461	833 2006 D-2	Unit 2	50-60 cm	3.13 +/- 0.20	1041
2462	833 2006 E-1	Unit 2	50-60 cm	4.24 +/- 0.20	1813
2463	833 2006 E-2	Unit 2	50-60 cm	3.55 +/- 0.20	1311
2464	833 2006 E-3	Unit 2	50-60 cm	3.95 +/- 0.20	1593
2465	833 2007 E-1	Unit 2	60-70 cm	3.37 +/- 0.20	1192
2466	833 2007 E-2	Unit 2	60-70 cm	3.52 +/- 0.20	1291
2467	833 2007 E-3	Unit 2	60-70 cm	3.43 +/- 0.20	1231
2468	833 2007 F-1	Unit 2	60-70 cm	3.51 +/- 0.20	1284
2469	833 2007 F-2	Unit 2	60-70 cm	2.99 +/- 0.20	958
2470	833 2008 E-1	Unit 2	70-80 cm	3.44 +/- 0.20	1238
2471	833 2008 E-2	Unit 2	70-80 cm	3.25 +/- 0.20	1116
2472	833 2008 F-1	Unit 2	70-80 cm	NOH	
2473	833 2008 F-2	Unit 2	70-80 cm	3.10 +/- 0.20	1023
2474	833 2008 F-3	Unit 2	70-80 cm	3.02 +/- 0.20	976