Radiocarbon Dates from California of Archaeological Interest

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The recently developed method of dating organic remains of archaeological, paleontological or geological interest by measuring the remanent radioactivity of the C14 (radiocarbon) component is described in a number of readily available printed sources--for example, Libby (1955, 1956), Wise (1955), Carr and Kulp (1954), Deevey (1952), Kulp (1952, 1953), Griffin (1955), Broecker and Kulp (1956). Levi (1955) has a valuable bibliography of radiocarbon dating covering the period 1946 to 1954.

Although the radiocarbon method is commonly represented as a "scientific" technique for determining the exact age of a sample of organic materials under carefully controlled laboratory conditions, this conception is quite erroneous (Spaulding, 1958). The age determinations are never precise, since they are always accompanied by a plus-or-minus error which is never less than 100 years and at times as much as 1200 years. Indeed, although the half-life of radiocarbon is now agreed to be 5568 ± 30 years, both the half-life figure and error figure are approximations and at the same time averages. Actual mistakes or errors can occur in the radiocarbon laboratory, and the possibility of this having happened must be kept always in mind. In some instances these errors have been detected by the archaeologists who submitted the sample for dating,[1] but in other cases it must be presumed that there is no way to detect such errors and the assumption must be made that the date is acceptable. Any single run, therefore, is hypothetically suspect as regards accuracy. When two determinations of the same sample, or several samples from the same deposit, are assayed, we are in a stronger position of judging the probably accuracy by noting the degree of consistency of the dates.

The plus-or-minus error figure is statistically derived, and is interpreted, with reference to the radiocarbon date itself, as signifying one chance in three that the true date of the sample will fall outside the laboratory-run date plus or minus the error, and one chance in twenty that

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1. To cite one example, R. F. Heizer and E. Antevs in 1950 submitted sample C-554 to Libby and received a date of 2736 ± 500 B.P. This was so patently in error that Libby re-ran more of the same sample and secured two dates which are acceptable since they agree with other chronological indications. The re-runs were 5779 ± 400 and 5694 ± 325 B.P.--certainly a major correction. This incident is described in context in Heizer, 1951 , p. 92. For other instances, see Bird (1951) and Hunt (1955).

the true date will fall outside the laboratory date plus or minus two times the error (cf. Wauchope, 1954, pp. 19-20; Bird, 1951, pp. 46-47). For example, let us illustrate with combined sample C-440/C-522 from an Early Central California horizon site (SJo-68). The laboratory date is 4052 ± 160 years. There is one chance in three that the true date of this sample is outside the range 3892-4212 years old, and one chance in twenty that it falls outside the range 3732-4372 years old. The several columns in the accompanying table give the laboratory date (elapsed years) with ± error, the B.P. date range within one sigma of ± error, the laboratory date converted to Christian calendar date, and the Christian calendar date range within one sigma of ± error.

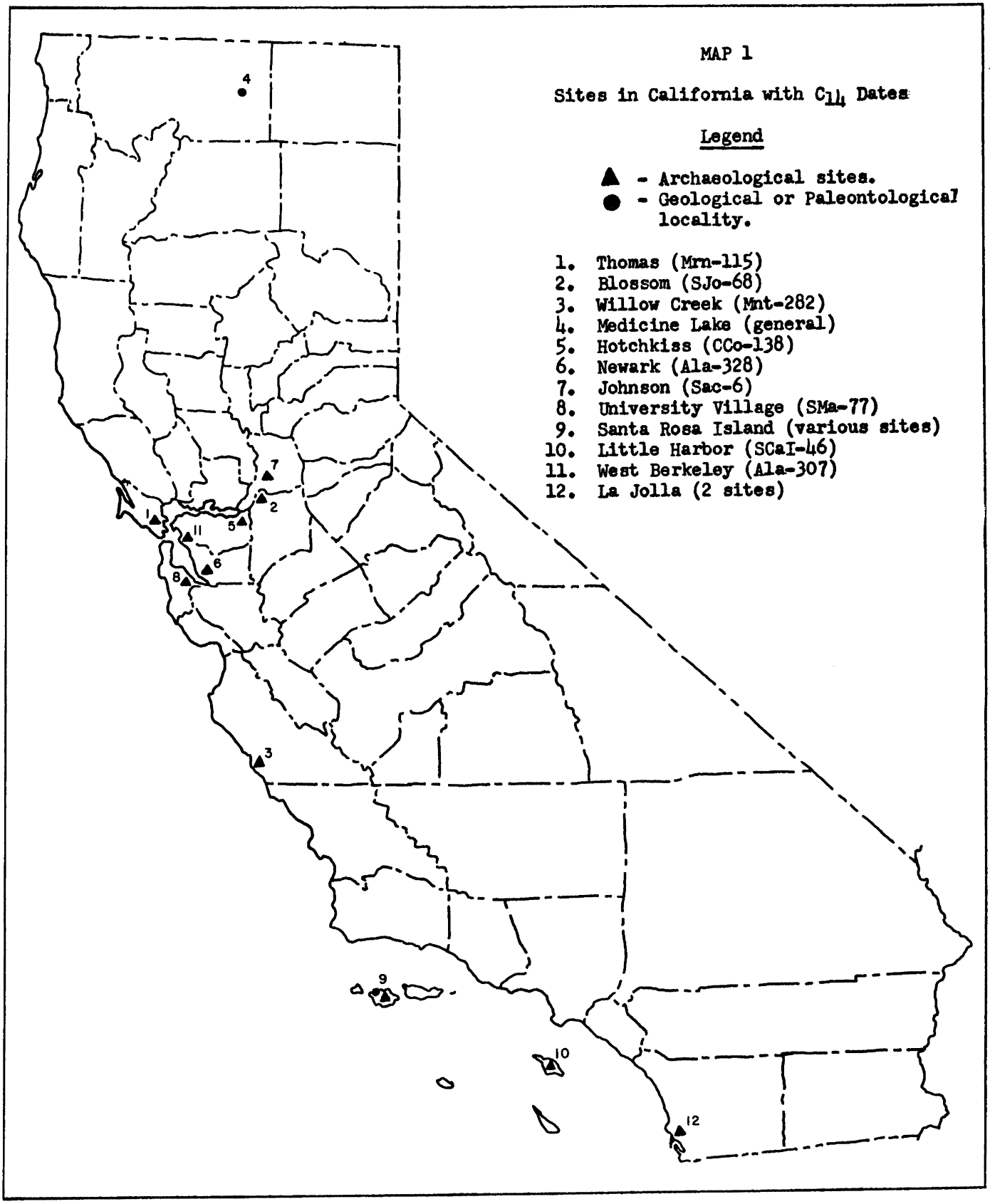
Errors in dating determination can be made in the laboratory, as mentioned earlier. There is no way to guard against such mistakes, and the archaeologist can only hope that these are infrequent. Johnson (1956) has clearly set forth the responsibilities of the sample collector. The person who collects the sample must make the decision as to whether the sample is suitable or not, and further must be qualified to judge the archaeological or geological significance of the sample (cf. Antevs, 1957). The sample collector has a second main responsibility which is publication and this may be divided into two parts. First is the matter of description of the sample. This must be informative, complete, and accurate. Second is the requirement for careful and complete analysis and judgment of the date and its significance in the light of association or archaeological context. Such assessment ought, properly, to cite all relevant literature in order to provide other workers with orientation.

The following comments are offered as suggestions to those readers who may wish to learn more of the context of the California dates. The opinions as to the significance of particular dates given here are those of the present author unless otherwise stated.

C-186. Date for this sample refers to a large shellmound (4-Mrn-115) on the Marin County shore of San Francisco Bay. The significance of the date is not clear since it has not been definitely established whether the level from which the sample was taken is of Middle Horizon or Phase I Late Horizon date. This confusion rests squarely upon the shoulders of the present author who collected the material (charcoal) and submitted it to Libby without being certain at the time as to the cultural association. This sample has been discussed elsewhere by Heizer (1951a, p. 25) and Meighan (1953, pp. 5-6).

C-440 and C-522 (combined sample). Two small lots of charcoal screened from the midden mass of this Early Horizon site provide a direct date for this culture period. Of the several sites (Sac-107, SJo-142, SJo-56, SJo-68) known of this period, SJo-68, from which sample C-440/C-522 comes, is believed to be the latest (Heizer, 1949, p. 34).

In 1957 the Michigan Laboratory (more correctly the University of Michigan Memorial-Phoenix Project Radiocarbon Laboratory) determined dates


MAP 1
Sites in California with C_{14} Dates
Legend
▲ - Archaeological sites.
● - Geological or Paleontological locality.
1. Thomas (Mrn-115)
2. Blossom (SJo-68)
3. Willow Creek (Mnt-282)
4. Medicine Lake (general)
5. Hotchkiss (CCo-138)
6. Newark (Ala-328)
7. Johnson (Sac-6)
8. University Village (SMa-77)
9. Santa Rosa Island (various sites)
10. Little Harbor (SCaI-46)
11. West Berkeley (Ala-307)
12. La Jolla (2 sites)

of three site SJo-68 samples. These are numbered M-645, M-646, M-647. One has been mentioned in print (Heizer, 1957, p. 3).

Sample M-645 consisted (like the original sample, No. C-440/C-522) of a screenings sample of small bits of wood charcoal from the midden between 24 inches and 60 inches below the surface. Sample M-646 was one lot of calcined human bone from a cremation, but as stated by Dr. J. B. Griffin, "the specimen did not fill the counter, so that this date does not have quite the reliability of that from our M-646 of charcoal." In view of the closeness of dates from combined sample C-440/C-522, sample M-645 and sample M-647, I also believe that the date of M-646 is not reliable since it is rather younger in years while being stratigraphically equivalent to C-440/C-522, M-645, and M-647.

Sample M-647 was a large batch of calcined human bone from a cremation, and Dr. Griffin's opinion is that "this is certainly a more reliable date than for M-646, and I think that that [i.e., M-646] should be more or less ignored in your considering the age of the Early Horizon of the Windmiller Complex."

A point of interest here is the closeness of dates of two different materials--wood carbon (C-440/C-522 and M-645) and calcined and carbonized human bone (M-647).

We conclude that there are now three reliable radiocarbon dated samples for this site which are 4052 ± 160, 4100 ± 250, and 4350 ± 250 years old.

C-628, C-695. Two samples of wood charcoal from the bottom of a buried shell mound (Mnt-282) at the mouth of Willow Creek, Monterey County, date within the first century of the Christian era. The site was excavated by the summer field classes of the University of California (Berkeley) under the direction of R. F. Heizer in 1951 and R. K. Beardsley in 1952. The final archaeological report has not been completed.

The radiocarbon date was deemed desirable because the lower midden was capped with a sterile waterlaid gravel stratum over ten feet in thickness, and these gravels were capped in turn with a superficial shell mound layer. The lower, buried midden is site Mnt-282; the uppermost midden is site Mnt-281.

C-673. The date of the volcanic eruption in the Medicine Lake Highlands which formed Glass Mountain provides a "maximum age for the huge flows of obsidian found in the vicinity of Medicine Lake" (see Chesterman, 1955). Glass Mountain obsidian, widely used by Indians in Northern California (Heizer and Treganza, 1944; Smith and Weymouth, 1952, p. 10) could not, therefore, have been available before 600 A.D. This fact may prove, in future, of interest to archaeologists.

C-689. A charcoal sample from a Late Horizon site (CCo-138) in the Sacramento-San Joaquin delta region just east of Knightsen gives a date which refers to the earlier phase of Late Culture (Phase I). The site is not fully described in print, but a manuscript is deposited in UCAS files, and a brief analysis has been published (Lillard, Heizer and Fenenga, 1939, pp. 70-72). The radiocarbon date fits reasonably well with a guess-chronology based on other evidence (Heizer, 1949, p. 39).

C-690. This sample of wood charcoal was collected from the lower levels of the Newark site (Ala-328) which has been excavated by A. E. Treganza of San Francisco State College. For the past seven years he has returned to the site each fall semester with a weekend class. An interim analysis of data recovered has been prepared by J. Davis (n.d.). This detailed report will be published in the near future by the UCAS.

Davis recognizes three components: A, Late Horizon; B, later Middle Horizon; C, earlier Middle Horizon. The date for sample C-690 refers to the lower level component B. Component C at Ala-328 is equated with the lowest levels at Ala-307 (cf. samples M-121 to M-127), Ellis Landing site (CCo-295), and the Bodega Bay site (Son-299).

C-691. A sample of the butt of a carbonized wooden post associated with a house floor in the Johnson mound (Sac-6) gives a radiocarbon date that is certainly in error. The true age might be as much as 1000 years, but somewhat less would be expected. The carbon sample belongs stratigraphically to late Phase 1 or Phase 2 of the Late Horizon culture. Since the date is clearly in error, and presumably the explanation lies in something which went wrong in the dating laboratory, no accounting can be given. Libby planned to check the date with an alternative sample which was specially collected, but has not done so to date.

L-187A, L-187B. The University Village site (SMa-77) was excavated by B. Gerow of Stanford University. Gerow believes that the site probably falls in the little known transitional period between the Early and Middle Horizon cultures. Gerow has written a report (Gerow, n.d.) on the excavations which has not yet been published.

Although our present body of fact concerning chronology of Central California cultures is pretty small, we may observe that the two University Village dates which average 2925 B.P. (972 B.C.) do fall between the Early Horizon culture dates (samples C-440/C-522, M-645, M-647) which average at 2204 B.C. and the Newark site date (sample C-690) of 386 B.C.

L-244. Of geological significance, and referring to Santa Rosa Island. Discussed by Orr (1956, p. 7).

L-257. Date based on red abalone (Haliotis rufescens) shell from midden deposit. No information given by Orr (1956, pp. 257-258) to permit independent judgment of significance of date. Orr ascribes the date as doubtfully "Dune Dweller." Carr and Kulp (1954) discuss the reliability of dates derived from marine-shells.

L-290D. Same comment as for L-257. Broecker and Kulp (1957, p. 1328) give a different date for this sample--7050 ± 300 years.

L-290R. Orr (1956, p. 7) implies that this date, derived from charred mammoth bone, refers to the presence of man on Santa Rosa Island. Until full details of occurrence are presented judgment as to significance of this and other Santa Rosa Island dates should be avoided. A slightly different date, perhaps based on recomputation, is given for this sample by Broecker and Kulp (1957, p. 1326).

L-299B. Date based on shell (species not given) "from an old midden." No information given on significance of the date beyond statement that age of lime-pan type of midden and age of valley fill is indicated.

L-299C. Date based on charcoal from a midden. No cultural information given on site. Significance of date impossible to discern.

L-299D. Sample stated to be charcoal from Texas Street site at San Diego. Carter's opinion, not shared by many persons who have seen the locality, is that evidence of early man (Carter says third Interglacial) occurs here.

W-142. Date derived from charcoal recovered during construction excavations on the Scripps campus at La Jolla. The collectors (C. Hubbs and G. Carter) believe that the charcoal "is probably of human origin," but cannot give proof that the stratum from which the charcoal came marks an occupation deposit. One can only conclude that this date is still another upon which judgment should be reserved, since its stratigraphic and situational contexts are unclear.

W-154, W-155. Shells (sample W-154) and charcoal (sample W-155) are from the same locality as sample W-142, but apparently derive from a younger fill layer. No significance can be attached to this date which refers to a hearth containing charcoal and Mytilus shells. In the published description of the sample (Rubin and Suess, 1955, p. 487) it is noted that samples W-154 and W-155 "came from the same terrace fill as sample W-142, but the possibility of a more recent canyon cut and fill was mentioned by the collector at the time the samples were submitted. The dates show that the samples are indeed from this younger fill." More recently, Carter (1956, fig. 6) has treated the significance of this date, and in comparing the date with his soil color-time scheme says, "The [soil] color is wrong [i.e. indicates an older date] for this [C14] date and may be due to somewhat weathered materials deposited on the hearth." One who is uninitiated in Carter's soils-time method can only suggest that if the alluvial geology only suggested the possibility of a younger canyon cut and fill, and if the soil color indications are contrary to the radiocarbon date, there is a possibility that the radiocarbon date itself may be incorrect. If the present author were faced with this situation, he would secure a check run on samples W-154 and W-155.

M-121, M-127. According to W. Wallace who excavated the West Berkeley site (Ala-307) for the UCAS, "the mound is probably the earliest one yet excavated

in that [east bayshore] region." Although this may be true, the Ellis Landing shellmound and the Emeryville shellmound (site Ala-309, from whose base the UCAS in 1957 secured charcoal for dating) may be equally old or older than Ala-307.

It will be noted that the suite of dates from Ala-307 refers to arbitrary stratigraphic levels in the site, and that these are not fully consistent. The broad conclusion permitted by these dates is that site Ala-307 may have been occupied about 3500 years ago. To take each of the age figures literally involves one in attempting to explain inconsistencies which may result from sampling errors, laboratory errors, or other factors.

A report on the Ala-307 excavation is being prepared by Lathrap and Wallace (ms.).

M-434. Date based on Haliotis shells from bottom level (depth 24 inches) of midden at Little Harbor, Catalina Island. Excavation was supervised by C. W. Meighan whose report is now ready for publication (Meighan, n.d.). He states that the site is "pre-Canalino."

M-645. Discussed above under C-440 and C-552.

M-646. Discussed above under C-440 and C-552.

M-647. Discussed above under C-440 and C-552.

M-648. Compare with sample C-691 which is an erroneous date for the same site (Sac-6).

Sample M-648 (wood charcoal) refers to Late Phase 1 and sample C-689 (Hotchkiss site CCo-138) refers to Middle Phase 1. Mr. James Bennyhoff, who is making an intensive study of the Late Horizon culture, believes at this time that this culture can be subdivided into the following phases:

Phase 2	1600 - 1850 A.D.
Late Phase 1	1100 - 1600 A.D.
Middle Phase 1	700 - 1100 A.D.
Early Phase 1	300 - 700 A.D.

CT-38. This date, based upon a piece of matting made of surfgrass (Phyllospadix), refers to Santa Rosa Island. Orr (1956, pp. 4-5) believes the date refers to the Late Canalino period. The Canalino culture is described by Rogers (1929); it is equivalent to the Late Mainland and Late Island culture of Olson (1930).

CT-40. This date is said by Orr (1956, p. 5) to refer to the Early Canalino culture phase (cf. CT-38).

Carter (1956, fig. 6) lists the "Late Dune Dwellers" phase on Santa Rosa Island at 2500 years old. Orr (1956, p. 5) states that the Canalino

culture (which postdates Dune Dwellers) begins about 3500 years ago. It is probable that Carter is referring to sample CT-40 which Orr classes questionably as Early Canalino. Such inconsistencies leave the uninitiated in some confusion, since Orr's publication (1956) which Carter (1956, fn. 2) cites clearly makes CT-40 refer to Canalino. One can only conclude that the dating is primary and cultural assignation comes later so that the best fit is arranged between culture phase and time. The ever-present possibility that single-run dates may be very incorrect (two examples are given above) should make the archaeologist very cautious about changing culture classifications to fit such single dates.

Discussion

Of the dated samples listed in the table and briefly discussed above, some concluding observations may be offered.

The Early Horizon of Central California now appears, as judged by samples C-440/C-522, M-645, and M-647, to have begun to either develop into, or to be replaced by, the Middle Horizon culture about 4000 years ago (cf. Heizer, 1949, p. 34).

The culture disclosed at site Mnt-282 shows significant connections with the Santa Barbara channel between 1800 and 1900 years ago.

Phase 1 of the Late Horizon culture of Central California, as judged by sample C-689, was in operation by 700 A.D. The actual beginning date of this culture phase can probably be projected back to about 300 A.D.

San Francisco Bay was occupied by the Middle Horizon shellfish gatherers, if we consider samples C-690, L-187A, L-187B, and M-121 to M-127, by 3500 years ago. The radiocarbon dates confirm existing conclusions on chronology which are ultimately based upon the rate-of-accumulation age computations made by Nelson, Gifford and Cook.

The large number of radiocarbon dates from the Santa Barbara region (mostly from Santa Rosa Island) are unfortunately not of much utility at the moment since the content of the culture phases mentioned are not detailed. We urgently need a fully documented report on Santa Rosa Island archaeology which contains detailed plans and profiles of all particular find sites with illustrations of artifacts, mammoth bones exhibiting the marks of human action, burials, etc., etc., etc.

In broad terms, most of us will admit that the radiocarbon dating method has made significant contributions to the important matter of archaeological chronology in California. Among the factors which contribute to the necessity at this time of viewing the results of radiocarbon dating analysis for California as a mixed blessing are collector's errors (e.g.

samples C-186, W-154, W-155) which provide dates that cannot be put into meaningful archaeological contexts; probable laboratory errors which produce internal inconsistencies (e.g., the sample series M-121 to M-127) or are clearly wrong (e.g., sample C-691); single-run dates whose accuracy cannot be checked, or even estimated; and finally, a number of dates for which no adequate report on the archaeological situation has been provided. Errors of collecting are unfortunate and the archaeologist should be fully aware of his responsibility in regard to collecting materials to be dated (cf. Johnson, 1956; Meighan, 1956); errors which occur in the preparation of the sample and its laboratory analysis and in the mathematical computations are also unfortunate, but nothing can be done by the archaeologist to control or correct such errors.[2] The inability of the archaeologist to provide the scientific public with the detailed facts required to establish cultural context for those radiocarbon dates which have been announced is the archaeologist's responsibility. No active archaeologist is ever fully up to date on his reporting, and the present author does not except himself from the stricture of failing to report the archaeology of some of the cultural dates--thus the report on the Willow Creek site for which there are two dates (samples C-628, C-695) has not yet been completed, although analysis of the materials has been done. In general terms, workers at Berkeley have tried to secure dates for sites and culture phases which are already fairly well known since such dates can be more usefully employed in ordering the larger body of archaeological data.

Nothing said above should be construed as anything but constructive criticism. Radiocarbon dating has been until now, and will probably continue for some time to be, done on an informal basis where individual workers make their own arrangements with dating laboratories. These arrangements depend either upon personal contacts or locally available funds, and the result is a body of data which in its totality is unprogramed and cannot be harmonized by any single person.

In California it would be most constructive to hold a conference at which dates could be discussed and where arrangements for a detailed joint analysis and publication of all information could be worked out.

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2. Except, of course, to request that a sample be re-run, or to submit a second sample to another laboratory in the hope of checking the suspect date.

Table 1: California Radiocarbon Dates

	BP Date*	1σ Range BP	BC-AD Date	1σ Range BC-AD	Source
Chicago Dates:					
C-186					
(4-Mrn-115) Thomas Site	633 B 50 ± 200	833- 433 B 50	1,317 AD ± 200	1,117 AD- 1,517 AD	(1)
	911 B 50 ± 180	1,091- 731 B 50	1,039 AD ± 180	859 AD- 1,219 AD	
Ave.	720 B 50 ± 130	850- 590 B 50	1,230 AD ± 130	1,100 AD- 1,360 AD	
C-440, C-522 (Combined sample)					
(4-SJo-68) Blossom Site	4,052 B 50 ± 160	4,212- 3,892 B 50	2,102 BC ± 160	2,262 BC- 1,942 BC	(1)
C-628					
(4-Mnt-282) Willow Creek	1,879 B 51 ± 250	2,129- 1,629 B 51	72 AD ± 250	178 BC- 322 AD	(4)
C-673					
Medicine Lake, Siskiyou Co.	1,660 B 52 ± 300	1,960- 1,360 B 52	292 AD ± 300	8 BC- 592 AD	(5)
	1,107 B 52 ± 380	1,487- 727 B 52	845 AD ± 380	465 AD- 1,225 AD	
Ave.	1,360 B 52 ± 240	1,600- 1,120 B 52	592 AD ± 240	352 AD- 832 AD	
C-689					
(4-CCo-138) Hotchkiss Site	1,229 B 54 ± 200	1,429- 1,029 B 54	725 AD ± 200	525 AD- 925 AD	(7)
C-690					
(4-Ala-328) Newark Site	2,588 B 53 ± 200	2,788- 2,388 B 53	635 BC ± 200	835 BC- 435 BC	(6)
	2,090 B 53 ± 220	2,310- 1,870 B 53	137 BC ± 220	357 BC- 83 AD	
Ave.	2,339 B 53 ± 150	2,489- 2,189 B 53	386 BC ± 150	536 BC- 236 BC	
C-691					
(4-Sac-6) Johnson Site	2,360 B 53 ± 400	2,760- 1,960 B 53	407 BC ± 400	807 BC- 7 BC	(6)
	2,460 B 53 ± 165	2,625- 2,295 B 53	507 BC ± 165	672 BC- 342 BC	
Ave.	2,410 B 53 ± 200	2,610- 2,210 B 53	457 BC ± 200	657 BC- 257 BC	
C-695					
(4-Mnt-282) Willow Creek	1,840 B 52 ± 400	2,240- 1,440 B 52	112 AD ± 400	288 BC- 512 AD	(5)
Lamont Dates:					
L-187A					
(4-SMa-77) University Village	2,700 B 53 ± 350	3,050- 2,350 B 53	747 BC ± 350	1,097 BC- 397 BC	(2)
L-187B					
(4-SMa-77) University Village	3,150 B 53 ± 300	3,450- 2,850 B 53	1,197 BC ± 300	1,497 BC- 897 BC	(2)

*BP means Before Present, or years ago. Since the year in which the sample's age was determined marks the P date, we have adopted the system of using the last two years of the P date to indicate more exactly the computed age. Thus, B 50 means "before 1950."

California Radiocarbon Dates (continued)

	BP Date	1σ Range BP	BC-AD Date	1σ Range BC-AD	Source
L-244 Tecolote Canyon, Santa Rosa I. Wood below mammoth	Ave. 15,820 B 55 ± 280	16,100-15,540 B 55	13,865 BC ± 280	14,145 BC-13,585 BC	(2,8)
L-257 Early Dune Dweller, Santa Rosa I. Locality 131.6 (shell)	Ave. 6,820 B 55 ± 160	6,980- 6,660 B 55	4,865 BC ± 160	5,025 BC- 4,705 BC	(2,8)
L-290D Dune Dweller, Red Head phase. Locality 131.3A, Santa Rosa I. (shell)	Ave. 7,070 B 55 ± 250	7,320- 6,820 B 55	5,115 BC ± 250	5,365 BC- 4,865 BC	(8)
L-290R Charred mammoth bone, Quarry 10, Santa Rosa I.	Ave. 29,650 B 55 ±2500	32,150-27,150 B 55	27,695 BC ±2500	30,195 BC-25,195 BC	(8)
L-299B La Jolla. (Shell)	6,680 B 56 ± 170	6,850- 6,510 B 56	4,724 BC ± 170	4,554 BC- 4,894 BC	(12)
L-299C La Jolla, (Wood charcoal)	2,800 B 56 ± 150	2,950- 2,650 B 56	844 BC ± 150	694 BC- 994 BC	(12)
L-299D Texas Street, San Diego, (charcoal)	Older than 35,000 B 56				(12)
U.S.G.S. Dates:					
W-142 Scripps service yard, La Jolla (charcoal)	21,500 B 54 ± 700	22,200-20,800 B 54	19,546 BC ± 700	20,246 BC-18,846 BC	(9)
W-154 La Jolla (shell)	580 B 54 ± 200	780- 380 B 54	1,374 AD ± 200	1,174 AD- 1,574 AD	(9)
W-155 La Jolla (charcoal)	600 B 54 ± 200	800- 400 B 54	1,354 AD ± 200	1,154 AD- 1,554 AD	(9)
University of Michigan Dates:					
M-121 (4-Ala-307) West Berkeley (96-108 in.)	2,200 B 55 ± 400	2,600- 1,800 B 55	245 BC ± 400	645 BC- 155 AD	(3)
	2,700 B 55 ± 300	3,000- 2,400 B 55	745 BC ± 300	1,045 BC- 445 BC	
	Ave. 2,450 B 55 ± 250	2,700- 2,200 B 55	495 BC ± 250	745 BC- 245 BC	
M-122 (same) (132-144 in.)	3,210 B 55 ± 300	3,510- 2,910 B 55	1,255 BC ± 300	1,555 BC- 955 BC	(3)

California Radiocarbon Dates (continued)

	BP Date	1σ Range BP	BC-AD Date	1σ Range BC-AD	Source
M-123 (same) (144-156 in.)	2,880 B 55 ± 300	3,180- 2,580 B 55	925 BC ± 300	1,225 BC- 625 BC	(3)
M-124 (same) (156-168 in.) (west)	3,500 B 55 ± 300	3,800- 3,200 B 55	1,545 BC ± 300	1,845 BC- 1,245 BC	(3)
	3,700 B 55 ± 350	4,050- 3,350 B 55	1,745 BC ± 350	2,095 BC- 1,395 BC	
Ave.	3,600 B 55 ± 250	3,850- 3,350 B 55	1,645 BC ± 250	1,895 BC- 1,395 BC	
M-125 (same) (156-168 in.) (east)	3,860 B 55 ± 450	4,310- 3,410 B 55	1,905 BC ± 450	2,355 BC- 1,455 BC	(3)
M-126 (same) (180-192 in.)	3,140 B 55 ± 300	3,440- 2,840 B 55	1,185 BC ± 300	1,485 BC- 885 BC	(3)
M-127 (same) (192-204 in.)	2,700 B 55 ± 400	3,100- 2,300 B 55	745 BC ± 400	1,145 BC- 345 BC	(3)
	3,700 B 55 ± 300	4,000- 3,400 B 55	1,745 BC ± 300	2,045 BC- 1,445 BC	
Ave.	3,200 B 55 ± 250	3,450- 2,950 B 55	1,245 BC ± 250	1,495 BC- 995 BC	
M-434 Little Harbor, Catalina I.	3,880 B 56 ± 250	4,130- 2,630 B 56	1,924 BC ± 250	2,174 BC- 1,674 BC	(10)
M-645 (4-SJo-68) Blossom Site	4,100 B 57 ± 250	4,350- 3,850 B 57	2,143 BC ± 250	2,393 BC- 1,893 BC	(11)
M-646 (4-SJo-68) Blossom Site	3,080 B 57 ± 300	3,380- 2,780 B 57	1,123 BC ± 300	1,423 BC- 823 BC	(11)
M-647 (4-SJo-68) Blossom Site	4,350 B 57 ± 250	4,600- 4,100 B 57	2,393 BC ± 250	2,643 BC- 2,143 BC	(11)
M-648 (4-Sac-6) Johnson Site	620 B 57 ± 200	820- 420 B 57	1,337 AD ± 200	1,137 AD- 1,537 AD	(11)
California Institute of Technology Dates:					
CT-38 Late Canalino, Santa Rosa I. 131.2 (surfgrass)	1,860 B 54 ± 340	2,200- 1,520 B 54	94 AD ± 340	246 BC- 434 AD	(8)
CT-40 Early Canalino, Santa Rosa I. 131.4 (charcoal)	2,590 B 54 ± 360	2,950- 2,230 B 54	636 BC ± 360	996 BC- 276 BC	(8)

Notes to Data in Table

Samples C-186 and C-440/C-522 (two combined) were run during the eighteen months preceding February 2, 1951. For the purpose of converting to the Christian calendar the year 1950 was assumed as the date of the run. Sample C-628 was run during the period September 1, 1950 to September 1, 1951. 1951 was used as the conversion date. Samples C-673 and C-695 were run during the period September 1, 1951 to September 1, 1952. 1952 was used as the conversion date. Samples C-690 and C-691 were run during the period September 1, 1952 to September 1, 1953. 1953 was used as the conversion date. Sample C-689 was run during the period September 1, 1953 to September 1, 1954. 1954 was used as the conversion date.

Samples L-187A and L-187B were run in 1953. Samples L-244 and L-257 were run in 1955 [see (8)]. Samples L-290D and L-290R were run during the period September, 1955 to July 27, 1956. 1955 was used as the conversion date.

Samples W-142, W-154, and W-155 were run in 1954. Samples M-121 through M-127 were run during a period from early in 1954 to October, 1956. 1955 was used as the conversion date.

Samples CT-38 and CT-40 were run during the period from 1952 to 1956. 1954 was used as the conversion date.

Samples L-299B, L-299C, and L-299D were run between October, 1955 and September, 1957. Conversion date for these three is calculated at 1956.

The average dates given (in parentheses) for University of Michigan dates did not appear in source (3), but were calculated arthmetically from the dates given. The margin of error of the average date was calculated by the formula:

$$\text{Av. error} = \frac{\sqrt{(E_1)^2 + (E_2)^2 \ldots + (E_n)^2}}{n}$$

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Radiocarbon Dates from Nevada of Archaeological Interest

Gordon L. Grosscup

Since the publication of the first Nevada C14 dates in 1951, a total of twenty-two archaeological and thirty geological samples have been tested and the results published in over a dozen different issues of "Science" or other journals. These dates are here gathered together and briefly analyzed in the belief that they will be more available and useful in this form.

While Danger Cave is indicated on the accompanying map because of its obvious pertinence to Nevada archaeology, the numerous radiocarbon dates from that site are not discussed herein. Instead, the reader is referred to Jennings' (1957) extensive analysis published in his report on the cave.

The accompanying table lists only the archaeological dates. ("BP" in the headings of the table means "Before Present," or years ago. Since the year in which the sample's age was determined marks the P date, we have adopted the system of using the last two digits of the P date to indicate more exactly the computed age. Thus, B50 means "before 1950." This innovation is made for the sake of clarity, not accuracy.)

Inasmuch as the actual dates of the test runs are not always published, the P date used herein is often a compromise between the date of submission of the sample and its date of publication, or, where it is stated that the published list was accumulated over a period of several years, a more or less arbitrary date within that span was selected.

Leonard Rockshelter (26-Pe-14)

All samples from Leonard Rockshelter were collected under the direction of R. F. Heizer and dated by the Chicago Laboratory (Arnold and Libby, 1951; Libby, 1951; Heizer, 1951b).

Sample C-599, with a date of 9248 B.C. + 570 years, consisted of guano from immediately next to the Pleistocene gravels in Leonard Rockshelter. The sample dates the first occupancy of the shelter by bats and gives a minimum age for the recession of Lake Lahontan below 4175 feet elevation. Several obsidian chips were recovered which probably date from this time period, and presumably indicate man's presence in the area. The sample was collected in 1950.

Sample C-281, which is dated at 6710 B.C. ± 300 years, consisted of guano from near the artifacts dated by sample C-298.

Sample C-298, which is dated at 5088 B.C. ± 350 years, consisted of atlatl foreshafts from the matrix of guano dated by sample C-281. The sample dates the "Humboldt Culture." The samples, which were collected in 1937, indicate the importance of dating cultural material whenever possible rather than associated non-cultural material.

Sample C-554 consists of carbonized twined basketry associated with an infant burial. Three runs were made on this sample. The first run, which yielded an age of 2736 ± 300 years, was in error. Two subsequent runs gave an average date of 3787 B.C. ± 250 years. The sample dates the infant burial (attributed to the "Leonard Culture") found in wind blown silts which Antevs interprets as deriving from the time of the middle-postglacial "Long Drought." The sample was collected in 1950.

For a description of the site and for interpretations of the dates see Cressman, 1951; Heizer, 1951b; Heizer and Krieger, 1956; and John, 1951.

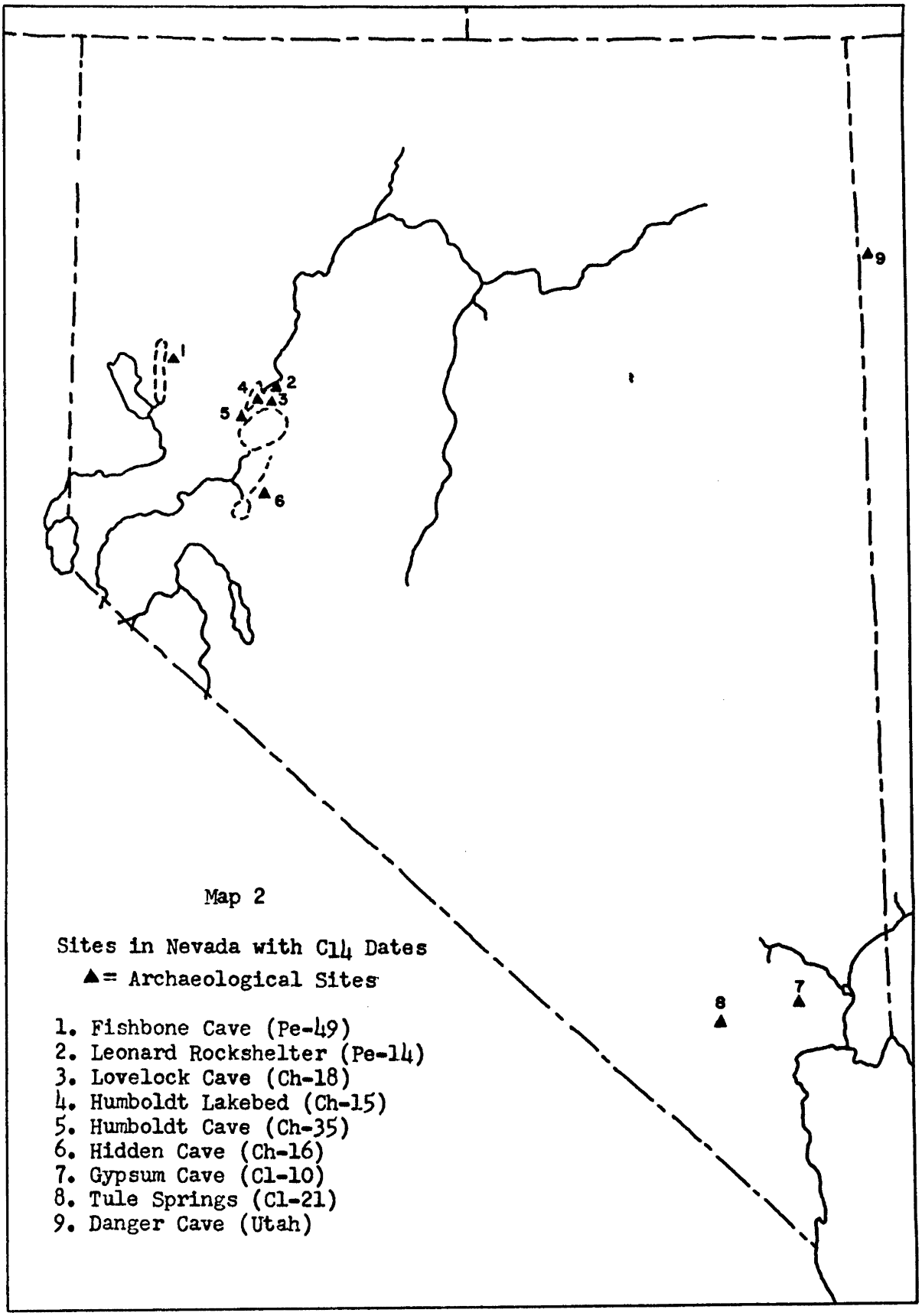
Lovelock Cave (26-Ch-18)

Sample C-276, dating at 531 B.C. ± 260, consisted of basketry fragments. It was recovered from under a large rock toward the front of the cave, and was believed at the time to represent the earliest occupation of the cave. Other dated samples indicate that older deposits occur in the rear of the cave.

Sample C-735, from Harrington's original stratipit, Level V (counting from the top down), yielded a date of 1218 B.C. ± 260, and combined samples C-728, C-729, and C-730, from Level II, yielded a date of 268 A.D. ± 220. A minimal time range for the cave's occupation of 1218 B.C. to 268 A.D. is suggested.

The remaining two samples consisted of bat guano underlying the cultural deposits. Sample C-277 (burned bat guano) yielded a date of 2498 B.C. ± 250; sample C-278 (unburned bat guano) yielded a date of 4054 B.C. ± 250. Both dates suggest a long interval of time when the cave was unoccupied by man and when Lake Lahontan had receded below the level of the mouth of the cave (roughly 4240 feet). The dates also suggest at least a small bat population during the "Long Drought."

Samples C-276, C-277, and C-278 were collected by R. F. Heizer in 1949. Samples C-728, C-729, C-730, and C-735 were collected by M. R. Harrington in 1924 and dated under the instigation of L. S. Cressman. All samples were dated at the Chicago Laboratory (Arnold and Libby, 1951; Libby, 1951, 1954).



Map 2

Sites in Nevada with C^{14} Dates

▲= Archaeological Sites

1. Fishbone Cave (Pe-49)
2. Leonard Rockshelter (Pe-14)
3. Lovelock Cave (Ch-18)
4. Humboldt Lakebed (Ch-15)
5. Humboldt Cave (Ch-35)
6. Hidden Cave (Ch-16)
7. Gypsum Cave (Cl-10)
8. Tule Springs (Cl-21)
9. Danger Cave (Utah)

For a description of the site and for interpretations of the dates see Loud and Harrington, 1929; Cressman, 1951, 1956; Heizer, 1956; Heizer and Krieger, 1956; and Johnson, 1951.

Humboldt Cave (26-Ch-35)

The sample was collected by R. F. Heizer and A. Krieger in 1936 and dated by the Chicago Laboratory (Libby, 1951). Sample C-587, which yielded a date of 2 B.C. ± 175 years, consisted of basketry from a pit considered to be the oldest in the cave. The occupation of the cave is believed, on typological grounds, to represent Lovelock Culture remains of the Transitional and Late periods.

For a description of the site and an interpretation of the date see Heizer and Krieger, 1956.

Humboldt Lakebed (26-Ch-15)

The sample was collected by R. F. Heizer, A. B. Elsasser, and M. A. Baumhoff in 1956, and dated by the University of Michigan Laboratory (personal communication, J. Griffin to R. F. Heizer). Sample M-649, which yielded a date of 733 B.C. ± 250, consists of carbonized twined (?) basketry and other vegetal material from under a partially cremated skeleton lying in a pit dug into the lake bottom silts. Artifacts from the surface of the site and from other similar pits are typologically similar to those of the Lovelock Culture, as well as to possibly more recent material. The date is entirely consistent with those from Lovelock, Humboldt, and Hidden Caves, all of which are components of the Lovelock Culture.

Since the site must have been above the level of the lake when it was occupied, the lake level about 733 B.C. must have approximated that of the historic lake (the site was covered, at least seasonally, as late as about 1915). The site may have been occupied in the dry season only and there is no necessary reason for assuming an extensive drought at that time, particularly not the "Long Drought"; however, it also seems unreasonable to assume a wet season lake much higher than the historic one.

For a description of the site and the artifacts recovered there see Harrington, 1927; Heizer and Grosscup, ms.; and Loud and Harrington, 1929.

Hidden Cave (26-Ch-16)

There are two dated samples from Hidden Cave which were collected by Phil C. Orr in 1955, and dated by the Lamont Laboratory (Broecker and Kulp, 1957). Sample L-289AA is from a tufa diaphragm and is included in the discussion of tufa dates in a later section of this paper. Sample L-289BB, which dated at 1094 B.C. ± 200 years, consisted of partially decomposed

organic matter from the "32 inch midden" layer in the cave. Artifacts from this layer equate typologically with Lovelock Cave material, and the date is entirely consistent with the dates from Lovelock Cave and other Lovelock Culture sites. For a brief summary of the materials from this site and its stratigraphy see Grosscup, 1956.

Fishbone Cave (26-Pe-49)

The samples from Fishbone Cave were collected by Phil C. Orr and dated by the Lamont Laboratory (Broecker, Kulp and Tucek, 1956; Orr, 1956; Broecker and Kulp, 1957). The date published for L-245 by Broecker, Kulp and Tucek (1956) is 9245 B.C. + 250 years. The date for the same sample (L-245) published by Orr is 8945 B.C. + 300 years. Another date, without sample number, published by Orr, is 9600 B.C. + 500 years. Presumably all three dates are runs on the same sample, which consists of juniper bark from the lowest occupation level in the cave, or perhaps one may be an average of several runs. The sample dates the beginning of occupation of the cave by man or other animals and gives a minimum date for the fall of Lake Lahontan below the level of the cave (ca. 4050 feet).

Sample L-289KK consisted of netting fragments "from the topmost portion of the lowest habitation level in Fishbone Cave." The date yielded is 5874 B.C. + 350 years. This date suggests a rough contemporaneity with the Humboldt Culture in Leonard Rockshelter. Netting, made with sheetbend knots, is one of the limited number of known items of the Humboldt Culture.

Presumably this sample is the netting described as made with square knots reported by Orr (1956, pp. 7-9) as occurring in level 4 in association with a human burial, a pelican skin, three pieces of "wickerware," three fragments of Catlow Twined basketry, and several pieces of cordage. The burial was apparently wrapped with netting (a common Lovelock trait). Lovelock Culture nets are made with sheetbend knots. Wicker basketry is one of the primary criteria of the Lovelock Culture. The Fishbone Cave specimens are not illustrated, so their identification cannot be checked. Orr describes "three short pieces of wickerware . . . recovered with the burial; these are counter-clockwise twist and appear to be willow bark." Since the weft ribbons in Lovelock wicker are laid flat and are never twisted, it is clear that Orr is not describing true wicker basketry but is probably referring to stiff-twined basketry. If the Catlow Twined basketry from Fishbone Cave is dated by sample 289KK, this would make the occurrence the earliest yet known. Catlow Twined is late in the Oregon Caves, at Lovelock, Humboldt, and Danger Caves, and in the Sacramento Valley (Baumhoff, 1957). Under the circumstances of the obviously inadequate description of Fishbone Cave artifacts and the idealized stratigraphy presented, any decision as to the significance of the radiocarbon dates from the site should be withheld.

In the same level in Fishbone Cave, but not necessarily associated with the burial, were a piece of matting, a bone awl said to be made of

the metapodial bone of an extinct species of Equus, a scraper, and a scraper plane. For further information on this site see Orr, 1952, 1956.

Guano Cave (26-Pe-42)

Guano Cave is situated near Fishbone Cave on the northeastern shore of Winnemucca Lake. Its elevation is about 4050 feet. Orr reports (1952, p. 8) that the inner portion of the cave has been mined for guano and that " . . . some arrows with feathers attached are said to have been found, while the outer portion [of the cave] has been badly destroyed by excavation for 'relics.'" The relic collector's collection, seen in 1952, contained Lovelock Culture material as well as several glass trade beads and a gorge fishhook made of iron. The dated sample (L-356) is described as twigs coming from a habitation level 22 to 28 inches deep, but is not specified as to inner or outer portion of the cave. The date, 1244 B.C. ± 130 years, equates with Early Lovelock dates from Lovelock and Hidden Caves. A description of the artifacts and stratigraphy will make the date much more meaningful.

Crypt Cave (26-Pe-46)

Crypt Cave is in the same area as Guano Cave, but is higher up the slope (elevation ca. 4170 feet). Four cultural layers are reported by Orr (1952, pp. 14-20). The dated sample (L-289II consisted of basketry from the upper portion of the deposits and dated at 444 B.C. ± 200 years. This date would suggest contemporaneity with Transitional Lovelock. The material associated with the dated sample has not been described, but presumably is of the Lovelock type.

Cow Bone Cave (26-Pe-60)

Cow Bone Cave is mentioned briefly by Orr (1956, pp. 9-11). It occurs in the Dendritic terrace slightly below the level of Guano Cave at an elevation of 4020 feet. Its cultural content is not described. The sample (L-289FF) consisted of matting associated with a human burial and dated at 4014 ± 150 years. This date would place the occupation as occurring during the Altithermal, roughly at the same time as the Leonard Culture at Leonard Rockshelter.

Stuart Rockshelter

The site is located in Clark County several miles northwest of Moapa (northeast of Gypsum Cave.) A four-fold cultural stratigraphy was revealed which included Southern Paiute, Pueblo, Basketmaker III, and an earlier period presumably to be equated with "Pinto." Two samples from the "Pinto" level were dated by the Arizona Laboratory in 1955. The site was test excavated and the samples collected by Dick Shutler, Jr.

Sample No. 1 is carbon from a fire hearth (Feature No. 2) found at a depth of 78 inches. It yielded a date of 4050 ± 300 years (2095 B.C. ± 300 years). Sample No. 2 is carbon from a fire hearth (Feature No. 1) found at a depth of 54 inches. It yielded a date of 3870 ± 250 years (1915 B.C. ± 250 years).

These dates cannot be properly evaluated until the cultural materials with which they are associated are described. They are internally consistent, however, and fall within the expectable time range of the "Pinto Culture." The dates are published by Harrington (1957, p. 72).

Gypsum Cave (26-Cl-10)

Gypsum Cave was excavated by M. R. Harrington in 1930 and 1931, for the Southwest Museum and other institutions, and was reported upon in 1933. Artifacts from the cave were classified as Paiute, Puebloan, Basket Maker, and "Sloth Period," the latter term being replaced by the term "Gypsum" in later literature. Physical stratigraphy was confused, but Harrington concluded there was contemporaneity indicated by the association of composite darts, torches, oval scraper knives, two-ply right twist cordage, and a type of lozenge-shaped stone dart point ("Gypsum Cave" type) with sloth remains or between layers of sloth dung. In parts of the cave, sloth debris was exposed on the surface. The cave deposits were steeply sloping and contained numerous large rocks which had fallen from the roof.

Both C14 dates were run on samples of sloth dung. Sample C-221, dating at 8505 B.C. ± 340 years, is from Room 1, 6 feet, 4 inches deep, and sample C-222, dating at 6577 B.C. ± 250 years, is from a small room southwest of Room 1, 2 feet, 6 inches deep. The samples were collected by M. R. Harrington in 1931, and were dated by the Chicago Laboratory (Arnold and Libby, 1951). While these samples presumably date the presence of sloth in the cave, they only date the Gypsum artifacts if the association of the latter with the dung is valid. It would be valuable to know the radiocarbon date of the wooden artifacts from the sloth layer of the cave.

The sloth dung also yields evidence of a milder climate in the form of vegetal remains. The two samples suggest, therefore, that between 8505 and 6577 B.C. the climate was milder in southern Nevada than it is at the present time.

For further information on this site see Cressman, 1951; Harrington, 1933; Laudermilk and Munz, 1935.

Tule Springs (26-Cl-21)

Tule Springs was first noted as a paleontological site. During excavations for extinct mammalian remains, a deposit of charcoal, burned and splintered bones and an obsidian flake, was discovered. Since the

first discovery, archaeological investigation has revealed more of the same sort of material, except flakes. A possible scraper has apparently been recovered, however.

The sample (C-914) was collected by M. R. Harrington in 1934, and was dated by the Chicago Laboratory (Libby, 1954). It yielded a date of greater than 23,800 years before the present. New samples need to be tested with the more accurate methods now available and a geological study of the area should be made. The date given indicates an occupation before the Mankato period of the Wisconsin glaciation and is one of the oldest dates for human occupation in the New World. Until more cultural material or less questionable material is recovered, the find must remain an enigma.

For further data on this site see Simpson, 1933; and the many references cited in Grosscup, 1957, p. 25.

Lahontan Basin Tufa

Phil C. Orr and W. S. Broecker collected a series of tufa samples from the Lahontan Basin, and these have been tested by the Lamont Laboratory (Broecker and Kulp, 1957). The dates thus obtained cannot be properly evaluated until Broecker and Orr's article on the dateability of tufa is published, but several observations can be made and problems suggested from the data now at hand.

There are three major forms of tufa in the Lahonton Basin. These are called Lithoid, Thinolite, and Dendritic tufa. Russell (1885) equated Lithoid tufa with the highest and earliest Lahontan lake. Dendritic tufa is equated with the second lake stage and Thinolite tufa is equated with the lower lake stage between the two high rises. Russell found the three forms of tufa in stratigraphic position in the order suggested above. Recent geological investigators have found more than two fluctuations in Lahontan lake levels but have not changed the relative chronological position of the three tufa forms.

Tufa is still forming at the present time, but it is apparently not known if it takes the form of any or all of the three types mentioned above. Tufa forms under water, presumably near the surface, but the depth at which it may still form is not known. It is assumed that tufa may be formed through the agency of algae, but may also be precipitated directly from the water (Howe, 1932, pp. 57-64). Diaphragms of tufa-like lime were deposited in caves which would have been relatively dark, i.e., the lack of light may preclude the agency of algae in the formation of the diaphragms. Morrison (personal communication) believes the diaphragm in Hidden Cave is coetaneous with the deposit of Dendritic tufa outside of the cave. A later review of the radioactive carbon content of materials from hard-water lakes by Deevey et al. (1954) concludes with the statement, "It seems probable that in alkaline lakes in closed basins in semiarid regions not underlain by limestones, all the carbon in the carbonate and bicarbonate in the water is

of atmospheric origin. Samples from such lakes are likely to be free from the [contamination] error here discussed."

A fragment of Lithoid tufa was found between two layers of Lahontan clays in Hidden Cave which were overlain by the tufa diaphragm.

If tufa formed continuously as the lake in which it was forming dried up, the tufa at lower elevations should be younger than that at higher elevations.

Turning to the dated samples, it is noted that the ten Lithoid tufa dates range from 9,500 to 11,800 years ago, and average about 10,800 years ago. The dated samples suggest that Lithoid tufa is younger than the other two varieties, rather than older, as Russell believed. Clearly all evidence suggests that the date for Lithoid tufa is too young. Half of the Lithoid tufa dates, as well as the average date, are in direct conflict with dates from Leonard Rockshelter and Fishbone Cave on dry, organic materials which cannot have been covered with water since deposition. All but one of the dated Lithoid samples came from an elevation higher than the two archaeological sites.

In Hidden Cave, as pointed out above, Lithoid tufa is stratigraphically older than the tufa diaphragm which has been dated at 15,670 years old. Either one or both dates must be wrong.

Lithoid samples were collected from elevations varying from 4380 to 4050 feet. Two samples from the highest elevation yielded dates of 9,500 and 11,800 years ago, and the one date from the lowest elevation yielded a date 11,700 years ago, thus revealing no appreciably younger date for the lower sample.

Dates on Dendritic tufa, and shell and marl associated with such tufas, present a range of dates from 8,500 to 19,750 years ago (average 15,100 years ago). In general the higher deposits are older than the lower ones. No conflict with known data is apparent, except for the Lithoid tufa dates as mentioned above. Similarly the date for the Thinolite tufa (28,900 years ago) shows no conflict with other evidence and is older than Dendritic tufa, as was expected from Russell's evidence.

In summary, not all of the tufa dates can be correct; some may be correct. Further evidence is needed. Lithoid and Dendritic samples should be tested from the Humboldt, Carson, and Walker Lake basins. They should date the same, provided elevation and mineralogical controls are accurate, as those already tested from the Pyramid and Winnemucca Lake basins. Similarly, Thinolite from the Humboldt and Carson Lake basins should be tested. Russell did not report Thinolite from the Walker Lake basin.

Russell reports all three tufas in stratigraphic superposition, especially in the tufa towers or domes. A series of samples from such

a dome should help clarify the dating of Lithoid tufa. Orr and Broecker did collect and test an inner and an outer sample from one dome, but apparently both samples are Dendritic tufa (outer date, 8,500 years ago, inner date, 14,500 years ago).

Fresh water snail shells occur in some deposits of Dendritic tufa (at Leonard Rockshelter, for instance). If these shells could be isolated and tested, it would produce an additional check on the Dendritic tufa dates.

Orr and Broecker have apparently tested modern tufa, but the resultant dates have not been published. They should prove critical in evaluating the older tufa dates.

Sources Referred to in Table 1

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2. Broecker, Kulp and Tucek, 1956.
3. Libby, 1951.
4. Libby, 1954.
5. Orr, 1956.
6. Broecker and Kulp, 1957.
7. Heizer, 1951a, b.
8. Libby, 1952, p. 86.
9. Personal communication, J. Griffin to R. F. Heizer.
10. Harrington, 1957, p. 72.

Table 1. Nevada Radiocarbon Dates

	BP Date*	1σ Range BP	BC-AD Date	1σ Range BC-AD	Source
Chicago Dates:					
C-221 (26-Cl-10) Gypsum Cave (dung)	10,902 B 50 ± 440	11,342-10,462 B 50	8,952 BC ± 440	9,392 BC-8,512 BC	(1)
	10,075 B 50 ± 550	10,625- 9,525 B 50	8,125 BC ± 550	8,675 BC-7,575 BC	
	Ave. 10,455 B 50 ± 340	10,795-10,115 B 50	8,505 BC ± 340	8,845 BC-8,165 BC	
C-222 (26-Cl-10) Gypsum Cave (dung)	8,692 B 50 ± 500	9,192- 8,192 B 50	6,742 BC ± 500	7,242 BC-6,242 BC	(1)
	8,051 B 50 ± 450	8,501- 7,601 B 50	6,101 BC ± 450	6,551 BC-5,651 BC	
	8,838 B 50 ± 430	9,268- 8,408 B 50	6,888 BC ± 430	7,318 BC-6,458 BC	
	Ave. 8,527 B 50 ± 250	8,777- 8,277 B 50	6,577 BC ± 250	6,827 BC-6,327 BC	
C-276 (26-Ch-18) Lovelock Cave (vegetal material)	2,452 B 51 ± 280	2,732- 2,172 B 51	501 BC ± 280	781 BC- 221 BC	(3)
	2,517 B 51 ± 320	2,837- 2,197 B 51	566 BC ± 320	886 BC- 246 BC	
	Ave. 2,482 B 51 ± 260	2,742- 2,222 B 51	531 BC ± 260	791 BC- 271 BC	
C-277 (26-Ch-18) Lovelock Cave (burned guano)	4,448 B 50 ± 250	4,698- 4,198 B 50	2,498 BC ± 250	2,748 BC-2,248 BC	(1)
C-278 (26-Ch-18) Lovelock Cave (unburned guano)	6,046 B 50 ± 300	6,346- 5,746 B 50	4,096 BC ± 300	4,396 BC-3,796 BC	(1)
	5,961 B 50 ± 400	6,361- 5,561 B 50	4,011 BC ± 400	4,411 BC-3,611 BC	
	Ave. 6,004 B 50 ± 250	6,254- 5,754 B 50	4,054 BC ± 250	4,304 BC-3,804 BC	
C-281 (26-Pe-14) Leonard Rockshelter (unburned guano)	8,443 B 50 ± 510	8,953- 7,933 B 50	6,493 BC ± 510	7,003 BC-5,983 BC	(1)
	8,820 B 50 ± 400	9,220- 8,420 B 50	6,870 BC ± 400	7,270 BC-6,470 BC	
	Ave. 8,660 B 50 ± 300	8,960- 8,360 B 50	6,710 BC ± 300	7,010 BC-6,410 BC	
C-298 (26-Pe-14) Leonard Rockshelter (atlatl foreshaft)	7,038 B 50 ± 350	7,388- 6,688 B 50	5,088 BC ± 350	5,438 BC-4,738 BC	(1)
C-554 (26-Pe-14) Leonard Rockshelter (carbonized basketry)	2,736 B 50 ± 500	3,236- 2,236 B 50	786 BC ± 500	1,286 BC- 286 BC	(1)
	5,779 B 50 ± 400	6,179- 5,379 B 50	3,829 BC ± 400	4,229 BC-3,429 BC	(8)
	5,694 B 50 ± 325	6,019- 5,369 B 50	3,744 BC ± 325	4,069 BC-3,419 BC	(8)
	Ave. 5,737 B 50 ± 250	5,987- 5,487 B 50	3,787 BC ± 250	4,037 BC-3,537 BC	(8)

*See note on Table 1 of preceding paper (California Radiocarbon Dates).

Nevada Radiocarbon Dates (continued)

	BP Date	1σ Range BP	BC-AD Date	1σ Range BC-AD	Source
C-587 (26-Ch-35) Humboldt Cave (basketry)	1,953 B 51 ± 175	2,128- 1,778 B 51	2 BC ± 175	177 BC- 173 AD	(3)
C-599 (26-Pe-14) Leonard Rock-shelter (guano)	11,199 B 51 ± 570	11,769-10,629 B 51	9,248 BC ± 570	9,819 BC- 8,678 BC	(3)
C-728, C-729, C-730 (combined) (26-Ch-18) Lovelock Cave (basketry)	1,686 B 54 ± 220	1,906- 1,466 B 54	268 AD ± 220	48 AD- 488 AD	(4)
C-735 (26-Ch-18) Lovelock Cave (basketry)	3,172 B 54 ± 260	3,432- 2,912 B 54	1,218 BC ± 260	1,478 BC- 958 BC	(4)
C-914 (26-Cl-21) Tule Springs (charcoal)	Older than 23,800 B 54				(4)
Lamont Dates:					
L-245 (26-Pe-49) Fishbone Cave (juniper fibers)	11,200 B 55 ± 250	11,450-10,950 B 55	9,245 BC ± 250	9,495 BC- 8,995 BC	(2)
L-245 (26-Pe-49) Fishbone Cave (vegetal material)	10,900 B 55 ± 300	11,200-10,600 B 55	8,945 BC ± 300	9,245 BC- 8,645 BC	(5)
L-? (26-Pe-49) Fishbone Cave (vegetal material)	11,555 B 55 ± 500	12,055-11,055 B 55	9,600 BC ± 500	10,100 BC- 9,100 BC	(5)
L-289BB (26-Ch-16) Hidden Cave (organic layer)	3,050 B 56 ± 200	3,250- 2,850 B 56	1,094 BC ± 200	1,294 BC- 894 BC	(6)
L-289FF (26-Pe-60) Cow Bone Cave (matting)	5,970 B 56 ± 150	6,120- 5,820 B 56	4,014 BC ± 150	4,164 BC- 3,864 BC	(6)
L-289II (26-Pe-46) Crypt Cave (basketry)	2,400 B 56 ± 200	2,600- 2,200 B 56	444 BC ± 200	644 BC- 244 BC	(6)
L-289KK (26-Pe-49) Fishbone Cave (netting)	7,830 B 56 ± 350	8,180- 7,480 B 56	5,874 BC ± 350	6,224 BC- 5,524 BC	(6)
L-356? (26-Pe-42) Guano Cave (twigs)	3,200 B 56 ± 130	3,330- 3,070 B 56	1,244 BC ± 130	1,374 BC- 1,114 BC	(6)

Nevada Radiocarbon Dates (continued)

	BP Date	1σ Range BP	BC-AD Date	1σ Range BC-AD	Source
Michigan Dates:					
M-649 (26-Ch-15) Humboldt Lake Bed (vegetal material)	2,690 B 57 ± 250	2,940- 2,440 B 57	733 BC ± 250	983 BC- 483 BC	(9)
Miscellaneous:					
No number (Sample 1) Stuart Rockshelter (carbon)	4,050 B 55 ± 300	4,350- 3,750 B 55	2,095 BC ± 300	2,395 BC- 1,795 BC	(10)
No number (Sample 2) Stuart Rockshelter (carbon)	3,870 B 55 ± 250	4,120- 3,620 B 55	1,915 BC ± 250	2,165 BC- 1,665 BC	(10)

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