I.

ARCHAEOLOGICAL INVESTIGATIONS IN LOVELOCK CAVE, NEVADA

Robert F. Heizer and Lewis K. Napton

It is a remarkable circumstance that one of the most widely cited and important archaeological sites in western North America--Lovelock Cave, in west-central Nevada--had until 1969 been visited by only two archaeological expeditions, consisting of a party of one in 1912 and a party of five in 1924. In the intervening decades the cave's contents and history, as interpreted by the 1912 and 1924 excavators, has been the subject of countless references and inferences. As other archaeological sites in the western Great Basin have been excavated, we have witnessed the gradual disclosure of an entire culture that has taken its name from this site, which contained one of the most detailed and best preserved records of prehistoric life ever found in western America.

The principal purpose of this report is to assemble and integrate the salient facts of the archaeology of Lovelock Cave in the light of excavations recently conducted there by the authors. It is our hope that this report will at least partially satisfy the need for a synthesis of the early work in the cave and the recent excavations that have been made there in connection with the Lovelock Cave Coprolite Research and Analysis Project, which has been carried on by us since 1965.

Lovelock Cave was the first major Great Basin archaeological site to be excavated. Unfortunately, from the point of view of procedure, the initial explorations in the cave were the antithesis of even the relatively unsophisticated archaeological methods practiced at the beginning of the present century. The first digging in the cave was the wholesale removal, by pick and shovel, of some 250 tons of bat guano, which was dug from the upper cave deposits, screened on the hillside outside the cave, and shipped to a fertilizer company in San Francisco. The extent of the damage to the archaeological strata and artifacts will never be known, but some idea of its magnitude may be gained from the fact that after cessation of guano mining operations, L. L. Loud (1929:29) salvaged from the guano dump in front of the cave "several thousand specimens," consisting mainly of human skeletal material and artifacts made of vegetal material. In 1965 and 1969 we screened portions of the same dump and recovered flaked implements of stone as well as objects of ground stone, bone and shell, numbering in all about 200 specimens.

It is probably fair to say that the guano mining activities in 1911 nearly destroyed Lovelock Cave as an archaeological site. Subsequent excavations, including those conducted by Loud in 1912, Loud and Harrington in 1924, and by us, have been essentially salvage operations--efforts to reconstruct, insofar as possible, the remarkably detailed record of prehistoric

occupation that was preserved in the cave. The excavations made by us during 1968 and 1969, nearly six decades after the first exploration of the site, may prove to be one of the last attempts that can be made to investigate some of the unanswered problems that have obscured many important aspects of Lovelock prehistory. Lovelock Cave is situated on lands administered by the Bureau of Land Management and our work at the site is authorized by a Federal permit. To our knowledge the site is wholly without protection from vandalism, and relic collectors have carried out their burrowings (often with great success) with impunity, another example of the fact that failure to protect archaeological sites on Federal lands is the rule and not the exception.

The Site

Lovelock Cave (latitude 39°57'42" N, longitude 118°33'25" W), located in Churchill County, Nevada, occurs in the hinge fold of a massive limestone unit of middle Jurassic age, identified as unit Jal (R.C. Speed, personal communication, 1970), which is discontinuously exposed along the slopes of the West Humboldt Range, located in west-central Nevada.[1]

The outcrop containing the cave is an intricately foliated limestone unit locally containing quartzite, gypsum, and dolomite breccia. The limestone unit dips at an angle of 65 degrees to the northeast, and has been subject to extensive tectonic stress, which contributed to development of the cave in the north-trending hinge fold. The cave was further modified by wave-action of Pleistocene Lake Lahontan, as well as by recent seismic activity, the effects of which may be seen in several locations along the flanks of the Humboldt Range and nearby Stillwater Mountains. The limestone unit containing the cave rises some 150 feet above the dissected mountain slopes and alluvial fans that lie on either side of the outcrop. The cave entrance (elevation 4240 feet) faces north and commands a panorama of the desolate Humboldt Sink, the "lower valley area," and the distant Trinity and Eugene Mountains rising to the north on the far side of the valley. Behind the cave formation, to the south, is the low summit ridge of the West Humboldt Range (average elevation 4700 feet), beyond which lies the extensive, nearly barren desert of the Carson Sink, bordered on the south by the Stillwater Range (fig. 1). Eight miles northeast of Lovelock Cave is the massive igneous dike forming Leonard Rockshelter (NV-Pe-14) (Heizer 1951:89-98), while some ten miles to the southeast, on the same flank of the Humboldt Range as Lovelock Cave and at about the same elevation, are Humboldt Cave (NV-Ch-35) (Heizer and Krieger 1956) and Ocala Cave (NV-Ch-24) (Loud 1929:150-151). (See fig. 2).

At one or more times in the geologic past Lovelock Cave was inundated by the waters of Pleistocene Lake Lahontan, and the wave-action of the receding lake was one of the principal factors contributing to the development of the cave. It is probable, however, that the cave is not entirely wave-cut, but was developed by fracturing and shearing of the folded limestone unit (fig. 3).

An extensive deposit of tufa accumulated on the rock surfaces outside the cave (pls. 3, 5) and on the walls inside the cave (pls. 9, 10), unmistakable evidence of the fact that the cave portal was open during the periods when the outcrop was inundated by Lake Lahontan.[2] Wave cuts and depositional features created by the receding stages of Lake Lahontan may be seen at locations that are at least 100 feet higher than the cave entrance. In this vicinity the highest shoreline of Lake Lahontan was 4380 feet above sea level (Tatlock, personal communication, 1969); hence, at lake maximum, the cave may have been covered by as much as 140 feet of water. Following the final withdrawal of Lake Lahontan, as Harrington (1929:1) has pointed out, the cave was probably a long, shed-like rockshelter which was easy of access along almost its entire length, forming, one would suppose, an inviting abode for man (fig. 5, event I).

Harrington (1929:120) believed that the earliest human occupation of Lovelock Cave occurred circa 1000 B.C. This estimate, made on the basis of his excavations in the cave in 1924, seemed to be verified in 1956 by a radiocarbon date obtained from fragments of basketry found in level 5 of lot 15, a test unit that had been dug by Harrington in the west end of the cave. The radiocarbon age of the basketry is 1218 B.C.±260 (C-735, Libby, 1954:733-742), and this date has long been accepted as marking the approximate beginning of human occupation of the cave. However, the date is much later than the probable date of the earliest known human occupation of nearby Leonard Rockshelter (9249 B.C.±570; Heizer, 1951:89-98), and is considerably short of the date of 5088 B.C.±350 (C-298, Arnold and Libby, 1950:111-120), which was obtained by radiocarbon analysis of three atlatl dart shafts found in the middle levels of the same site. It is difficult to understand why Leonard Rockshelter (4175 feet) was apparently occupied as early as 9249 B.C., while Lovelock Cave, located eight miles west, at an elevation of 4240 feet, seems not to have been occupied prior to circa 3000 B.C. Some of the ramifications of this problem will be discussed in the following synopsis of the excavations made in the cave between 1911 and 1967.

SUMMARY OF PREVIOUS INVESTIGATIONS ON LOVELOCK CAVE

1911-1912; Hart and Pugh, Guano Mining

James Hart and David Pugh of Lovelock, Nevada, filed a mineral location on Lovelock Cave (then known as "Horseshoe Cave" or "Sunset Guano Cave") and mined the guano deposits from the fall of 1911 to the spring of 1912 (Loud and Harrington 1929:168). In order to facilitate removal of the guano, the miners used explosives to open a tunnel through the rubble left by a large rockfall at the northeast end of the cave (fig. 7, event VI) and laid a track for mine cars which were used to haul the guano to a tipple built on the hillside in front of the cave (see Clewlow and Napton, this volume).

The guano and assorted cave debris was dumped onto a large screen, and the materials held by the 3/4-inch mesh, including sticks, rushes, stones, Indian artifacts, pieced of mummies, and bone fragments, were discarded on the hillside, forming what has been termed the "miners' dump."

Harrington (1929:2) states: "It was during removal of this guano that the first Indian objects were found in the cave..."; whereas, according to Hart (Loud and Harrington 1921:168): "All the Indian objects began to appear about four feet below the surface of the guano." The guano layer apparently thinned out near the original cave entrance, a narrow, slanted crevice at the southwest end of the cave (fig. 6, event IV; see pl. 5).

Hart and Pugh may have dug in some places to a depth of as much as 20 feet. Baskets, nets, sandals, 13 mummies (Loud 1929:31), and numerous other specimens were found. Hart and Pugh, probably acting on the suggestion of John T. Reid of Lovelock, reported their finds to the Nevada Historical Society, to C. Hart Merriam of the Smithsonian Institute, and to J. C. Merriam of the University of California, Berkeley, who made arrangements with A. L. Kroeber of the University of California for L. L. Loud of the Museum of Anthropology to conduct excavations in the cave.

Comments: Hart (Loud and Harrington 1929:168) stated that Indian artifacts "began to appear about four feet below the surface of the guano." This remark induced later observers to conclude that the entire site had been abandoned during the lengthy period of time required for deposition of such a thick layer of guano. Grosscup (1960:5,6,12,60,65,66) speculated that the cave was not used during this guano-deposition period, and that the site had in fact been abandoned by the Lovelock population circa A.D. 900. However, as he points out (ibid:6):

> The accounts relate that artifacts were not encountered in the top 4 feet of deposits, but the guano miners did expose numerous artifacts.

Nevertheless, he does not deny (ibid:60) that "decisive evidence for a break or a continuum is still lacking." Recent excavations in the cave have provided new evidence, which, in our opinion, helps to clarify the problem of the proto-historic occupation of the cave.

1912; L. L. Loud, Salvage Excavations and Collection of Specimens

L. L. Loud, employed by the Museum of Anthropology, University of California, was sent by A. L. Kroeber to Lovelock in the spring of 1912 in order to salvage whatever materials might be secured following cessation of commercial exploitation of the guano deposit (see Kroeber 1947:180). Unassisted, Loud conducted excavations in the cave from April to August, 1912, and collected

approximately 10,000 archaeological specimens, most of which came from three locations: the refuse dump left outside the cave by the guano miners; the remnants of the lower level deposits in the northeast end of the cave; and the scattered pockets of undisturbed refuse remaining *in situ* along the peripheral edges of the cave.

Comments: It is impossible to provide detailed information concerning Loud's excavations, since he devotes less than a paragraph to this topic in his published report (Loud 1929:29). Loud did not establish a grid system of the type presently used in recording the depth and provenience of the specimens. Instead, he designated each of his digging locations as "lots," of which there were 41. It has been stated (Loud and Harrington 1929:vii) "that one of the joint claimants of the cave prohibited work in his end of the cave;" however, the map prepared by Loud and Harrington (1929, pl. 2) shows that Loud dug in a number of locations in both ends of the cave. Lots 1,2,4,5,7,15,20,21, and 24 are not marked on the map referred to, nor do these locations appear on Loud's field map, copies of which are in the files of the Lowie Museum, and none of the artifacts described in the report of his excavations are attributed to these lots. However, a partial list of the contents of these lots is given on the original museum accession sheet prepared by Loud.

It is a matter of historical interest that Loud's report of his work at the cave was not published until 1929, 17 years after his first visit to the cave. His description of the artifacts found in the cave is quite detailed (Loud 1929:31-109), but in only a few instances were the specimens located by "lot"--information that would have provided at least the approximate horizontal provenience of the specimens.

Many of the specimens illustrated in the report are located as to "lot" in the explanatory notes accompanying the plates (*ibid*:172-181). Using this information and the sketchy notes in the museum catalog cards, we have attempted to determine the quantity and type of artifacts found in each of the lots designated by Loud--bearing in mind, of course, that the vertical or stratigraphic provenience of the material is unknown. We hoped that in spite of the deficiencies in Loud's methods of recording data, it might be possible to discern a few details of the prehistoric occupational uses or "activity-facies" that might have been manifested in the cave, based on the number and distribution of various types of artifacts. Unfortunately, because some of the lots (*e.g.*, lot 9) cover as much as 20 feet horizontally, the attempt was unsuccessful.

It is evident, however, that lots 19,33,34,37, and 44 are the deepest in the cave, and, with the exception of the deep cache pits (which Loud failed to find or did not recognize) probably contained some of the oldest cultural material found in the cave. This possibility is all the more likely

in view of the fact that the upper stratigraphic layers, which may have been as much as six feet thick, were removed by the guano miners, and the deeper deposits were worked by Loud.

The material collected by Loud does not form a single collection. The bulk of it is housed in the Lowie Museum, University of California, Berkeley, and a lesser proportion is in the Nevada State Historical Society building in Reno. Detailed restudy and functional analysis of this material, in the light of the considerably expanded knowledge of the chronology and stratigraphy of the cave, would probably provide new insights into the prehistory of the cave and of the Lovelock Culture.

Loud visited another cave located on the north slope of the Humboldt Range. This is Ocala Cave (NV-Ch-24) situated about ten miles west of Lovelock Cave, at an elevation of 4370 feet. The cave yielded two tons of bat guano in 1911, and Loud (1929:150-151) found 77 artifacts. Several specimens, including part of a mummy, several baskets, and some well-preserved nets are said to have been found there recently by a Lovelock pothunter.

Loud examined the former shore of Humboldt Lake and located 17 occupation sites, from which he collected 1464 artifacts and the bones of 16 humans (see Gifford 1926:382). The material was briefly described by Loud without comment as to the possible relationship of the open-air lakeshore sites and the nearby caves.

One of the open-air occupation sites near the lake (NV-Pe-67) has been excavated and reported upon by Cowan and Clewlow (1968:195-236), and NV-Ch-15, the principal lakeshore site, is now under investigation by P.H. Hallinan.

1924; M. R. Harrington and L. L. Loud, Heye Foundation Expedition

Excavations in Lovelock Cave: In July, 1924, Harrington, Loud and several Northern Paiute Indian assistants began a season of excavation in Lovelock Cave for the Museum of the American Indian, Heye Foundation, New York. During the three-month field session, Harrington's party dug to the base of the deep deposits in the west end of the cave, and also excavated in the center and east end of the cave a few remnants of the original deposit that had been overlooked by relic collectors.

Harrington elected to follow Loud's method of collecting artifacts by "lot" rather than by use of a controlled grid system. Fortunately, Harrington paid much more attention to stratigraphy than had Loud, and recorded the vertical provenience of some (but by no means all) of the material that came to light in the course of the digging.[3] Harrington also recognized and mapped 40 cache pits (ibid:9-14; pl. 2), eight burials (ibid:14-18), and observed at least three occupational "floors" (ibid:7; fig. 2) in the southwest end of the cave. The specimens found in 1924 were briefly reported upon (ibid:110-118),

but the collection as a whole was not studied until 1959, when G. L. Grosscup visited the Heye Foundation and described most of the specimens of known stratigraphic provenience.

The major accomplishment of Harrington and Loud in 1924 was their controlled test of the deep deposits located in the west end of the cave. Part of the deposits in this location seemed to be intact, and Harrington laid out a trench six feet wide and eight feet long. This was the famous "lot 15" test pit, by means of which Harrington (1929:18-28) hoped to demonstrate some of the existing stratigraphy of the cave (fig. 23). Lot 15 was divided into six arbitrary levels representing three equally arbitrary "phases" of occupation:

Later Period: Level 1 (0"-18") (1'6" thick) consisted mostly of stones and ashes. Level 2 (18"-48") (2'6" thick) was mostly grass, stones, and rushes with few artifacts. A hard packed floor occurred 48 inches below the surface.

Transitional Period: Level 3 (48"-72") (2' thick) contained grass, rushes, and dust, but "many more artifacts" than had level 2. These specimens were described in some detail by Harrington (ibid:20-21). Level 4 (72"-96") (2' thick) was of the same general composition as level 3, but had been penetrated by two cache pits (numbers 38 and 39). Harrington (ibid:22) found numerous artifacts:

> The arrow fragments and foreshafts typical of the upper levels were not found in this one, but instead a single pointed foreshaft so large that it probably belonged to an atlatl dart rather than to an arrow, and also part of a typical atlatl dart foreshaft [Emphasis ours].

Older Period: Level 5 (96"-120") (2' thick) contained "a deposit of basketry and other articles." A sample of this material gave a radiocarbon age of 1218 B.C.±260 (C-735, Libby 1954:733-742).[4] The grassy refuse in this level gave way to guano "with a slight admixture of grass and rushes," followed by ashes resting "on the white lacustrine deposit forming the bottom of the cave." Level 6 (120"-148") (2'4" thick) was mostly guano with "some admixture of stones, grass, rushes, and on the very bottom, ashes." Harrington notes (ibid:23);

> Of weapons we found only a large, heavy, pointed foreshaft of greasewood, larger than those commonly used for arrows, which may have been part of an atlatl dart [emphasis ours].

Comments. In his description of level 5, Harrington refers to the "white lacustrine deposit" which apparently formed the bottom of the cave. This same deposit was encountered by us beneath the cultural deposits in five widely separated locations (fig. 22). This deposit is an important feature of the cave and is discussed in detail below.

Harrington's principal contribution to archaeology of Lovelock Cave was his excavation of lot 15. The relative importance of this test unit has been over-emphasized because of the fact that it is the single unit in the cave for which any stratigraphic data have been available. The potential value of lot 15 was somewhat diminished by the excavation procedures used by Harrington. The lot was dug in arbitrary levels, rather than by removal of each successive stratigraphic level. The artifacts found in this unit constitute the only reasonably well documented sample from the cave, but these specimens comprise only a very small percentage of the total Lovelock Cave artifact inventory. Lot 15 is located in an area close to the inward-sloping southwest wall of the cave. Consequently, as excavation proceeded, the length of the test pit increased under the sloping wall, until, at the bottom of the deposit, the original pit (six by eight feet) was nearly 16 feet long (Harrington 1929:19, fig. 5). Because of the reduced headroom provided by the overhanging cave wall, it is possible that lot 15 did not contain a "representative" sample of the occupational midden. It is likely that a better sample could have been obtained by excavation of a more suitable habitation area located near the center of the cave, or near the entrance.

Harrington (ibid:24-28) believed that the artifacts found in lot 15 gave evidence of the shift from the use of the atlatl to the bow and arrow. It is probable that his interpretation of the limited evidence from lot 15, supplemented by information from other lots in the cave, is generally correct, but students of Great Basin prehistory who assert that Harrington's Lovelock Cave material provides a well-documented demonstration of the transition from the atlatl to the bow and arrow should note the paucity of the actual evidence--lot 15 contained a single probable atlatl shaft in level 4 and another possible dart in level 6. We believe that Harrington classified shaft sections of Phragmites as arrows or atlatl darts on the basis of shaft diameter. Atlatl darts with very small diameters are known from caves in the lower Humboldt Valley. It is because we find the actual evidence of the atlatl-bow succession in Lovelock Cave to be tenuous that we consider Harrington's conclusions on the matter not acceptable.

The deposit of basketry found in the gradational contact between levels 5 and 6 in lot 15 may have been contained in the "older guano layer," as Harrington calls it, but it is equally possible that the basketry might have lain in an undetected cache pit that had been dug into the guano layer from an upper and later occupation level. This is further attested, perhaps, by the fact that the basketry cache was found in an out-of-the-way area against

the cave wall. In any case, this cache of basketry provided a radiocarbon age of 1218±260 (C-735), which has been interpreted as being the approximate date of the earliest human occupation of the cave. However, it is evident that the older bat guano is stratified, and contains occupational debris that is considerably older than 1218 B.C.

Harrington photographed a few of the more important finds in the cave in situ, and in the summer of 1969, through the courtesy of Dr. Frederick J. Dockstader, one of us (Napton) examined Harrington's negatives and contact prints which are filed in the Museum of the American Indian, Heye Foundation, New York.[5] One of the photographs gives the viewer an idea of the quantity of material, some of it undoubtedly cached, which was found in lot 15 under the inclined cave wall. The photograph is imperfect, but is reproduced here for its documentary value (pl. 7).

Many of the photographs taken by Harrington in 1924 are reproduced in the 1929 report. One of these (1929; pl. 7,b) shows Harrington holding the famous bundle of 11 duck decoys found in cache pit 12. Loud was photographed in the same pose. With the kind permission of Dr. Dockstader, we have reproduced this hitherto unpublished picture, one of the few existing photographs of Loud (pl. 6). Other unpublished photographs taken by Harrington in 1924 appear in plates 2 and 7.

Excavation of lot 15, discovery of the duck decoys, and the careful recovery of several inhumations were the most important features of the excavations made by Harrington. One of the human bodies found by Harrington had been mummified by natural desiccation and was quite well preserved. It was photographed in situ (see Loud and Harrington 1929, pl. 9a,b) prior to its removal from the cave and subsequent shipment to the Heye Foundation in New York, where it reposed in the museum's annex until the summer of 1969, when it was located by Vincent Wilcox and studied by Napton and Dr. John Budinger. Laboratory photographs of this specimen were taken and a detailed paleoautopsy is now in progress.

Other Work by Harrington in 1924: Loud and Harrington (1929:8-9) investigated at least three other locations; the outer rockshelter of Lovelock Cave, the Humboldt Lakebed site (NV-Ch-15), and Ocala Cave (NV-Ch-24). Their excavations in the outer rockshelter of Lovelock Cave, which is 65 feet long and 25 feet wide, evidently failed to disclose any evidence of post-contact occupation--or, if such evidence was found, it was not reported. Harrington described the deposits in the outer rockshelter as being about two feet deep at the back of the overhang in an area located immediately north of rock C (fig. 12), which blocks the cave portal. Harrington (ibid:8) states that the dry deposit of occupational refuse lay "just northeast of the slope leading down into the southwest entrance of the cave...." The upper

four or five inches of this deposit was limedust and rock fragments; beneath this was charred grass contained "many small round charred seeds, doubtless used as food by the Indians." Below this was a layer containing grass, feathers, human hair, rushes, cattail spikes, felted cattail down, two sandals, and the feathered end of a wooden arrow.

Comments. This was the only reported test ever made of the rockshelter deposit. We believe that most of the deposit excavated by Harrington in 1924 accumulated after the fall of rock C and must therefore represent very late use of the cave (see pl. 5; see also Napton 1969:90, pl. 2). In 1968 we discovered in the "west alcove" of the outer rockshelter an intact section of stratified midden that probably constitutes a small remnant of the original outer rockshelter deposit.

Harrington and Loud found some duck decoys and other artifacts in Ocala Cave (NV-Ch-24). These are undescribed. They also examined the Humboldt Lakebed site (NV-Ch-15). The extent of their work at this site is unknown, but Harrington subsequently published a brief report of the salient features of this site and pointed out the possible significance of the juxtaposition of the lakebed site and the cave (Harrington 1927:40-47). Harrington's photographs of the lakebed area include a good view of a dense stand of Phragmites communis, now totally extinct in the immediate vicinity of the site. The photograph is instructive in demonstrating the deterioration through desiccation of the floral cover at this location in the years since 1924 (see pl. 2; compare pl. 1 taken in 1968).

Investigations in Lovelock Cave, 1924 to 1960

1936; Nels Nelson, Surface Collection: Nels Nelson, sponsored by the American Museum of Natural History, visited Lovelock Cave for a brief period in 1936, according to Grosscup (1960:2), to whom we are indebted for some of the data in these pages. All of the specimens collected by Nelson were surface finds, some of them probably came from backdirt left by relic hunters.

1936; R.F. Heizer, Surface Collections: Heizer, Krieger and their work crew visited Lovelock Cave and Leonard Rockshelter in the summer of 1936 (see Heizer 1938:68-71; 1967b:49-52; Heizer and Krieger 1956). A small number of specimens found in crevices and under rockfalls were contributed to the Lowie Museum, Berkeley.

1949, R.F. Heizer and J. Mills; Collection of Samples for Radiocarbon Determinations: Heizer and Mills obtained several samples of organic materials to be used for the radiocarbon dating process then being applied by Willard Libby at the University of Chicago. The locations of these samples and the radiometric data have been reviewed by Heizer (1956:50-57) and Cressman (1956: 311-312).

1950, R.F. Heizer and Field Party, Surface Collections: Heizer, E. Antevs, N. L. Roust, and a large group of Berkeley students excavated Leonard Rockshelter (Heizer 1951:89-98), Granite Point cave (Roust 1966: 37-72), NV-Pe-8 (Baumhoff 1958:14-25), and surveyed surface sites in the lower valley (fig. 2). A visit was made to Lovelock Cave for the purpose of collecting grab samples of numerous coprolites (desiccated human feces), which were in evidence on the surface and in the spoil dirt that had been dug from various locations in the cave. (See Heizer and Krieger 1956:33; Heizer 1967b:50.) Fifty-one of these coprolites were analyzed by N. L. Roust (1967:49-88).

G.L. Grosscup, 1960, Synthesis of Culture History of Lovelock Cave: Grosscup's reconstruction of the culture history of Lovelock Cave was based on his study of Lovelock Cave artifacts collected by Loud and Harrington for the Museum of the American Indian, Heye Foundation, New York. Grosscup (1960:13) is explicit in stating that his reconstruction of the culture history of Lovelock Cave is based on examination of only those artifacts "for which a depth has been recorded or for which some other associational data are available," but he does not give the total number of specimens examined by him for which such data exist.[6] His interpretations of the culture history of the cave have helped to define some of the problems that have been investigated by recent fieldwork at the site.

One of the principal conclusions reached by Grosscup was that Lovelock Cave had been abandoned circa A.D. 900, and that an occupational hiatus of some 800 years duration occurred between the departure of the prehistoric Lovelock population and the arrival in the area of the numic-speaking Northern Paiute. This postulate is stated several times by Grosscup (1960: 5,6,12,60, 65,66) and is the principal theme of a later article (Grosscup 1963:67-71). The "occupational hiatus" theory has been discussed in some detail in another publication (Napton 1969:28-97), and at this time we can only reiterate our opinion that there is no demonstrable hiatus, either cultural or chronological, between the Lovelock Cave populations and the Northern Paiute of the Historic Period. The problem of the putative linguistic discontinuities in the Great Basin during this period continues to be a matter for speculation (see Lamb 1958:95-100; Taylor 1961:71-81; Swadesh 1964:527-556; Miller 1966: 75-112; and Goss 1968:1-42). The latter has summarized the major arguments advanced by the principal protagonists in the dusty arena of Great Basin lexiostatistics. Unfortunately, linguistic problems do not lend themselves to solution by archaeological investigation, no matter how detailed. The linguists have formulated a very interesting problem, and they must shoulder the burden of devising tests for its solution.

An important contribution made by Grosscup (1960:3-4) was to point out the fact that if the white "lacustrine deposits left by the waters of Lake

Lahontan" (Harrington 1929:9) are really lacustrine in origin, they are "unlike other Lahontan deposits in caves in this area." This remark by Grosscup was prompted by his first-hand observation of the deposits in Hidden Cave (Roust and Grosscup n.d.). Further excavation would be needed, he believed, in order to solve the problem of whether the white deposit consisted of lacustrine sediments laid down over 14,000 years ago (ibid:62), or was a diaphragm of decomposed cave material.

1965; Heizer and Field Party, Collection of Human Coprolites: In the summer of 1965 members of a new group of Berkeley graduate students were being introduced to Great Basin archaeology, and the Lovelock valley was selected as a training area. The field party visited Lovelock Cave and from two locations collected some 500 human coprolites. One series, the "crevice" or "entrance" coprolites, came from the area between rocks A and B (pl. 5). (The grid coordinates of this locus are N50/W55; see fig. 9.) These specimens were found on the surface of refuse contained in a crevice under the inner edge of rock B (see Heizer 1967a:12, fig. 1). It is likely that the crevice was used as a latrine by some of the latest occupants of the outer rockshelter. One of the entrance samples yielded a radiocarbon date of A.D. 1805±80 (UCLA-1071-E, Tubbs and Berger 1967:89-92).

A second group of human coprolites was found in an abandoned cache pit (designated pit No. 48, following the numbering system used by Harrington [1929:14]). The pit was against the north wall of the cave, grid coordinates N30/W5; see fig. 9; see also Heizer 1967a:12, fig. 1). A few artifacts and other specimens found in the cache pit have been accessioned by the Lowie Museum, Berkeley. The radiocarbon age of a sample "interior" coprolite was A.D. 740 ±60 (UCLA-1071-F, for additional information see Tubbs and Berger 1967:89-92).

Twenty entrance and thirty cache or "interior" coprolites were analyzed in 1966-1967 by R. Ambro (1967:37-47) and R. Cowan (1967:21-35). Additional reports based on analysis of these specimens are by Heizer (1967a:1-20), Follett (1967:93-116), Napton and Heizer (1969:i-v), Douglas (1969:1-8), Napton and Brunetti (1969:9-18), Napton and Kelso (1969:19-27), Heizer and Napton (1969:563-568), Napton (1969:28-97) and Heizer (1969:244-250). (See also the additional articles in this volume.)

Another location examined in 1965 was the "guano miners dump" on the slope in front of this cave. Salvage screening of part of this deposit produced 73 projectile points, including specimens of Desert side-notched, Rose Spring corner-notched, and Cottonwood triangular types, all of which were in use during the Late Period in the Great Basin (see Clewlow 1968:89-101). Other types of artifacts found in the dump are described by Clewlow and Napton (this volume).

Summary

Thousands of perishable artifacts have been collected during the sporadic excavations made in Lovelock Cave during the half-century from 1912 to 1967. It is probable that more than 20,000 specimens have been found, exclusive of coprolites, of which there are now an estimated 6000 whole and fragmentary specimens in the collections of the Lowie Museum, University of California, Berkeley. Our interest in disclosing some of the vast amount of information contained in the Lovelock coprolites led us to conclude, in 1967, that while preliminary analyses of the Lovelock Cave coprolites had produced very interesting information concerning the dietary regimes of the Lovelock population, we lacked an adequate chronological framework for correlation and comparison of these data. Our assessment of the condition of the site, following a brief visit to the cave in the spring of 1968, encouraged us to plan a further program of excavations.

RECENT EXCAVATIONS IN LOVELOCK CAVE

The excavations made by us during 1968 and 1969 at Lovelock Cave, NV-Ch-18 (legal location SE 1/4 of the SW 1/4 of the NE 1/4 of section 12, T24N, R30E, Churchill County, Nevada) were conducted under authority of a U. S. Department of Interior excavation permit, with the cooperation of the Bureau of Land Management, Reno and Winnemucca, Nevada. Field work was accomplished in two stages, beginning with pilot tests during the week of September 13 to 19, 1968. The field party was composed of seven Berkeley students (K. Nissen, P. Hallinan, C. Johnson, R. Ambro, J. O'Connell), Dr. Albert Elsasser, and the authors. The second phase of the project was carried out during a six-week period from April 14 to May 20, 1969, by a group of 22 undergraduate students enrolled in an experimental course in field methods in archaeology (pl. 4).

The field party camped at the old Ragucci ranch on the east edge of the Humboldt lakebed, now maintained as a line camp by Mr. John Froelich and Mr. Leon Anderson, whom we thank for allowing us to use the ranch building, and for granting us access to the cave via their lease holdings in the lower valley. The 1969 field crew was divided into two groups, one of which, supervised by P. Hallinan, carried out mapping and excavations at the Humboldt Lakebed site (NV-Ch-15). The remainder of the crew, supervised by Napton, worked in the cave.

The 1969 excavations in Lovelock Cave, particularly those in the west alcove and in the "LX" (Lot X) area, were largely direct continuations of the probes begun in 1968; hence, instead of describing the work season by season, we will summarize the cumulative results of excavations completed in each unit.

Conditions inside the cave were more or less the same during both field seasons. Protective "hard-hats" and respirators (Agri-Tox dual cartridge type) were mandatory. Goggles would have been desirable, but were impractical in actual use. Some relief from breathing the dust-laden atmosphere was obtained in 1969 by means of ventilating equipment loaned by the Pacific Telephone Company, San Francisco. Illumination was provided in 1968 by a small portable power plant. In 1969 an 1100 watt alternator was used to provide power for suction fans and for electric lights. In spite of their relatively short life, photoflood lamps were quite useful in illuminating the excavations in the poorly ventilated west end of the cave, where clouds of dust often achieved an almost unbelievable density.

The general appearance of the interior of the cave has apparently remained almost unchanged since 1924 (pls. 8,9,10,11) except for the fact that at present the chamber is the home of a large flock of feral pigeons, whose nests, feathers, and droppings are highly deleterious to the remaining occupational deposits in the cave. Relic collectors have dug in the cave for years, and continue to do so, but casual diggers are usually discouraged by the extremely dangerous condition of parts of the cave roof, by the obnoxious odor of the cave, by the fact that few good specimens have been found in recent years, and by the fact that the clouds of dust produced by even the most casual disturbance of the deposits rapidly clogs the air intake valves of gasoline lanterns--to say nothing of the respiratory apparatus of the diggers themselves. Carbide lamps, used by Harrington in 1924, have the potential hazard of producing a flash explosion of the thick clouds of organic cave dust. Ventilation is inadequate throughout the cave, although a "venturi" effect resulting from strong westerly winds provides limited air circulation. (The same effect would have helped to draw off the smoke produced by the Indians' campfires.)

We established a uniform grid system designed to be expanded over the entire site (fig. 9). The principal datum, referred to here as UCB datum A, was located inside the cave in an area where it would be readily accessible for measurements in the areas to be excavated. The coincidence of the north/south and east/west grid coordinates is marked by this datum. From this point it is possible to see the east and west ends of the cave, and instrument sightings can be taken through the guano miners tunnel and through a narrow gap between rocks B and C to points located in the outer rockshelter (fig. 10). An auxiliary datum, designated UCB datum B, was established on the tabular summit of massive rock F, located on the floor of the outer rockshelter, approximate grid location N30/W40. We cleaned the rock surface and chiseled into it a cruciform index mark, the center of which is the zero point of UCB datum B. This point is also considered to mark the mean elevation of the entrance of Lovelock Cave, which is approximately 4240 feet above sea level.[7]

From UCB datum B one may see most of the outer rockshelter, Humboldt Lakebed, and various landmarks to the north, such as the Toulon tungsten mill,

the BLM windmill on the Humboldt lakebed, and the buildings at the old Ragucci Ranch. Bearings were taken intersecting the center of the Derby Field airway rotating beacon (No. 26-A) located near the site of U.S. Geological Survey bench mark No. 317 (elevation 3899.802 feet), and on the center of the dome of the Lovelock VOR (Vortack) radio range 54-A on Derby Field. The assumed elevation of UCB datum B, 4240 feet, may be subject to correction. Therefore, datum B, the highest elevation with which we were to be concerned during excavation of the cave, was given an arbitrary elevation of 100.00 feet. A preliminary map of the site was prepared by Napton, using a Gurley high-standard alidade and Johnson plane table (fig. 9). The rockshelter was mapped and some of the more important landmarks in the lower valley, including datum One, established by P. Hallinan on NV-Ch-15, the lakebed archaeological site, were plotted in reference to datum B. From this datum it is possible to sight on UCB datum A, located at floor level inside the cave. The distance between datum A and datum B, corrected to the horizontal, is 51'3"; the difference in elevation is 14'3", giving UCB datum A a reference elevation of 85.70 (or 4225.7 feet). The latter figure coincides with an estimate of the elevation of the cave made in 1950 by Ernst Antevs (personal communication to Heizer, 1950), who used a Paulin altimeter calibrated on the U.S. Coast and Geodetic Survey Lovelock south base, elevation 3908 feet. The elevation of other cave features of interest are given in the text, or are plotted on the preliminary site map (fig. 9).

The site grid is laid out in increments five feet square, with the north-south grid axis oriented on magnetic north (declination 17 1/2 degrees west, 1969), so that each test unit is aligned with the cardinal points of the compass. All measurements made to determine horizontal and vertical provenience of an artifact or feature found within each grid unit were taken from the center of the southwest grid stake, so that all internal data were recorded as distance north and east of the southwest control stake (Heizer 1958: 54, fig. 9).

The following "areas" and grid units were selected for excavation in 1968-1969 (see Heizer 1969a:3-4). The year of excavation is given in brackets; all grid locations refer to UCB datum A:

1. Lot "LX," a deposit of midden trash located between rocks B, C, and D (grid location NSO/W30) [1968].

2. Grid unit NSO/W35, an extension of the "LX" area [1969].

3. Grid unit N5/W25, a deposit of disturbed refuse near the cave entrance [1969].

4. Grid units S5/W10; S5/W15 ("miners entrance") a test entry made for the purpose of sounding the deep white "lacustrine" deposit forming the apparent basal stratum of the cave [1969].

5. Lot "AN" (grid units S10/W50; S10/W55), first explored in 1967, and entirely covered by massive rock B [1968].

6. West crevice area ("WC"), approximate grid location S40/W95, UCB datum A, a nearly vertical chute leading down from the west alcove into the deep west end of the cave (the chute is actually a narrow passage between massive rock A and the inward-tilting north wall of the cave [1968, 1969].

7. The west end area ("WE"), grid location S40/W80 and S40/W85, UCB datum A, a deposit of refuse adjacent to Harrington's lot 15 dug in 1924 [1969].

8. The west alcove ("WA") the hitherto unexcavated extreme west end of the cave (grid location approximately S10/W95; S15/W100), the north portal of which lies some 60 feet southwest of UCB datum B [1968, 1969].

9. The east alcove area ("EA"), in grid location N40/W25, an unexcavated area almost completely covered by rubble [1969].

10. The guano miners dump ("MD") (approximate grid location N100/W100) situated on the steep hillside in front of the cave. Debris and rubble from the interior of the cave was discarded here by the guano miners in 1911, forming a loose, sliding mass some 200 feet long and 40 feet wide. Part of this mantle of debris had been screened by us at an earlier date [1965, 1968, 1969].

The excavation of these ten locations will be described in some detail, in view of the paucity of such information for previous excavations in Lovelock Cave.

Lot "LX", Grid Location NS0/W30, UCB Datum A

The purpose in excavating "Lot X" was to recover from this part of the cave further specimens of desiccated human excrement, samples of which were analyzed in order to supplement the data from the "entrance" and "interior" samples previously described. The surface of the deposit in this area was tested by Harrington (Loud and Harrington 1929, pl. 2), but we hoped to find some undisturbed remnants of the midden. The test unit was approximately five feet long, east to west, narrowing in the center due to a projection of rock D. The deposit was excavated in arbitrary six-inch levels from the surface to a depth of 72 inches, at which point we encountered the powdery-white "lacustrine" substrate deposit. The test was successful in its primary purpose: 52 coprolites were found in the unit and all of these were subsequently analyzed.

The upper three levels of the test unit consisted of fragments of grass, dust, rocks, twigs, pieces of rush or tule, and other organic debris, all of which was thoroughly mixed. The middle levels (levels 3 to 5) had been

disturbed in prehistoric times by construction of a cache pit (No. 49, feature No. 1), which (unfortunately) was empty. The basketry lining of one wall of the pit was well preserved, and a pile of rushes and grass served as the bottom of the pit. A sample of this material (LX-56) gave a radiocarbon age of A.D. 50±60 (UCLA-1417, see table 1), which dates the construction of the pit. The refuse deposits enclosing the pit must of course be older (fig. 16).

Samples for palynological analysis were taken at six-inch intervals from the bottom to the top of the entire test unit. The "LX" test unit could not be expanded due to the mounting danger of further undermining rock D, upon which rests (in a most precarious fashion, as it appears when viewed from beneath) the 20 ton mass of rock C (fig. 11).

Levels 4 and 5 consisted almost entirely of bat guano, probably the "older guano" found at about the same depth by Loud and Harrington in lot 15 (1929:22-23). The lower part of the layer is interfingered by thin strata of sand, dust, and at least one layer of vegetal material, consisting of Scirpus sp. and other species of aquatic vegetation. The presence of this material as an integral member of the guano layer suggests that Lovelock Cave was occupied by man, if only intermittently and briefly, during part of the time in which the bat guano layer was forming. The gradational contact of the surface of the early guano and the base of the overlying layers of midden trash is only moderately well defined, but there is an abruptly well-defined transition from the early guano to an underlying white ash layer. The ash layer is about two inches thick. Under this is a stratum of crystalline white-colored material. We were able to penetrate this deposit to a depth of 12 inches, at which point several very large rocks were encountered. None of these could have been extracted from the pit without the use of heavy equipment.

The north profile of this unit, as depicted in Figure 16, was recorded by J. O'Connell and P. Hallinan. The section is quite similar to a somewhat idealized profile-section prepared by Loud and Harrington (1929:7, fig. 2; compare ibid:11, fig. 3).

Part of the LX or NSO/W30 unit lies within Harrington's lot 4 (Loud and Harrington 1929; pl. 2). We have no way of knowing how deep Harrington dug in lot 4, but he discovered five cache pits (Nos. 9,10,11,12, and 13). Harrington (ibid:12) states that pit 10, found in lot 4, belonged either to the "transitional" or "older" period of cave occupation. The bottom of the pit was "6 feet 1 inch below the surface." Unfortunately, it contained little of interest, although Harrington noted that a grass layer in the bottom of the pit was covered by a layer of bat guano approximately one inch thick, "showing that the pit had lain open awhile," and also indicating, of course, that bats had occupied the cave either during or after human use of the site.

A section transecting pits 9 and 10 from east to west was sketched by Harrington (1929:11, fig. 3; see fig. 15, this volume). The west side of the profile is on the right side of the illustration, so the viewer is looking north toward the "LX" profile, which is about six feet farther north of the section recorded by Harrington. The rock shown at the right hand side of Harrington's drawing (1929, fig. 3) is omitted on his plan map of the site (1929, pl. 2), but a large rock does exist at this location (rock E; see fig. 6, event IV). Loud and Harrington (1929, pl. 2) place pit 12 in lot 4, whereas, in the text Harrington (1929:12) states that pit 12 is in lot 7. The latter location is probably erroneous, for in his figure 4 (ibid:13), pit 12 is shown next to pit 11, and is also shown in Plate 2 as occurring in lot 4 with pits 9, 10, 11, and 13. Pit 12 is of more than routine interest, since it contained the remarkable cache of 11 duck decoys. The bottom of this pit was five feet below the surface, according to Harrington, indicating that his excavations in this area reached at least that depth. Pit 12 was apparently situated just beyond the south wall of the LX unit.

Grid Unit NSO/W35, UCB Datum A

In 1969 we continued exploration of the LX area by excavating unit NSO/W35, a sloping mass of refuse located under the edge of massive rock C and just west of unit LX in the narrow passage between rocks B, C, D, and E. The upper layers of the east end of this unit had been excavated by Harrington in 1924. We could not extend the test unit to the west since this would undermine a group of poorly supported rocks lying in the passage between rocks B and C.

The test unit was excavated in six-inch levels, but very little was found, other than the usual fragments of twine, quids, feathers, etc. (feature No. 2). At a depth of 30 inches we found a mass of rushes and grass (Distichlis cf. spicata) (feature No. 4). A piece of fox skin (Vulpes sp.) was found at a depth of 50 inches (feature No. 7), under which was a large, fragmentary tule mat (feature No. 8). Crushed bulrush culms were observed adhering to the underside of rock E, an indication that this boulder was part of the massive Event IV rockfall (fig. 6).

The principal value of this unit is the excellent display of the cave strata in the north profile, extending from the surface under rock C to a depth of at least 72 inches. The profile was brushed and dusted with the aid of a small bellows. When this was done it was possible to see that the deposit sectioned by the profile is undisturbed, and is a good sample of the original stratigraphy of Lovelock Cave. The strata to the north of the profile, extending into the area covered by massive rock C (units N5/W35, N5/W40, N10/W30, N10/W35) are probably undisturbed, in view of the fact that they are capped by at least 20 tons of limestone.

Most of the internal features recorded by Harrington for lot 15 in the west end of the cave apparently also occur in the north profile of NSO/W35, with the important difference that in the latter unit the strata are a good deal thinner. The minimum depth of lot 15, according to Harrington (1929: 19, fig. 5), is ten feet. In NSO/W35 the same strata are six feet thick, and probably become progressively thinner under rock C as one ascends the slope toward the mouth of the cave. It might be possible to excavate part of the deposit under rock C, depending on the engineering problem involved in working under this monolith, which appears to be poorly supported on the south (the downhill side of the slope). We surmise that most of rock C rests on cultural midden trash, but this possibility must of course be demonstrated by excavation, which could be accomplished by extending a lateral cut under rock C to the outer rockshelter, revealing at the same time the relationship of the white "lacustrine" stratum and the basal strata of the outer rockshelter.[8]

Stratigraphy of the test unit: The NSO/W35 test unit is overlain by rock C, which, if we correctly interpret the apparent situation, fell on the deposits during the time that the cave was occupied by the Indians (fig. 11). The approximate date of the fall of massive rock C (event IV) can be estimated by obtaining the radiocarbon age of a sample of the uppermost cultural material found under the rock. One such sample gave a radiocarbon age of A.D. 440±90 (I-4629), but this date is probably somewhat short of the actual occurrence of the rockfall, due to the fact that there is a gap between the surface of the deposit and the under side of the rock, as shown in Figure 12. The gap is partially filled with packrat nest and midden material, and a date for the occurrence of the rockfall based on a radiocarbon determination of this debris would almost certainly be erroneous. Because of this, the sample for radiocarbon dating was taken from the uppermost integral member of the stratified deposit (fig. 13). A more precise date for the rockfall could probably be obtained by determining the radiocarbon age of organic material which was crushed when the rock fell.

The uppermost part of the deposit under rock C could not, of course, have been removed by the guano miners, but one should note that the profile NSO/W35 indicates that the rock does not seem to rest on a layer of bat guano, which, as Harrington (1929:1) describes it, was "3 to 6 feet deep" elsewhere in the cave. It would appear that two possibilities obtain: the thick "Later Guano" removed by the guano miners may have been deposited after the Event IV rockfall; or perhaps the Later Guano deposit never existed in this locality, near the mouth of the cave. However, a deposit of guano about one foot thick is indicated by Harrington (ibid:11, fig. 3) as a feature near the surface of the cross-section between lots 9 and 10. It is possible that most of the thick Later Guano layer was deposited after the Event IV rockfall nearly closed the cave portal, an occurrence that might have made the cave less suitable for human occupation, but probably improved it as a colony site

for bats. Hence, in our view, it is likely that most of the Later Guano unit, said to be three to six feet thick, was deposited during the period between A.D. 440 and A.D. 1911, a period of about 1500 years, indicating that estimates of cave chronology based on the assumption that the cave debris accumulated at a constant rate are likely to be erroneous (fig. 14).

The radiocarbon determinations of samples taken from the north profile NSO/W35 are given in Figure 13. Because of the varying (and unknown) amounts of midden removed from the surface of the cave deposit by the guano miners, and because of the slope of the cave floor in this vicinity, the total thickness of the NSO/W35 unit is greater than that of the "LX" units. However, the buried surface of the white "lacustrine" deposit forms a stratigraphic marker throughout the cave, and the various strata can be correlated approximately, using this feature as a common reference (fig. 23).

Additional details of the stratigraphy of the NSO/W35 profile are given in the caption of Figure 13. (See also pl. 7.) Particle-size fractionation, identification, analysis of organic material, and palynological studies of 30 samples, which were taken from the profile at six-inch intervals, remain to be completed. A rough analysis of the samples is given in Table 2. The stratigraphy of unit NSO/W35, from the top to the bottom of the deposit, consists of the following components:

The surficial deposits are composed of packrat nest and midden debris. Packrats, or wood rats (Neotoma cf. cineria), tend to defecate in specific locations in their middens, and part of the uppermost deposit of this test unit consisted of a compact mass of rat dung. A slab of this material (field specimen 65:1427) was removed for laboratory examination, and was found to contain a quantity of mudhen feathers (Fulica americana) which was once part of a garment similar to one found in lot 12 (Loud and Harrington 1929, pl. 18). The surficial layers also contained bits of twine and several human coprolites. Beneath the rat nest was a thin layer of aeolian sand, followed by a layer of vegetal material, dated by sample I-4629. Below this were layers of sand, dust, and limestone spalls, interspersed with distinct layers of rushes. It is possible that some of these layers of organic materials represent occupational "horizons" or single occupations. In a site as large as Lovelock Cave, different areas may have been occupied at different times.

The layers of dust, sand, and rushes cease abruptly at a depth of 40 inches below the surface, at the contact of the underlying "Older Guano." The buried surface of the Older Guano strata is so compact that it can hardly be penetrated with a pointing trowel. The hard surface is probably an occupational floor, but only a small segment of this feature was found to be intact in this test unit (fig. 17). On the hard surface of the "floor" were found quids, strands of human hair, and other evidence of human occupation (pl. 13).

The "Older Guano" layer, previously described, is about 12 to 16 inches thick in this location. The upper part of this deposit, consisting of approximately 90 per cent bat guano, is superimposed on a thin cultural stratum, under which is a six-inch thick deposit of sand, guano, and dust. A single quid was found in the occupation layer. The basal portion of the Older Guano layer has been burned, either by man or as a result of spontaneous combustion. In this test unit, the burned guano is superior to a thin layer of white ash, beneath which, as might be expected, is the white lacustrine deposit.

N5/W25

The upper part of the refuse deposit in this test unit was found to be badly disturbed. The loose debris contained modern trash and very few artifacts. An empty cache pit (feature 9) came to light at a depth of 12 to 18 inches below the existing surface. The test unit location is covered by Harrington's lot 11 and perhaps by part of his lot 9. Pit 46, which contained the partially desiccated body of an adult male, was found by Harrington near this location.

S5/W10, S5/W15; Miners Entrance Pit ("ME")

This test entry, located approximately in the center of the cave near the guano miners entrance (fig. 10), was the scene of our ambitious but abortive effort to reach the bottom of the white "lacustrine" deposit--the "lime-powdered bottom of the cave," as it was described by Harrington. The deposit had been exposed to view in this vicinity by the guano miners and by Loud, during his excavations in 1912. Harrington (1929:4) gives this description of the exposed deposit:

> Here could be seen its general character--higher in the center of the cave and sloping gradually downward from the northeast end toward the southwest, and sharply downward 2 or 3 yards from the wall everywhere. This condition is doubtless due to rockfalls from the roof when the cave was forming, the fallen material creating a pile higher in the center than around the edge. The bottom was composed of such limestone from the roof, cemented together with a rather soft, white mineral substance which crumbles into fine granules when dug.

If this feature is a lacustrine deposit it is a very unusual one, as Grosscup (1960:3-4) has pointed out, for no comparable stratum is known to have been found in any of the excavated cave and rockshelter sites located in the Humboldt-Carson Sink area. Some of these sites, such as Humboldt Cave, approximate elevation 4065 feet (Heizer and Krieger 1956); Leonard

Rockshelter, elevation 4175 feet (Heizer 1951:89-98); and Hidden Cave, elevation 4104 feet (Roust and Grosscup n.d.), contain strata that can be correlated with one or more stages of Lake Lahontan, but none of these lacustrine strata resemble the white deposit which uniformly underlies the midden and older guano deposits in Lovelock Cave (fig. 22).

Excavation of test unit S5/W10 disclosed an apparently stratified deposit some six feet thick. The stratification is spurious, because the crossbedded debris found here is for the most part spoil dirt derived from numerous pits dug in this part of the cave by relic hunters. Pieces of newspaper, discarded cigarette butts and other modern trash attest to the recent disturbance of these layers. The older guano layer, which elsewhere usually occurs under the midden trash, was not present in this test unit.

The white deposit was encountered at a depth of six feet, as expected. The stratum contained several large rocks, greatly reducing the already limited work space in the bottom of the pit. The white deposit was anything but the "soft and powdery" material which Harrington (1929:4) described. Excavation could be continued only by means of railroad picks and pry bars. We removed from the pit several large slabs of material composed of a very hard, crystalline-mineral substance, usually grey-white in color, but not infrequently having a faint pink or green tinge. We were able to detach hand specimens with the aid of a sledge hammer. As the pit deepened it became increasingly difficult to penetrate the stratum, and work was finally discontinued at a depth of three feet into the white deposit, the test unit having been carried to a total depth of nine feet. There was no indication, of course, that we had reached the bottom of the white deposit, nor was there the slightest clue as to what lay beneath this stratum. It was obvious, however, that the white deposit was the product of phenomena very dissimilar to those responsible for the development of the stratigraphically superior deposits. Inspection of the crystalline structure of the deposit suggested that water had played a major part in its formation. In fact, the deposit seemed to be a precipitate resembling silicious sinter; however, its true nature was revealed only by spectroscopic analysis.

It is unfortunate that we were unable to reach the bottom of the white deposit, for it will be necessary to do so before this feature of the cave can be said to have been adequately examined. This particular location was probably a poor choice for a deep probe of the white deposit: much more could have been learned by excavation of a unit located adjacent to the cave wall, where the contact between the bedded limestone and the white stratum could be examined. There is an indication, in unit N25/E25, that the white deposit covers some of the tufa that adheres to the cave wall (fig. 21), but it will be necessary to expose a much better preserved contact.

Lot "AN", Grid Units S10/W50, S10/W55

This test unit is situated entirely under massive rock B, which is some 20 feet long, 12 feet wide, and is about six feet thick along the edge visible inside the cave. Rock B weighs approximately 20 tons, and, if nothing else, at least provided a reassuringly solid ceiling over the heads of the excavators of the underlying deposit. Due to the presence of this monolith, it was necessary to enter the "AN" unit laterally, from the south. Some of the refuse under the edge of the rock had been removed by Loud and Harrington as part of their lots 7 and 18. Pit 42, in lot 18, is shown by Loud and Harrington (1929, pl. 2) as having been located just under the edge of rock B, but the construction and contents of the pit are not described in the text.

The surface of the deposit beneath the rock rises steeply from the lower (south) edge of rock B to the "Entrance" coprolite crevice (grid location NS0/W55), which is formed by the north edge of rock B and several rocks resting against it (fig. 18). Between the surface of the deposit and the underside of rock B is an unobstructed space which was about ten inches high and four feet wide. On either side of this unobstructed passage, as viewed from the excavation entrance, rock B is supported by tightly packed occupational debris and rocks. The underside of rock B is smoke-stained, but much of the stain has exfoliated from the rock cortex due to the admission of moisture into this part of the cave via the access passage. The underside of the rock is embellished by graffiti, which include the legend "VC 1949" executed in carbide lampblack, mute testimony to the presence of relic collectors two decades ago in even this relatively inaccessible part of the cave.

As the details given in Figure 18 indicate, excavation of the "AN" unit proceeded through the remains of Harrington's lot 18, which had been almost completely refilled by debris sliding down from the "entrance" crevice. The northernmost extent of the lot 18 excavation pit was readily apparent. Beyond the edge of the pit, farther under rock B, lay the usual compact mass of rushes, rocks, sand and dust. Our hope that part of this deposit might be undisturbed failed to materialize, for we soon found evidence of an ancient cache pit (No. 50; feature 3), which had two separate bottoms formed by large pieces of tule mat. The mat fragments were very damp, and by Lovelock Cave standards, were very poorly preserved.

Below the cache pit, as indicated in Figure 19, was a layer of dry bat guano recognizable as the Older Guano layer described by Harrington (1929:18-28). This is the same layer that we found in the lower levels of units NS0/W30 and NS0/W35.

The upper portion of the Older Guano layer consists almost entirely of "pure" bat guano. It is "pure" in the sense that by visual inspection its principal component appears to be bat guano. Miscroscopic examination,

however, reveals that it contains hair, sticks, fragments of insects, bones of bats, and numerous other types of organic and inert debris (table 2).

The lower part of this layer is composed of several thin members of sand, grass, and guano. Dividing the layer is a thin but well-defined cultural stratum consisting of bulrush and other vegetal matter, which occurs at a depth of seven inches within the guano layer, or 78 inches below the surface of the test unit. This stratum of vegetal material could be traced throughout the profile of the Older Guano layer, wherever the latter was exposed in the walls of the test unit. A sample of the vegetal component of this stratum produced a radiocarbon date of 2740 B.C.±110 (I-3962; our sample AN-16). The fact that the vegetal material in this stratum consists of aquatic plants--the nearest source of which would have been Humboldt Lake, located 2.0 miles northwest of the cave--indicates that the lake was in existence at this time and that the cave was occupied by man, for it is unlikely that any other animal would transport large quantities of aquatic vegetation from the lake to the cave. This supposition is fully confirmed, in our opinion, by the presence in the layer of pieces of twine, human hair, bulrush quids (Scirpus sp.), and other cultural materials (pl. 14). The overlying guano was compact and undisturbed, giving satisfactory evidence of the fact that the vegetal and cultural material dated at 2740 B.C. ±110 (I-3962) is not intrusive in the guano, but represents an occupational horizon occurring as an integral member of the Older Guano layer. (As we noted in the preceding section, samples of the older bat guano obtained in 1949 gave radiocarbon ages of 2498 B.C.±250 [C-277] and 4054 B.C.±250 [C-278].) Sample I-3962 is bracketed by these determinations and by the interally consistant series of radiocarbon dates from the NSO/W35 profile, as shown in Figure 23 and Table 2.

The lowest part of the guano stratum had been charred and was black or cherry-red in color. An abrupt contact separates the guano and an underlying powdery ash layer of a grey-white or dark grey hue. The ash layer gave way to a powdery crystalline substance, which is the same deposit that occurred at the base of the preceding units, with the difference that in this location it is somewhat more soft and powdery than it was in any other location. The white deposit contained several rocks of the 200 pound variety (fig. 18). There was no possibility of moving these rocks in the restricted confines of the test location. In summary, the AN excavation provided a well-defined profile of the cave deposit. From top to bottom the stratigraphy consists of rushes, grass and dust, the older bat guano, grey ash, and the white crystalline basal deposit.

The north profile of the "AN" unit was sketched by R. Ambro (fig. 19). Palynological samples (field catalog numbers 71:1486-71:1503) were taken at six-inch intervals following the procedure outlined by Bryant and Holz (1968: 11-19).

The surface of the slope under rock C was littered with large human coprolites, some of which were of the same age and general composition as the

"Entrance" coprolite series. Ten coprolites were found in situ in the midden debris superior to the Older Guano.

Lot "WC", Grid Location S40/W95, UCB Datum A

The west crevice area is a nearly vertical chute descending from the back of the west alcove into the deep west end of the cave. The crevice is formed between the back, or south side, of rock A and the inner wall of the cave (fig. 9). When we first examined the crevice, it was full of debris of all kinds, mostly sticks, stones, grass, dust, and sand that had fallen from the west alcove (pl. 10). Several large boulders were wedged in the chimney-like upper end of the crevice, and excavations in 1968 were limited to removal of the lower portions of the refuse located beneath these rocks.

Three hundred human coprolites, 30 cane arrows with greasewood foreshafts, and a number of feathered arrow shafts were found in the debris. Other artifacts found in the west crevice included several sections of a string of beads described by J. Carroll (in press, 1970).

It was apparent that the west crevice is stratified, albeit on a very steep incline (fig. 10). Removal of part of the debris in the lower depths of the crevice exposed a small remnant of the midden in the west end of the cave.

West End Area ("WE"), Grid Location S40/W80; S40/W85

The major effort of the 1969 season was an attempt to excavate part of the deep midden deposits in the west end of the cave near the location of lot 15, dug by Harrington (1929, pl. 2). Here we hoped to find undisturbed remnants of the original cave deposit. Excavation proceeded very slowly--more than 800 man hours were expended before we reached the bottom of the midden deposit.

The excavation area was partially covered by colluvial debris derived from the west crevice, and the upper levels of the test unit area may have been removed as part of Harrington's lot 16. The deposits included reeds, grass, occasional coprolites, and a few small artifacts which were doubtless overlooked by previous diggers. Stratified layers, such as those observed in NS0/W35, were not present. An occasional find of modern trash, including a pipe tobacco tin bearing a tax stamp issued in 1924, gave evidence of disturbance in this area.

At a depth of seven feet below the surface we found an assortment of human bones representing three adults and one child (M. E. Morbeck, this volume). This assemblage, which we designated Feature 5, included a tibia and fibula, a large clavicle, a very large femur (the head and greater

trochanter is visible; see Morbeck, this volume), the mandible of a subadult, and about 100 other human bones. A single calcined skull fragment lay amid the mass of unburned bones. The dry refuse immediately above the bones contained a few pieces of decayed matting and a single Olivella bead. The loose sand matrix around the bones contained pieces of wood, fragments of reed (Phragmites sp.), and hundreds of small insect pupae cases. The bones were not found in anatomical order, although the individual represented by the large femur and other appendicular bones may have been buried in a flexed position prior to being placed in this common ossuary. A few of the bones bore remnants of cartilage. Part of a femur and a tibia sacrificed for radiocarbon determinations produced a date of 1450 B.C.±80 (UCLA-1459-C, Berger, personal communication, 1969).

The bones were removed from the excavation pedestal, which was composed of a six-inch thick layer of sand and cave debris. Beneath this we encountered the now-familiar, pavement-like layer of crystalline material that forms the floor of the cave beneath the midden trash.

We surmise that the bones comprising Feature 5 were the remains of several inhumations that at some time in the past had been exhumed by coyotes during a period when the cave was unoccupied by man. When the Indians reoccupied the cave, they probably collected the scattered bones and made a common burial of them in this location. It is probable that these events occurred early in the occupational history of the site, since the bones lay in such close proximity to the basal white deposit. An alternative explanation of the presence of the several lots of buried bones in the west end of the cave is that the cave was early used as a place to deposit corpses. When large-scale human occupation occurred (circa 1300 B.C.), the exposed human bones were collected and buried in the west end of the cave in order to clean up the living area. This hypothesis could be true only if the age of the bones is older than the age of the earliest layers of living debris indicating occupation of the cave by large numbers of people. According to radiocarbon age determinations now in hand, the bones in the secondary burial just described, which date from 1450±80 B.C. (UCLA-1459-C), are slightly older than the lowest levels of lot 15 which date at 1218±260 B.C. (C-735).

Harrington (1929:17-18) found an almost identical cache of bones under rock A in this same area. The numerous calcined inhumations and the several discrete caches of extraneous bones found in the west end of the cave demonstrate that this part of the cave was used as a general bone disposal area. Many of the human bones found in the cave by Loud (1929:31-32) were calcined. It would be desirable to secure radiocarbon dates for these bones. Loud apparently believed that most of the human bones that he found had been burned by a conflagration in the cave refuse. It is likely that these human bones are not evidence of intentional cremation, but have been carbonized through burning of the guano-refuse deposits in which they lay. The Wheelers (Wheeler and Wheeler 1944)

recovered from a cave near Grimes, southeast of Fallon, two twined wallets containing cremated human bones. These are atypical, perhaps unique, for the western Great Basin.

One hundred and fifty coprolites were found in the west end area, 50 of which have been analyzed.

West Alcove ("WA"), Grid Location S10/W95, S15/W100, UCB Datum A

The west alcove, a hitherto unexcavated area located in the western extremity of the outer rockshelter of the cave, can be entered from the rockshelter via either of two apertures located some 60 feet west of UCB datum B. The west alcove deposit is perched on the summit of massive rock A, which detached from the ceiling at an unknown, but probably early, date. The deep west end of the cave (S40/W80) at the base of the west crevice, is about 35 feet lower than the entrance of the west alcove. It is evident that rock A blocked most of the west end of the cave portal (fig. 10). Rock A, which is 50 feet long, 25 feet wide, and about 15 feet thick, is displaced into the cave a distance of about eight feet. The summit of the west end of rock A is approximately flush with the surface of the outer rockshelter; thus, the debris found on its summit constitutes an extension of the outer rockshelter deposit. Midden trash composed of rushes, sticks, stones, and sand covered the top of rock A and completely filled the crevice between it and the west wall of the alcove, forming a mass of debris at least 35 feet deep.

The west alcove deposit was excavated in six-inch levels, beginning at the north entrance and descending toward the upper part of the west crevice. The surface deposit consisted of sand and stones, and from this stratum, at a depth of six inches, came several interesting specimens, including a bullet mold and some associated gun parts (pl. 15).

These specimens were examined by C. E. Hanson Jr. and we are indebted to him for the following observations. According to Dr. Hanson (personal communication, 1970), three of the parts are the sear, bridle, and mainspring of a good quality percussion lock. Miscellaneous parts include a long screw (possibly a tang screw to fasten the breech of a barrel to the trigger plate). These parts were manufactured during the years 1830-1870, most probably circa A.D. 1850. Dr. Hanson states that the bullet mold is a cheap commercial mold made during the middle half of the nineteenth century. The number "46" refers to the size of the bullet (46 balls to the pound or about 45 caliber). The mold shows extensive use: the center pin has been hammered to tighten the joint, and the cutting edges to trim balls show extensive nicks and the ends of the handles have been sharpened to facilitate driving on wooden or horn handles. The ball is of the size which could be used in an Indian trade rifle. The good quality parts and the worn tang screw and bullet mold seem to suggest the presence in the cave of two separate guns.

Another interesting specimen found in the west alcove (S15/W100, depth 36") was a pouch or "kit" made of fox skin which contained three awls, some coiled vegetal fiber, and a piece of chert.

Beneath the recent surficial strata of sand and stones lay a quite remarkable series of cultural strata, some of which consisted of inch-thick layers of charred bulrush seeds (Scirpus cf. nevadensis and Scirpus robustus) (fig. 20). Detailed examination of a sample containing thousands of these charred seeds revealed that the seeds had not been burned as the result of a general fire in the strata, for intermixed with the burned seeds were twigs and fragments of other materials that had not been burned. The evidence suggests that these seeds were discarded in this area after having been charred on seed roasting trays. Bulrush seed (Scirpus sp.) found in level 7 of this unit (S10/W95, depth seven inches) gave a radiocarbon age of A.D. 1430±95 (I-4672). Fish bones, such as the bones of tui chub (Gila robustus) found in the Lovelock coprolites (Follett 1967:93-116), were scarce in the burned deposit, although a few cui-ui bones (Chasmistes cujus) were found in the surface sand layers (W.I. Follett, this volume). Samples of a successive series of 15 of these strata were secured in 1968 and 1969 by Napton and P. Healy. Five of these samples have been processed by application of the micro-analytic techniques used in the analysis of the Lovelock Cave coprolites (table 1). These 15 discrete strata were superimposed on a deep deposit composed of aeolian sand and pebble-sized fragments of rock scalings derived from the walls and ceiling of the cave (fig. 20). The deposit is yellow in color, in marked contrast to the dark organic layers superior to it, and is apparently devoid of cultural material. The sand contained a large number of tiny bones probably derived from decomposed owl pellets. The bones include the remains of pocket gophers, microtines and other rodents (Douglas, personal communication, 1970).

Table 1

Lovelock Cave, (NV-Ch-18) West Alcove, S10/W95, Microanalysis and Composition (estimated volumetric percentage) of Five Midden Samples

	Typha Latifolia	Panicum Capillare	Scirpus Robustus	Atriplex	Charcoal	Twigs	Vegetable	Insect	Fish Bone	Bird Bone	Mammal Bone	Rock
S-6 WA	tr	tr	80	tr	tr		tr			tr	tr	20
S-7 WA	5		70	tr	tr	tr	tr	tr	tr		5	20
S-8 WA	tr	tr	60	tr	tr			tr			tr	30
S-11 WA		tr	90		tr	tr	tr				tr	10
S-15 WA	tr	tr	70	tr	tr	tr					tr	25

In the spring of 1969, we excavated the deeper deposits in the west alcove. Excavations were resumed at a depth of three feet below the surface, in an area extending from the inclined summit of rock A to the back of the cave, and thence downward into the west crevice (S20/W100). This test unit was dug to a depth of 12 feet below the surface.[9] The strata became progressively damper in the lower levels, but moisture had not seriously effected preservation of perishable specimens such as coprolites, of which more than 1500 were found. We attribute the large number of coprolites found in the west alcove to the fact that the crevice at the back of the alcove is the sort of place to which Homo sapiens characteristically retires for such purposes. One hundred and thirty-five of the west alcove coprolites have been analyzed at this writing. Two human coprolites from this unit were dated by radiocarbon. Coprolite WA-21, from a depth of 11 feet, S20/W100, has a radiocarbon age of A.D. 120±60 (UCLA-1459-A). Coprolite WA-20-A, found 12 feet below the surface in the same unit was processed for comparison. This specimen gave a date of A.D. 300±60 (UCLA-1459-B, Berger, personal communication, 1969).

Three artifacts of more than routine interest were found in the deeper deposits. A container made of bulrush culms was discovered tucked away in the sand at the rear wall of the cave (S15/W100, depth 48", feature 6, pl. 16). The tule parcel, which appears to contain a large quantity of loose bird feathers, is unopened, pending special laboratory studies to be made of its undisturbed contents.

The principal west alcove excavation units were located about eight feet west of the nearly vertical "chimney" of the west crevice. We had by this time constructed a bulkhead in the upper end of the west crevice in order to give some protection to personnel working in the deep west end of the cave some 35 feet below. The west alcove test penetrated the uppermost part of the west crevice fill. All excavation was by troweling; the backdirt was screened and was dumped inside the cave against the south wall of the alcove, rather than being disposed of on the slope outside the cave--a common practice that has little to recommend it. The cave earth, even though mixed, could yield additional information. Merely because the arrowshafts, coprolites, basketry fragments and other materials have been removed does not thereby make this earth valueless. It doubtless contains a great deal of material that could provide additional information about ancient cultural practices. For this reason we elected not to dump the spoildirt outside the cave. Excavation was discontinued at a depth of 14 feet beneath the original surface. At this point the crevice had narrowed to a width of 16 inches, and the backdirt had to be handled three times on the stepped levels ascending the slope of rock A.

East Alcove "EA" area, Grid Location N40/W25

The east alcove of Lovelock Cave is approximately 25 feet east of UCB datum B. The east alcove is part of the outer rockshelter, and is formed on

the axial plane of the hinge fold oriented roughly east-west along the face of the cave outcrop. The east end of the alcove converges to form a narrow, nearly vertical chimney or cleft. The opposing faces of the rock walls, which are well protected from weathering, support a deposit of tufa some four inches thick. The exposed surfaces of the outer rockshelter are almost entirely devoid of tufa. The presence of tufa in the east alcove suggests that the outer rockshelter had assumed its present configuration prior to the last inundation of the cave by Lake Lahontan. Samples of the east alcove tufa were taken for radiometric dating.

Most of the floor of the east alcove is covered by large pieces of limestone from the alcove roof. A few artifacts, including several wooden firehearths (see Loud and Harrington 1929:96-97), were found in interstises of the rubble in grid unit N40/W25.

An area on the east edge of the alcove produced at least one notable artifact--a carved wooden grasshopper found in June, 1965 (Jones, Weaver and Stross 1967:123-128). This specimen is said to have come from a crevice located between the east alcove and the east abutment of the cave portal. The locus of the find, as it was indicated to us by Mrs. Ethel Hesterlee of Lovelock, is in grid unit N30/W20. The cave wall in this area is smoke-stained, and it is evident that it is part of the original cave portal.

Miners Dump (N100/W100)

The last area examined by us in 1969 was the guano miners dump ("MD") located on the hillside below the edge of the outer rockshelter. Part of this mantle of debris had been screened earlier (see Clewlow 1968:89-101), but the balance of the deposit had not been examined. The results of the recent work are reported by Clewlow and Napton (this volume).

This concludes our summary of the 1968-1969 excavations in the interior and outer rockshelter of Lovelock Cave. These data permit us to offer, as the concluding section of this report, a tentative synthesis of the stratigraphy and chronology of Lovelock Cave.

THE STRATIGRAPHY OF LOVELOCK CAVE

The discovery of an undisturbed remnant of midden or cultural material under massive rock C in grid unit N50/W35 and made available for the first time abundant stratified materials that can be used for isotopic age determinations, palynological analysis, particle-size fractionation, and other types of analyses. The following synthesis of the stratigraphy of Lovelock Cave is based primarily on data from the above location and from Harrington's excavations of 1924.

Figure 23 depicts a cross section of the cave along a transect designated by us as section I-J, following Loud and Harrington (1929, pl. 2). The axis

of this section roughly parallels their reference line A-B, which describes a transverse line NW to SW about 20 feet north of line I-J. The upper contact surface of the white lacustrine deposit is used by us as a common reference marker in the six enlarged cross-sections appearing in Figure 23. The deposits found in the course of our excavations in Lovelock Cave are described below, beginning with the uppermost layers.

Upper Guano Layer: We were unable to find any trace of the upper, or "Later Guano" layer, which was the deposit mined in 1911, although some remnants of it may exist under various rocks. This stratum, described by Hart (Loud and Harrington 1929:168), is apparently not present under rock C, which probably fell before the guano layer began to accumulate.

Midden Strata: The strata, from the surface of test unit NSO/W35 to the abrupt contact with the buried surface of the "Older Guano", consist of several discrete layers of midden trash interfingered by layers of sand, dust, and rubble. Unit NSO/W35 contains at least three discernible trash layers, each of which could represent an occupation horizon. The vegetal component of these strata is remarkably well preserved (pl. 12). Radiocarbon determinations were made on several samples of this material (table 4).

Older Guano Layer: We have continued to employ Harrington's term for this deposit in order to facilitate comparison of the stratigraphy of lot 15 and other units in the cave. The Older Guano seems to have occurred throughout the cave, except in the central part of the chamber, where it was removed by the guano miners. The characteristics of the various organic samples are given in Table 2.

Samples of the Older Guano layer were taken from the north profile of grid unit NSO/W35 at two-inch intervals. The existing surface of this stratigraphic unit is formed by a layer of rat nest material which accumulated under rock C. Each sample of the stratified debris under rock C weighed about 400 grams.

In the laboratory the samples were poured onto a large grid ruled in centimeter squares, and the composition of each sample was estimated as a volumetric percentage, using the same techniques employed in analysis of the Lovelock Cave coprolites. The data given in Table 2 indicate that this technique is useful in providing a rapid means of assessing the organic and inorganic contents of the midden. There are, of course, other techniques, such as sieving and gravimetric quantification, that yield much more precise data, and these procedures will be applied when larger samples of the test unit are obtained in 1970.

Table 2

Composition (estimated volumetric percentage) of Sediment Samples from Lovelock Cave and Radiocarbon Determinations, Grid Location NS0/W35, Samples 64:1428 - 68:1466, Collected in 1969 (Approximate Weight 400 gms. per Sample)

Depth (Inches)	Tule	Quids	Grass	Charcoal	Wood	Shell	Insects	Guano	Bones	Feathers	Fur	Bat Fur	Hair	Human Hair	Sand	Rock	Artifacts
1 - 2			tr	tr						tr					80	10	
2 - 4	5		tr	tr					tr	tr					90	5	
4 - 6	tr		5		tr				tr	1					80	5	
6 - 8	5		20	tr	tr					3					65	10	***
6	66:1432 A.D. 440 (I-4629)																
8 -10	5		5					tr		tr					90	tr	
10-12		tr	tr												90	tr	
12-14			tr		tr					tr					90	5	
14-16			tr		tr				tr	tr					90	5	
16-18	tr		30		tr				tr	tr					60	5	***
19	66:1438 660 B.C. (I-4630)																
18-20	tr		30		tr				tr	tr					60	tr	
20-22	tr		35	tr	tr					tr					65	tr	
22-24			10		tr			tr[a]	tr	tr			tr		80	5	
24-26			tr		tr			20	tr	tr		tr			70	5	
26-28			tr					25	tr	tr					70	5	
28-30			tr	tr	tr			15	tr	tr		tr			80	5	
30-32			tr	tr	tr			20	tr	tr			tr		80	tr	
32-34			tr	tr	tr			10	tr	tr			tr		90	tr	
34-36	tr		tr	tr	tr			5	tr	tr					90	5	
36-38	tr		30	tr	tr			tr	tr	tr		tr	tr		65	5	
38-40	10		40	tr	5			5	tr	tr			tr		25	tr	
40-42	tr		tr	tr	tr			90	tr	tr			tr		tr	5	
42-44	tr		tr		tr			95	tr	tr		tr	tr		tr	tr	
43	68:1453 2320 B.C. (I-4632)																
44-46	tr		tr	tr	tr			95	tr	tr		tr			tr	tr	
46-48	tr		tr	tr	tr			95	tr			tr			tr	tr	
48-50	tr		tr	tr	tr			95	tr	tr		tr			tr	tr	tr[b]
50-52	tr		tr	tr	tr			90	tr	tr		tr			10	tr	
52-54	tr		tr	tr	tr			95	tr	tr		tr			5	tr	
54-56	tr		tr	tr	tr			95	tr	tr		tr			5	tr	tr[c]
56-58	tr		tr	tr	tr	tr		95	tr	tr				tr	tr	tr	
58-60			tr	tr	tr		tr	95	tr	tr		tr			tr	tr	
60	68:1464 2570 B.C. (I-4633)																
60-62	tr		tr	tr	tr		tr	95	tr	tr		tr			tr	tr	tr[b]
62-64			tr	tr			tr	95	tr	tr		tr			tr	tr	
64-66				tr			tr	15	tr			tr			80	05	

*** = occupation level
a = owl pellet
b = cordage
c = net fragment

The guano layer is composed of fecal pellets deposited by cave-dwelling bats. Guano layers are found in many of the archaeological cave sites in the Great Basin, and the mere occurrence of these layers is often taken as evidence in support of various conjectures (which ultimately become someone elses' "facts") concerning supposed environmental alterations that might have occurred in the vicinity of the site. The well preserved guano layer in Lovelock Cave afforded a very good opportunity for us to attempt to determine the species of bat living in the cave, and its environmental and food requirements.

A mummified bat (22:391) found in the guano has been identified as an immature individual, probably two or three weeks old, of the genus Myotis cf. yumanensis (Pearson, personal communication, 1970). Hair samples from the "Older Guano" layer are from bats belonging to the cave dwelling genus Tadarida cf. brasiliensis. (For information on generic identification of bats by hair structure, consult Benedict[1957:285-548]. Background information on the bats of Nevada will be found in Hall [1946:127-171] and Cockrum and Musgrove [1964:636-637].) Dr. Pearson states that various species of Myotis gather in warm caves in groups called "nursery colonies." Myotis yumanensis has a wide range, extending from Lake Tahoe down to the Colorado River; therefore, its environmental constraints are not very specific. Dr. Pearson states:

> While both species would have needed water to drink every day, even a small puddle is enough to water a large number of bats. Neither Myotis or Tadarida require water to breed insects for a food supply.

One might theorize that the bats colonized Lovelock Cave following amelioration of ecological conditions in the immediate vicinity of the site. It is essential to bear in mind the fact that Humboldt Lake, located about two miles from the cave, could have been converted, in a matter of a few years or even during a single year, from a desolate, wind-scoured playa totally devoid of vegetation (pl. 1), to a comparatively lush, well-vegetated lacustrine environment of potentially high carrying capacity (pls. 17 and 18). This transformation could have been achieved without drastic climatological change, merely by maintenance, for a few consecutive seasons, of an adequate water supply in Humboldt Lake, located 2.0 miles northwest of the cave (pls. 19, 20). It is possible that the lake was dehydrated during the Altithermal (Antevs 1948). By Medithermal times, however, it might have rejuvenated sufficiently to support a colonial growth of vegetation, and, eventually, an extensive growth of hydrophytes and a large insect population, which in turn, provided food for the bat population of the cave. Jennings (1957:92) has advanced a similar explanation for the occurrence and development of the thin guano layer in level III of Danger Cave. Leonard Rockshelter, not far north of Lovelock Cave, contains a depositional layer attributed to the Altithermal

climate period of the Postglacial which is interpreted as reflecting a long period of desiccation of Humboldt Lake (Heizer 1951:89-98).

It is true, of course, that many species of bats feed over water (Hall 1946:128-129) and it is likely that the older and later guano layers in Lovelock Cave formed as a result of conditions such as those outlined above. However, one of the most knowledgable students of the bats of Nevada pointed out to us that the two largest known colonies of cave-dwelling bats now extant in Nevada are located at least 50 miles from the nearest large body of water (Alcorn, personal communication, 1969). This information does not, of course, refute the possibility that the explanation given above is the correct one. However, in an effort to resolve the problem we processed a large sample of the older bat guano and isolated the insects that it contained. The insects in the guano layer came from three sources: (1) insects ingested by the bats and contained in fecal pellets; (2) insect parts that were not ingested, but were dropped from the roost sites on the cave ceiling; and (3) bodies of various insects that might have lived in the guano. The guano layer contained an incredible quantity of insect remains, and it is of considerable interest to discover that almost all of the insects deposited in the guano by the bats are desert-dwelling, non-aquatic species (Chemsak, personal communication, 1970). Dr. Chemsak states that very few of the insects represented species usually associated with aquatic habitats.

Additional information on food habits of Nevada bats is given by Fautin (1946:277), who counted the remains of 43 scorpions and 17 sand crickets which had been consumed by bats (Antrozous pallidus) over three successive nights. Hall (1946:152) examined food remains on the floor of charcoal kilns and found insects, camel crickets, and elytra of Scarabaeid beetles. (See also Hatt 1923: 260-261.)

In summary, we can say that the development of the Older Guano layer and the beginning of human occupation of the cave occurred at about the same time, but the occurrence of guano layers in cave sites does not necessarily give evidence of local or regional climatic alterations. Study of the insect parts in the bat guano is continuing.

Ash Stratum: The ash stratum located between the older guano and the white deposit probably resulted from charring of the guano, but additional study will be needed to confirm this opinion.

White Deposit: We have quoted or cited most of the statements made by Loud and Harrington (1929) in reference to the "lime" or "lacustrine" deposit found beneath the cultural stratum of the cave. In his description of level 5 of lot 15, Harrington (1929:22) mentions the "white lacustrine deposit" forming the bottom of the cave. Elsewhere (ibid:4,9,15, and 17), in referring to this feature, it was his tacit assumption that the "white deposit" is lacustrine in

origin, probably consisting of sediment deposited by the receding waters of Pleistocene Lake Lahontan. If this is true, the white deposit was laid down circa 12,000-10,000 years ago (Morrison 1965, table 1; fig. 4D, see also Broecker and Kaufman 1965, table 1). Broecker and Orr (1958:1027) state:

> Thus far no evidence for a major post-11,000 year oscillation [of Lake Lahontan] has been found in the sediment sections.

The strata above the white deposit were laid down in the last 6000 years, if the isotopic dates of the guano strata are any criteria, indicating that there is a disconformity of some 6000 years duration between the two layers, if the lower white deposit does in fact refer to the recession of Lake Lahontan. The surface of the white deposit dips toward the west end of the cave, and it is difficult to believe that a deposit of lacustrine origin would assume an incline tangential to the water surface level. The entire limestone unit containing the cave could have been tilted by faulting. However, the Lahontan shorelines above and below the cave are nearly horizontal.

The chemical composition of the white deposit has recently been established by spectroscopic analysis of three samples, one each from the "AN" area (S10/W50, depth 76.4, sample No. 71:1503), "ME" area (S5/W10, depth 78.7, sample No. 22:400), and "WE" area (S35/W70, depth 69.0, sample No. 69-1469). These samples were processed in the laboratories of the U.S. Geological Survey, Menlo Park, California. The analyses demonstrate that the material in question is mostly sodium chloride and potassium chloride, forming a mineral commonly known as "halite" (Tatlock, personal communication, 1969), which is usually formed by precipitation of minerals from standing water, or by cyclic evaporation and rejuvenation of mineral-charged waters. There are large deposits of halite, anhydrites, and other evaporites on the surface of playas near Lovelock Cave. Another occurrence of a halite-like deposit is in Danger Cave, Utah (Jennings 1957:62,73-75,92-93) between levels II and III, the second and third depositional units above level I, the basal strata of the cave. Level II in Danger Cave has an isotopic age determination of 7839 B.C.$\pm$630 (C-6111); level III dates are 5150 B.C.$\pm$150 (GaK-1897) and 4620 B.C.$\pm$110 (GaK-1901) (Jennings, personal communication, 1969). The level III dates in Danger Cave are approximately concordant with the date of 4054 B.C.$\pm$250 (C-278) obtained from the unburned guano layer situated immediately above the Lovelock halite stratum. It may be mere coincidence that the dates are nearly synchronous, but the chemical compositions of the halites from each cave are remarkably similar (table 3).

Table 3

Chemical Analyses of Evaporites from Lovelock Cave, Nevada (NV-Ch-18)

Lovelock Cave Evaporite[a] (S5/W10) (64:1424)		Danger Cave Chemical Analyses of Salts[b] 1950		1951[d]	
C	0.51	Free H_2O	5.56	NaCl	21.42
H	0.29	Insoluble acids	8.56	KCl	6.42
Ca	8.8	$CaCO_3$	19.85	Na_2SO_4	13.75
SO_4	4.08	KCl	7.36	MgCl	1.04
Cl	3.58	NaCl	28.21	$NaNO_3$	1.73
		Na_2SO_4	18.09	Na_2CO_3	10.19
		NA_2SO_3	5.74	S_1O_2	7.96
		$NaNo_3$	.374	$CaCO_2$	18.74
		P_2O_5	.34	$MgCO_3$	2.11
			94.084[c]	Fe_2O_3	1.95
				$Ca_3(PO_4)_2$	1.05
				H_2O	5.78
				Organic (Soluble)	4.70
				Organic (Insoluble)	.40
					99.72

a. Analysis by H. Rapoport, Department of Chemistry, U.C.B.
b. After Jennings (1957, Table 9).
c. Balance was probably water and organic matter.
d. A 1953 sample virtually duplicated the 1951 specimen.

The "Salts" in Danger Cave did not uniformly overlie the level II strata, but occurred as a small "dike" or discrete member near the cave entrance. Jennings believed that the salts resulted from alternate periods of wet and dry conditions perhaps produced by sheetwash or groundwater which entered the cave, ponded, and eventually evaporated. We believe that the evaporites in Lovelock Cave probably had a similar origin. This deposit should be explored to a sufficient depth to expose the limestone bed of the cave.[8]

CONCLUSIONS

Hypothetical Sequence of Events in Lovelock Cave

The massive bed of Jurassic limestone in which Lovelock Cave is situated has been subjected to a variety of seismic and tectonic forces, including severe local folding and extensive erosion produced by wave action of Pleistocene Lake Lahontan. The collective effects of these forces has brought the cave to its present configuration. Some of these events, although very recent in terms of the geological time scale, have drastically effected human occupation of the cave. The hypothetical sequence of some of these events is outlined in the following section.

In our introductory comments we stated that the earliest geological event of immediate concern in studying the archaeology of Lovelock Cave is the initial development of the cave in a massive unit of Jurassic limestone. Dr. R.C. Speed (personal communication, 1970) has suggested that the cave was formed as an opening between a flexed upper unit which was thrust over unflexed subjacent strata. It is possible that the hinge region was strongly strained or fractured; therefore, the exposed hinge region was rapidly eroded by Lake Lahontan.

L. L. Loud (1929:30) states that the cave was located just above the Dentritic terrace of Lake Lahontan (see Russell 1885), and asserts that at one time the cave was "perhaps a hundred feet high". This is doubtful in view of the geomorphology of the site, but at the same time it is evident that wave action played a major part in its formation. Strand lines are visible both above and below the cave.

Tufa layers occur both inside and outside the cave (fig. 5, event 1). The tufa deposits inside the cave were not mentioned by previous investigators. The west end of the cave, which is more stable and is less subject to shearing than the roof of the east end, still supports a deposit of tufa eight to ten inches thick, and the opposing faces of some of the vertical fissures in the ceiling of the east end of the cave are covered with tufa. Much of the tufa deposit inside the cave has been destroyed by collapse of the cave ceiling. Large slabs of limestone with adhering tufa must lie buried in or beneath the white deposit in the east end of the cave.

Not long after Lake Lahontan finally withdrew below the level of Lovelock Cave, a huge block of limestone detached from the cave roof near the portal and fell into the west end of the cave. This block (fig. 5, event II, rock A) is some 50 feet long, 25 feet wide and 15 feet thick. Excavation demonstrated that the outer surface of the rock, which once formed part of the overhanging cliff above the cave portal, bears the weathered remnants of tufa, but nearly all traces of tufa have long since been eroded away from the cliff above the fallen rock. The west end of rock A is situated in such a way as to

form two important features of the cave: a discrete chamber or "alcove" in the upper west end of the cave, and the "west crevice," the narrow, constructed passage between rock A and the west wall of the cave (fig. 10). Both of these features contain cave debris of various kinds, including twigs, grass, aeolian sand, and roof scalings. Harrington (1929:17-18) found several artifacts and some human bones under the inner edge of rock A inside the cave, but these specimens surely were cached after the rock fell, rather than having formed part of an old midden deposit that had been laid down before the rock fell. The underside of this monolith is free of smoke-stain and cave varnish, the absence of which is important, in view of the fact that a thick deposit of hydrocarbons occurs on the undersides of rocks B and C in the northeast end of the cave.

It is possible that the initial occupation of the cave began soon after the fall of rock A. The central and east end of the cave remained open, with an estimated floor-to-ceiling clearance of at least 15 feet and a proscenium some 50 feet long, extending from the east end of rock A to the solid rock abutment at the east end of the cave portal (fig. 5, event II).

The depositional occurrences of "Event II" are as yet almost wholly unknown, and can be revealed only by extensive deep-probing tests of the white evaporite deposit. We do not know what kind of strata occur under the evaporite, nor do we know why the water-formed evaporite deposition ceased, to be succeeded by the older guano deposit, unless this occurrence represents the last recession of Lake Lahontan. It is possible that a temporal discontinuity of considerable magnitude is indicated between cessation of evaporite deposition and the beginning of guano accumulation. On the other hand, there may be no disconformity, but the problem cannot be settled without further excavation of the evaporite deposit.

The cave was occupied by bats at a date coinciding with the estimated end of the Altithermal (Antevs 1948), perhaps as a direct result of rejuvenation of Humboldt Lake. The problem could be investigated by study of an extensive series of core samples taken from the bed of Humboldt Lake. The initial buildup of the older bat guano layer may have begun circa 5000 B.C. A radiocarbon date (C-278), obtained in 1948 by solid carbon analysis, indicates that the lower part of the layer had begun to accumulate at least by 4000 B.C. (table 4).

Table 4

Radiocarbon Age Determinations, Lovelock Cave, Nevada (NV-Ch-18)

Sample No.	Material	$\delta - C^{14}$	Age B.P.	B.C./A.D. date	UCB Grid Location & Identification No.
UCLA 1071-E	Human Coprolite		145 ± 80	A.D. 1805	NSO/W55 (ENT-R.C.1)
I-4672	Scirpus seed	63 ± 11	520 ± 95	A.D. 1430	S10/W95 (82:1577)
UCLA 1071-F	Human Coprolite		1210 ± 60	A.D. 756	N30/W5 (INT-R.C.2)
I-3963	Human Coprolite	167 ± 9	1470 ± 90	A.D. 480	NSO/W30 (LX-10)
I-4629	Vegetal Material	171 ± 9	1510 ± 90	A.D. 440	NSO/W35-6 (66:1432)
UCLA-1418	Human Coprolite		1600 ± 50	A.D. 350	NSO/W30 (LX-16)
UCLA-1459-B	Human Coprolite		1650 ± 60	A.D. 300	S20/W100 (WA-20-A)
C-728,729,730	Basketry		1672 ± 220	A.D. 268	*
UCLA-1459-A	Human Coprolite		1830 ± 60	A.D. 120	S20/W100 (WA-21)
UCLA-1417	Vegetal Material		1900 ± 60	A.D. 50	NSO/W30 (LX-56)
C-276	Vegetal Material		2481 ± 260	531 B.C.	*
I-4630	Vegetal Material	277 ± 11	2610 ± 120	660 B.C.	NSO/W35-19 (66:1438)
C-735	Basketry		3168 ± 260	1218 B.C.	*
I-4758	Human Muscle Tissue	343 ± 8	3370 ± 100	1420 B.C.	*** (13-4954)
UCLA-1459-C	Human femur		3400 ± 80	1450 B.C.	S40/W85 (F-5 Femur)
I-4631	Vegetal Material	391 ± 9	3980 ± 120	2030 B.C.	NSO/W35-37 (67:1448)
I-4632	Bat guano	412 ± 8	4270 ± 110	2320 B.C.	NSO/W35-43 (68:1453)
I-4634	Bat guano	424 ± 9	4430 ± 130	2480 B.C.	NSO/W35-64** (68:1465)
C-277	Bat guano(B)		4448 ± 250	2498 B.C.	*
I-4633	Bat guano	430 ± 8	4520 ± 110	2570 B.C.	NSO/W35-60** (68:1464)
I-4673	Bat guano(B)	435 ± 8	4580 ± 120	2630 B.C.	S35/W70 (121:1654)
I-3962	Bat guano, veg.	442 ± 8	4690 ± 110	2740 B.C.	S10/W50(AN-16) (80:1556)
C-278	Bat guano		6004 ± 250	4054 B.C.	*

Notes to Table 4 on following page.

Notes to Table 4

* Original sample identification number not given.

** The apparent inversion of the ages of NSO/W35 sample 64 and NSO/W35 sample 60 is due to an error made in recording depths when the samples were collected; however, both samples are from the same stratigraphic component of the Older Guano layer; depth about 60 inches below the surface of the test unit.

*** Mummy found in Pit No. 35 (Loud and Harrington 1929:16).

The earliest evidence of human occupation that we have found up to the present time occurs in the Older Guano layer, age circa 2700 B.C.; however, at this time the cave was only intermittently occupied by man. Bats and other creatures continued to inhabit the cave until about 2500 B.C., when human occupation increased. We do not know why the cave suddenly (as it seems) became such a popular occupation site, circa 1500 B.C. One of the inhumations on the Humboldt Lake site (NV-Ch-15) has been dated at 733 B.C.±250 (M-649), so it is evident that the lakeshore was occupied at this time, but, as in the case of Lovelock Cave, we do not know the reason for the dramatic increase in occupation of this site.[10] It is evident that the fluctuations of human occupation of the cave and lakeside sites probably coincided with the oscillations of Humboldt Lake.

By the time of Event III (fig. 6), a considerable deposit of cultural material began to accumulate above the Older Guano. According to Harrington (1929), the midden deposits were 10 to 15 feet thick in the west end of the cave. We believe that intensive occupation of the cave began circa 1500 B.C. and continued until about A.D. 500. At this time, certainly no earlier, occurred Event IV (fig. 6), a massive rockfall probably triggered, as Harrington (1929:120) remarks, by some forgotten earthquake. Five or six extremely large blocks of limestone were dislodged from the ceiling of the cave and crashed down upon the occupational refuse left by the Indians. One hopes that no one was in residence in the cave at that exact moment. We say this charitably, because the value of any human casualties as subjects for paleopathological study would be considerably diminished by the impact of several tons of limestone. The nether side of rock C is thoroughly smokestained. The approximate date of the rockfall (A.D. 440±90) is indicated by radiocarbon sample I-4629, but this date is obtained from vegetal material that had accumulated prior to the rockfall. The exact date of the rockfall probably can be determined by isotopic analysis of samples taken from the impacted vegetal debris under rock C. It is likely that rocks B, C, and D fell at the same time. All are smokestained; all came from the same shear-zone; all rest directly on masses of occupational debris. The east and central part of the cave portal was gradually being reduced in height by the slow accumulation of occupational trash and other

cave debris, but prior to the Event IV rockfall the entrance was probably wider, and part of the human activity in the cave probably took place in this area.

The massive rockfall of Event IV (fig. 6) wrought great changes in the cave. Rocks B and C virtually sealed the cave portal, restricting access to the interior of the cave to a narrow, slanted cleft between rocks A and B. It is possible to theorize that since access to the interior of the cave was greatly impeded by the rockfall, the Indians began to occupy the outer rockshelter (fig. 7, event V). The interior of the nearly closed cave was quite dark, particularly in the center and east end of the chamber, but the site continued to be used as a repository for the dead and for caching valued articles.[11] Human occupation of the interior of the cave was drastically curtailed, and this, together with reduced illumination and air circulation, made it all the more attractive as a dwelling place for bats. Thus, between A.D. 700 and A.D. 1911, a thick deposit of bat guano accumulated over the cultural deposits, reaching, according to Hart (1929:168), depths of four to six feet. Human occupation of the outer rockshelter and infrequent use of the cave interior probably continued, if we correctly interpret the results of our recent excavations, until 1829, when Peter Skene Ogden and his comrades, the first white men to explore the lower reaches of the Humboldt River, arrived at Humboldt Lake, signalling the beginning of the end of the long history of exclusive Indian occupation of the lakeshore open-air and cave sites.

The date of abandonment of Lovelock Cave can probably be estimated, but it is difficult to do this because of the lack of post-contact European goods in the cave midden. The apparent absence of post-contact goods in the artifact inventory of this site has contributed to the widely-held belief that the cave was abandoned prior to 1829, when Ogden and his party reached Humboldt Lake (Cline 1963)." However, in 1833, near Humboldt Lake, members of the Bonneville-Walker expedition encountered a large group of Indians--33 of whom were slaughtered as a punitive measure. The following year, on their return trip from California, members of the same expedition killed another 14 Indians, setting the stage for long-term Indian-white hostilities."

These events, augmented by the rapid westward spread of disease in 1849, led to abandonment of the lakeshore sites (Hopkins 1883; Scott 1966). By 1849, of course, the Big Meadows northeast of Lovelock Cave had become a staging area for the California-bound emigrants, prior to their trek across the dreaded Forty-mile Desert that lay west of the Humboldt Sink. In 1869, less than 40 years after the first exploration of the valley, permanent settlers took up residence near the town of Lovelock. A few Indians continued to camp near the lake (Loud 1929:152-164), and to the present day a small "colony" of Northern Paiute live in the town of Lovelock--the last remnant of the once large Indian population of the valley (Heizer n.d.).

It would appear, on the basis of the evidence now at hand, that Lovelock Cave was not totally abandoned circa A.D. 900, as Grosscup (1960:12) suggested, but was visited until as late as 1829, and perhaps until as late as 1849, although there is no firm evidence for use of the cave at that late date. The gun parts found in the west alcove of the cave suggest late use of the site, but additional evidence has not been found--or has never been reported. We allude to the fact that when Loud catalogued the first of his finds in Lovelock Cave (Lowie Museum accession No. 443), he recorded three pieces of "white man's cloth" found in lots 6, 8, and 11. These specimens may be merely scraps of material left by the guano miners who quit the cave a few months prior to Loud's arrival. However, the wording used by Loud would seem to imply that the cloth might have been used by the Indians. The specimens have not been located for study. In any case, the fact remains that there is virtually no evidence of post-contact occupation in either the cave or the outer rockshelter.

Accounts of the emigrant travel across the Forty-mile Desert describe the incredible litter of abandoned goods that had been strewn along the route. The remains of this debris can still be found, 120 years later, on the lakebed near site NV-Ch-15. If the cave were in use after 1849, when the bounty of abandoned goods became available to the Indians, it is likely that some of this material would have been retrieved by the Indians and cached in the cave. That such evidence has not been found in Lovelock Cave is probably a very good indication of the fact that the site had been abandoned prior to 1849. In this connection, Stewart (1939:139) states of the Kupadokado band who occupied the Humboldt Sink region:

> This band, being along the old immigrant road, was one of the first Northern Paiute groups to feel the disasterous effects of Caucasian contact. It was in the Kupa territory that members of Walker's exploring party (1834) shot an Indian for the fun of seeing him fall, an event that was followed by a battle in which more than twenty others were slaughtered. Since the early contact proved so calamitous, the Indians soon left Humboldt Meadows to the immigrants. Consequently, later travelers reported few or no Indians there for a number of years.

It is probable that the area was abandoned by the Northern Paiute as a result of a combination of circumstances (see Cowan 1967:21-35). We suggest 1835 as the terminal date of Lovelock occupation.

Event VI occurred in 1911, when Hart and Pugh began mining the guano deposits (fig. 7). Events VII and VIII are Loud's excavations in 1912 and Harrington's work in 1924 (fig. 8, events VII, VIII).

Lovelock Cave and Humboldt Valley Sites

One of the most important aspects of Lovelock Cave, but one of the least emphasized in most of the early publications, is the relationship of the cave

to the several large open-air occupation sites that occur along the former shore of Humboldt Lake (Loud 1929:129-133; Elsasser 1968:26-51). It has been our opinion (Heizer and Krieger 1956; Heizer and Clewlow 1968:59-88; Napton 1969:28-97) that one of the largest of the lakeshore sites (Loud's site 15, now NV-Ch-15, commonly known as the Humboldt Lakebed site, located some 2.0 miles northwest of the cave at an elevation of approximately 3900 feet) was occupied during a span of time roughly coeval to the occupational span evidenced at Lovelock Cave. The extent and former importance of the Humboldt Lakebed site has never been demonstrated adequately. Loud (1929:132) devotes a single paragraph to descriptions of this site and the other Humboldt Valley sites which he examined.

Recently, having completed extensive re-investigation of these sites, we have suggested that Lovelock Cave may have been more or less ancillary to the Humboldt Lakebed site. The elucidation of the relationship of NV-Ch-15--with its numerous house and storage pits, hundreds of milling implements, and thousands of projectile points--and Lovelock Cave, which lacks significant quantities of milling implements and other lithic materials, is of great importance in the broad picture of human occupation of the Desert West. If Lovelock Cave is a satellite of a larger, nearby, open-air site, perhaps other Great Basin caves that have been treated as discrete manifestations should be viewed in terms of their possible association with adjacent open-air occupation sites.

If we suggest that the occupants or users of Lovelock Cave were also residents of the lakebed sites, it is of course necessary to demonstrate this by means of the available evidence. The comparable radiocarbon dates of specimens from NV-Ch-15 and NV-Ch-18 furnish an important clue (see note 10), but we believe that the most obvious evidence pointing to the relationship between the lakeshore and cave sites is the fact that the caves contain great quantities of materials such as bulrush, cattails, remains of mudhens, fish, etc., which could have been obtained only at the lake. The famous decoys found by Harrington (1929:12-31;114) could have been used on the lake, of course, and the same is true of the fishnets, fishhooks, and other artifacts used in exploitation of lacustrine resources.

Lovelock Cave has long been known for the well-preserved materials that it contained. Many specimens found in the cave were obviously worn-out discards, but a tremendous number of functional artifacts were found in cache pits dug in the cave midden. The enormous mass of artifacts from Lovelock Cave, probably amounting to more than 20,000 specimens, is an impressive collection. However, in examining the cave midden, we are equally impressed with what is <u>not</u> present. Absent, or nearly so, are the ash lenses that are almost invariably found in large rockshelters and caves, absent also are large amounts of flint debitage, discarded bones of large fauna, and many other kinds of debris that were usually produced in the course of daily living in prehistoric Great Basin occupation sites. The cave might have been used seasonally, or

as a cold weather retreat, or in spring, during periods when the lakebed sites were flooded (see Napton 1969:28-97).

In short, there are enough anomalies in the Lovelock Cave occupational debris to suggest that part of the daily human activity that usually occurred in this type of Great Basin occupation site probably took place at some other location--most probably at the lakeshore villages.

Summary

Recent excavations in Lovelock Cave, Nevada (NV-Ch-18) were made to obtain additional human coprolites and archaeological data that would provide, for coprolite data previously published and for the new data appearing in this volume, a well-defined frame of reference. The excavations led to the recovery of materials that have provided the oldest radiocarbon date of culturally associated vegetal material--2740 B.C.±110 (I-3962)--and the earliest absolute cultural dates: 1450 B.C.±80 (UCLA-1459-C) and 1420 B.C.±100 (I-4758), based on radiocarbon determinations of human remains. A series of internally consistent radiocarbon determinations was produced by analysis of samples taken from one of the last existing remnants of the original cave midden.

Recent occupation of the site is evidenced by additional finds of Desert Side-notched and Rose Spring Corner-notched points. Possible post-contact occupation is indicated by gun parts found in the hitherto unexcavated west alcove of the outer rockshelter. Thus, the known occupational history of the cave has been extended to include the time from circa 2500 B.C. to circa A.D. 1835. New geological information clarifies the tectonic development of the cave and the composition of the deepest non-cultural strata in the cave. Ecological studies made in conjunction with the excavations have been helpful in reconstructing the vegetational and faunal subsistence resources exploited by the prehistoric inhabitants of the cave.

We have summarized the history of excavations in Lovelock Cave and have discussed the important relationship between Lovelock Cave and the Humboldt lakebed archaeological sites. The full significance of this relationship will be investigated during the course of further fieldwork in the lower Humboldt Valley.

Notes

1. The latitude and longitude coordinates given here are based on observations made in the fall of 1969.

2. Tufa is calcium carbonate ($CaCO_3$) formed as an incrustation on the shore of most of the Pleistocene Great Basin lakes.

3. Between 1912 and 1924 N.C. Nelson had (in 1916) at Tano, New Mexico, presented American archaeologists with the archaeological principle of stratigraphy. Harrington, and other workers such as A. V. Kidder and L. Spier, learned the lesson of how to trace cultural change by stratigraphic digging. It was this principle, unknown to Loud in 1912, which Harrington applied in 1924.

4. The date of radiocarbon sample C-735, which is 1218 B.C.$\pm$260, was originally calculated by taking the date A.D. 1954 as "present." By accepted convention (Deevey, Flint, and Rouse 1967), the year A.D. 1950 is arbitrarily assumed to be the "present" date, so the date of sample C-735 would actually be 1222 B.C., if it is to agree with the other dates given in Table 4. However, the figure 1218 B.C. is entrenched in the literature, and to avoid additional confusion we must continue to use it here.

5. The emulsion of these negatives is supported on a base of highly inflammable cellulose nitrate. Most of these negatives have been copied in order to minimize the possibility of their loss through combustion (Guadagno, personal communication, 1969).

6. There are at least 556 Lovelock specimens in the Heye Foundation collections, but only a few of these are of known stratigraphic provenience.

7. Grosscup (1960:1) gives the elevation of Lovelock Cave as "4240$\pm$20 feet above sea level," but he does not state how this figure was determined. Napton and Heizer (1969:i) and Heizer and Napton (1969:563-568) give the elevation of the cave as 4240 feet, an estimate based on the apparent elevation indicated on the U.S.G.S. Carson Sink quadrangle map, 15' series, 1951. The common corner of sections 1, 2, 11, and 12, T24N, R30W, located about one mile northwest of the cave, which was located by the U.S.G.S. field survey, is given as 3941 feet. The cave entrance is about 350 feet higher than the surface of Humboldt Lake (3889 feet).

8. This project is scheduled for June, 1970.

9. The depth scale is marked on the west wall of the west alcove.

10. The date of 733 B.C.±250 (M-649) is based on carbonized twined basketry fragments from a burial pit on the Humboldt Lakebed site (NV-Ch-15), collected in 1956. Another storage pit on the Humboldt Lakebed site is dated A.D. 1400±60 (UCLA-1071-A, Berger, personal communication, 1968).

Charcoal from an unexcavated housepit at NV-Pe-67 gave a date of A.D. 1630±50 (UCLA-1071-D, Berger, personal communication, 1968). We are reluctant to place too much confidence in the isolated radiocarbon date of 733 B.C. ±250 (M-649), since the only other date from the Humboldt Lakebed site (A.D. 1400) is considerably later.

11. The area that had been covered by rocks B and C, located just inside the cave portal, should contain evidence of domestic activity preceding the rockfall, but probably few inhumations, which, one would imagine, would have been made in the less-used east and west ends of the cave or at the back of the cave in the crevice between the midden deposit and the cave wall. After the Event IV rockfall, however, this part of the cave was a dark, out-of-the-way area; therefore, the duck decoys cached in pit 12 and the inhumation in pit 46 probably post-date the Event IV rockfall (see fig. 7).

Explanation of Figures

Figure 1. The Great Basin region and Nevada. Danger Cave, in western Utah, is located a short distance from the Humboldt River Basin in Nevada.

Figure 2. Principal archaeological sites in the Lovelock Sub-Basin, lower Humboldt River Valley, Nevada. Area of map is inset, lower right.

Figure 3. Geological map of a section of the West Humboldt Range, western Nevada, from data prepared by R. C. Speed and R. Willden. Lovelock Cave is situated in unit Jal, a Jurassic limestone outcropping discontinuously along the north face of the range.

Figure 4. Simplified schematic diagram of the tectonic development of Lovelock Cave in limestone unit Jal, West Humboldt Range, Churchill County, Nevada. The cave chamber is formed between flexed unit Jal and an unflexed substrate. The cavern is exposed in the fractured hinge fold. Tertiary colluvium covers the lower part of the limestone unit.

Figure 5. Lovelock Cave, hypothetical development. Event I: The cave is exposed (as in fig. 4), wavecut, and tufa is deposited. The hatchure denotes existing layers of tufa. Presumably, the evaporite deposit is laid down in the cave during this time.

Event II: Massive rock A falls in the west end of the cave; the cave is open to occupation by terrestrial fauna. Gauno begins to accumulate; initial human occupation occurs in the west end of the cave.

Figure 6. Event III: Principal period of human occupation of Lovelock Cave, beginning circa 2000 B.C. Minor rockfalls, much use of the cave by local fauna, continuing until A.D. 500.

Event IV: Massive rockfall (seismic activity?) closes part of cave entrance, restricts access to passage between rocks A, B, and C. Rockfall between rocks C, F, and G (indicated by dotted line) was dynamited by guano miners in 1911.

Figure 7. Event V: Rate of deposition of occupational litter in the interior of the cave is reduced as human occupation shifts to the outer rockshelter. Interior of the cave used as repository for the dead (pit 46) and for storage of valuables (decoys, pit 12). "Later Guano" layer accumulates in the interior of the closed cave.

Event VI: Guano mining, A.D. 1911. Tunnel (indicated by broken lines) is driven through rockfall. Stipple indicates extent of removal of "Later Guano" deposit. Note "ramp" left by guano miners. This feature was excavated by Harrington in 1924.

Figure 8. Event VII: Excavations in Lovelock Cave, Nevada by Llewellyn L. Loud (after Grosscup 1960, fig. 2). Note the lateral extent of lots 9 and 38. The location of lots 1, 2, 4, 5, 7, 15, 20, 21, and 24 were omitted on all known maps of the cave prepared by Loud.

Event VIII: Excavations in Lovelock Cave, Nevada in 1924 by M. R. Harrington and L. L. Loud, sponsored by the Museum of the American Indian, Heye Foundation, New York. Cache pits recognized by Harrington are indicated by dots, burials by squares.

Figure 9. Event IX: Excavations in Lovelock Cave, Nevada, 1968-1969, by University of California field parties supervised by R. F. Heizer and L. K. Napton. Grid orientation is magnetic north. The principal datums (UCB-A; UCB-B) are indicated. Contour interval is one foot.

Figure 10. Interpretive isometric projection of Lovelock Cave indicating approximate location of major rocks A-H, test units of 1968-69, and other features of importance. The drawing is not to scale.

Figure 11. Lovelock Cave, Nevada (NV-Ch-18), "LX" area and massive rock C. Grid location NSO/W35 is indicated under rock C.

Figure 12. Lovelock Cave, Nevada (NV-Ch-18), cross section, grid unit NSO/W40 and rock C. The sketch depicts the "hinge-effect" fracture of rock C, which detached from the cave roof and rests on the underlying midden debris. The approximate of the outer rockshelter deposit, excavated by Harrington in 1924, is indicated in the upper right corner.

Figure 13. (See Explanation of Plates, pl. 12.)

Figure 14. Lovelock Cave, Nevada (NV-Ch-18), location NSO/W35. Graphic projection of radiocarbon date determinations plotted against chronology and stratigraphy. The exponential curve indicates that a sample of organic debris from 30 inches below the surface in this part of the cave might date circa 1600 B.C.

Figure 15. Lovelock Cave, Nevada (NV-Ch-18), section showing pits 9 and 10. (Loud and Harrington 1929, fig. 3). The sketch depicts, in an idealized cross-section, the north profile of the midden deposit near massive rock E.

Figure 16. Lovelock Cave, Nevada (NV-Ch-18), "LX" area, NSO/W30, west and north profiles, showing location and shape of empty cache pit No. 49 (feature No. 1).

Figure 17. Lovelock Cave, Nevada (NV-Ch-18), unit NS0/W35, hardpacked "floor" on the surface of the Older Guano layer, depth 41 to 43 inches.

Figure 18. Lovelock Cave, Nevada (NV-Ch-18), "AN" area, S10/W50, unit profile, view west. Note the relationship of the "Entrance" coprolite crevice and the slope under rock B.

Figure 19. Lovelock Cave, Nevada (NV-Ch-18), "AN" area, S10/W50, north profile.

Figure 20. Lovelock Cave, Nevada (NV-Ch-18), "WA" area, S10/W95, upper level, stratigraphic profile. View north, surface to 18 inches below the surface. Bulrush seed from Layer III provided a radiocarbon date of A.D. 1430±95 I-4672).

Figure 21. Lovelock Cave, Nevada (NV-Ch-18), "EE" area, N25/E25, contact of tufa layer and evaporite stratum. View east.

Figure 22. Lovelock Cave, Nevada (NV-Ch-18). Reported or observed occurrences of white evaporite deposit, showing source of samples used in chemical analyses.

Figure 23. Lovelock Cave, Nevada (NV-Ch-18). Stratigraphic schematic profile of cave deposit with cross sections of test units and sources of radiocarbon samples collected between 1948 and 1969. The "culture-chronology" of the cave, as proposed by Grosscup (1960) and Loud and Harrington (1929) is indicated on the left hand side of the diagram.

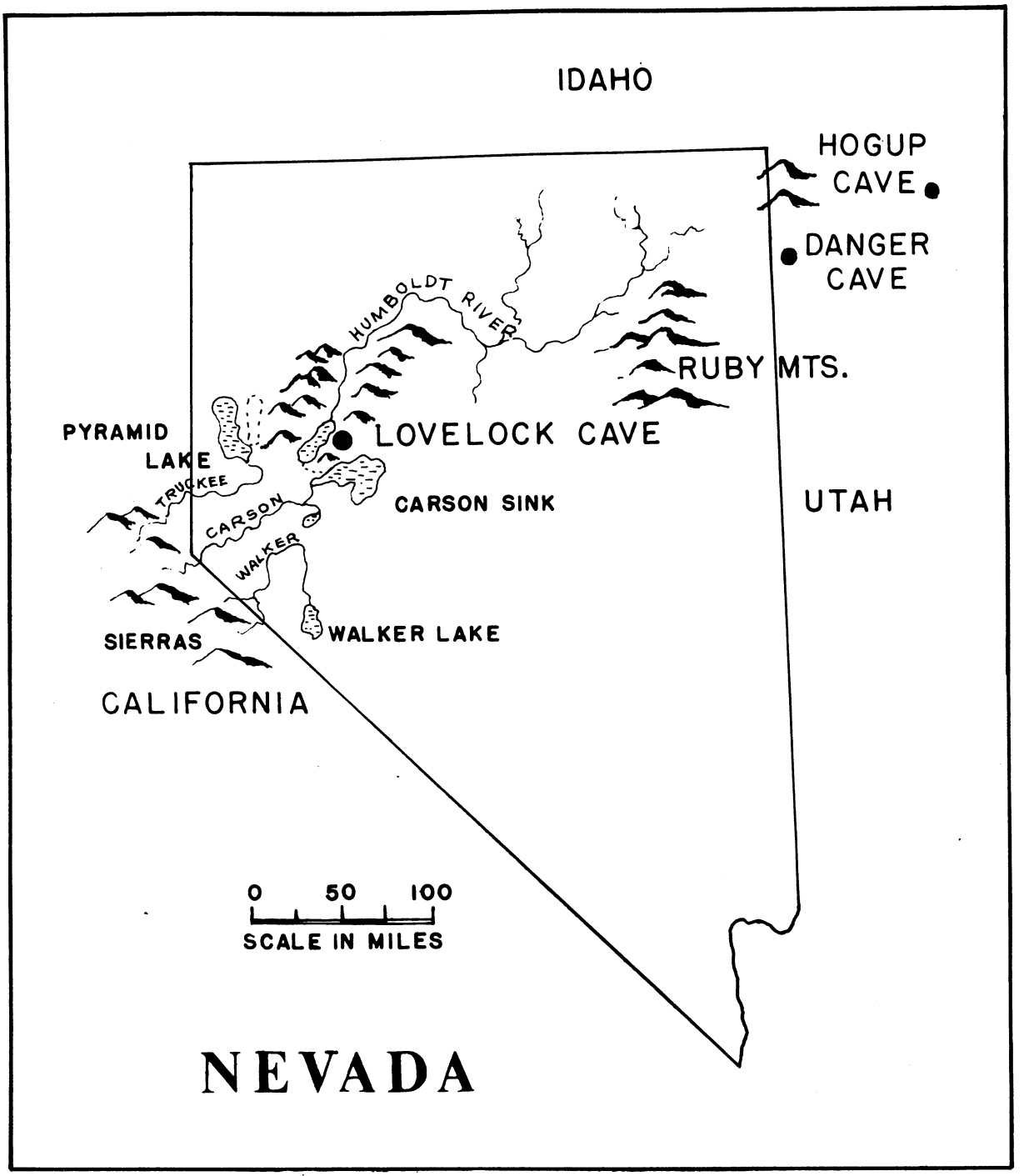


Figure 1. Location of Lovelock Cave (NV-Ch-18), Nevada

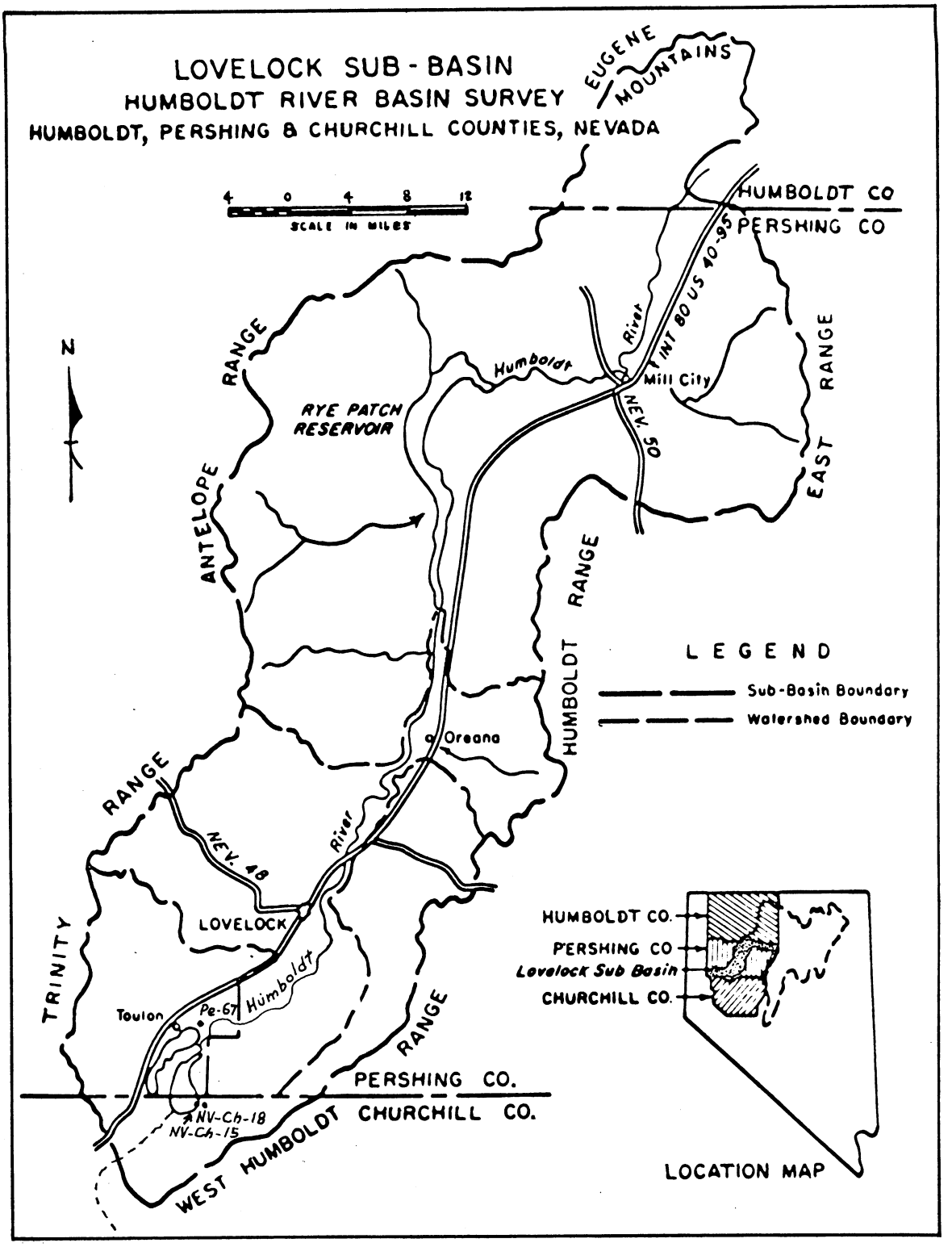


Figure 2. Lovelock Sub-Basin, Nevada, showing location of Lovelock Cave and the Humboldt Lakebed site (NV-Ch-15)

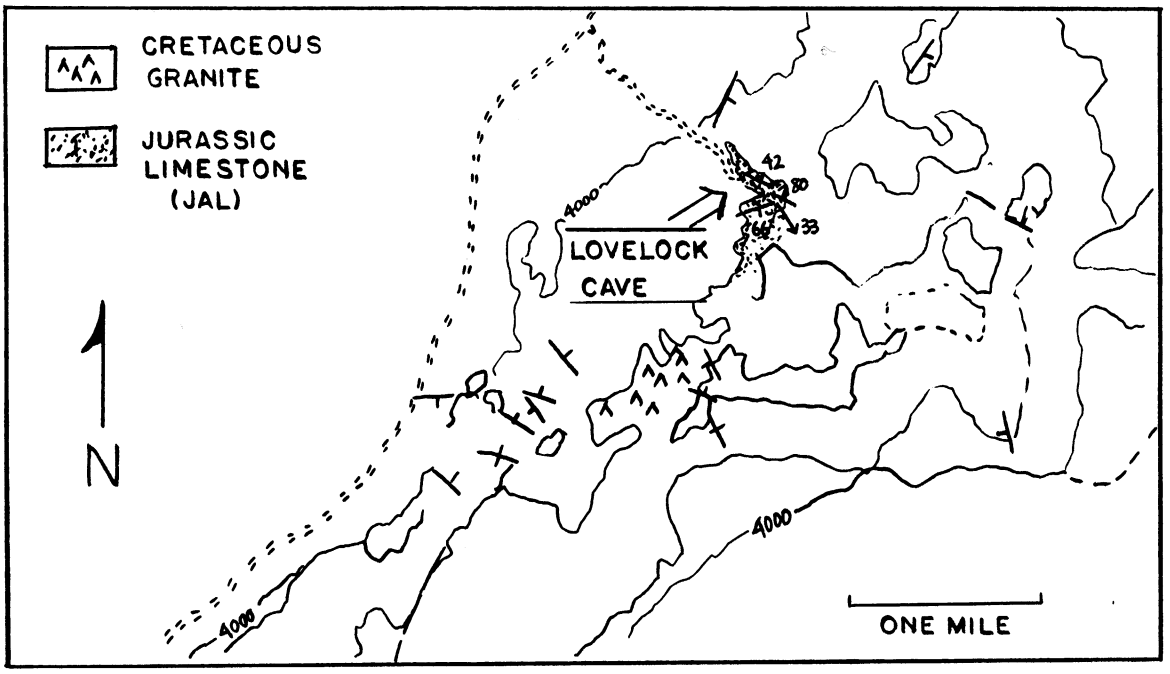


Figure 3: Geology of the vicinity of Lovelock Cave (NV-Ch-18), Nevada, showing portion of the West Humboldt Range. (Data from Speed and Willden n.d.).

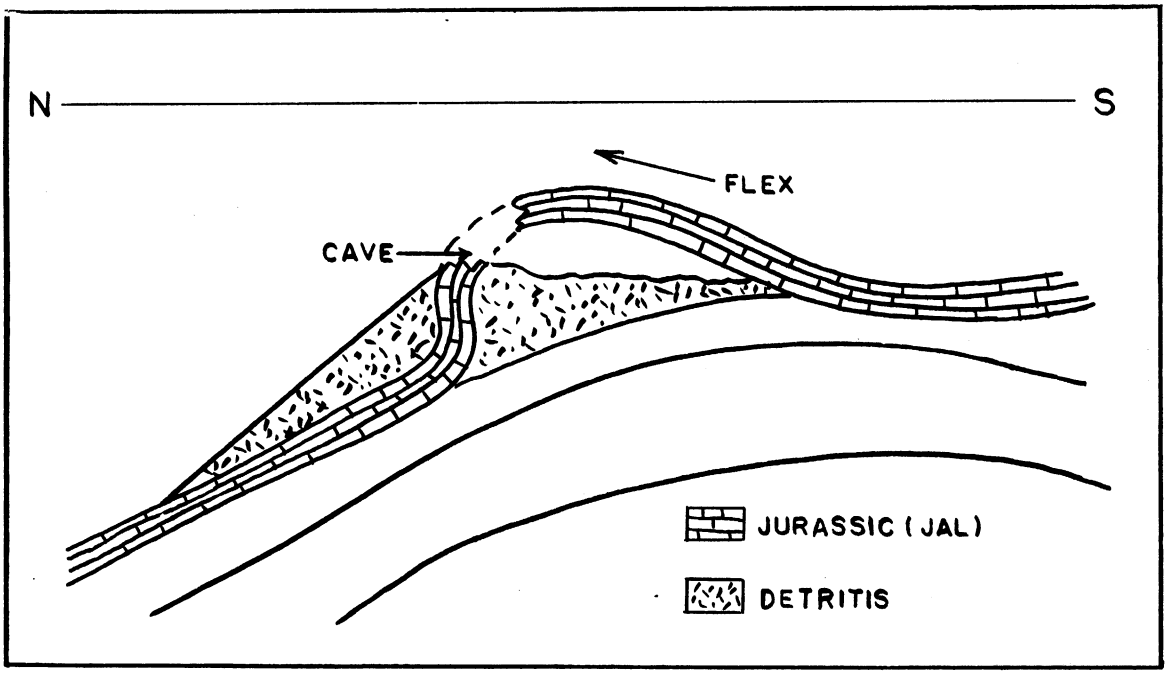


Figure 4: Structural geology of Lovelock Cave. Interpretation by the author, based on observations made by R.C. Speed.

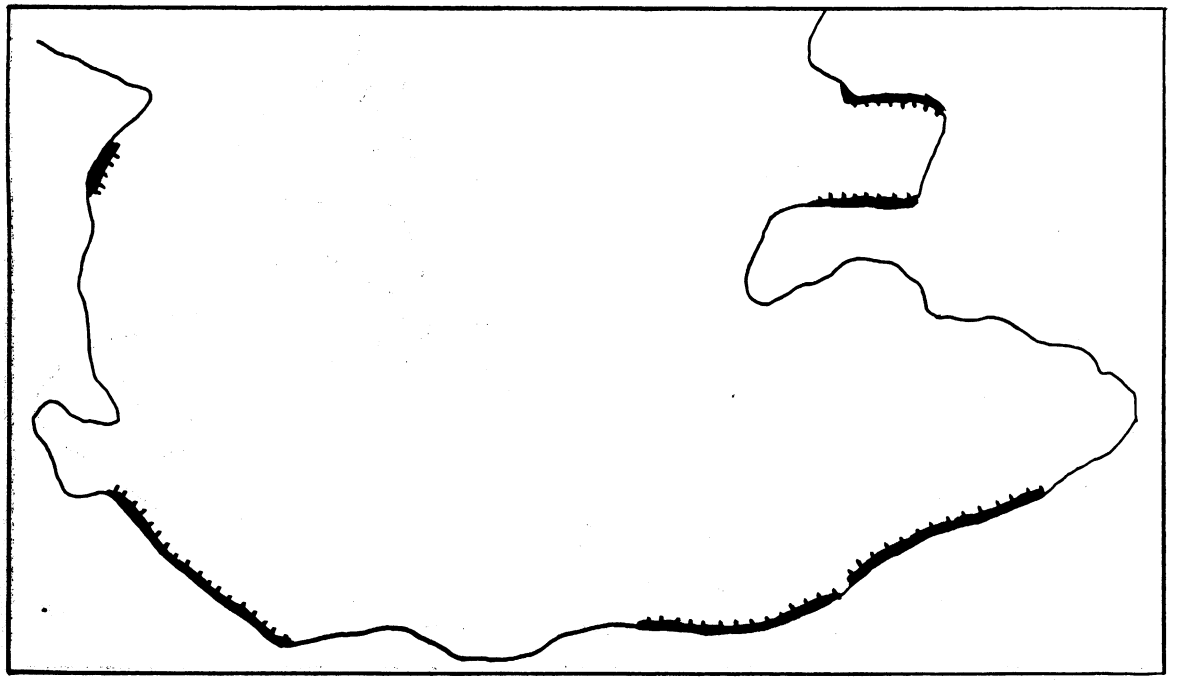


Figure 5: Lovelock Cave, Events I and II. Cave chamber exposed, wave erosion; tufa layers formed. = Existing tufa

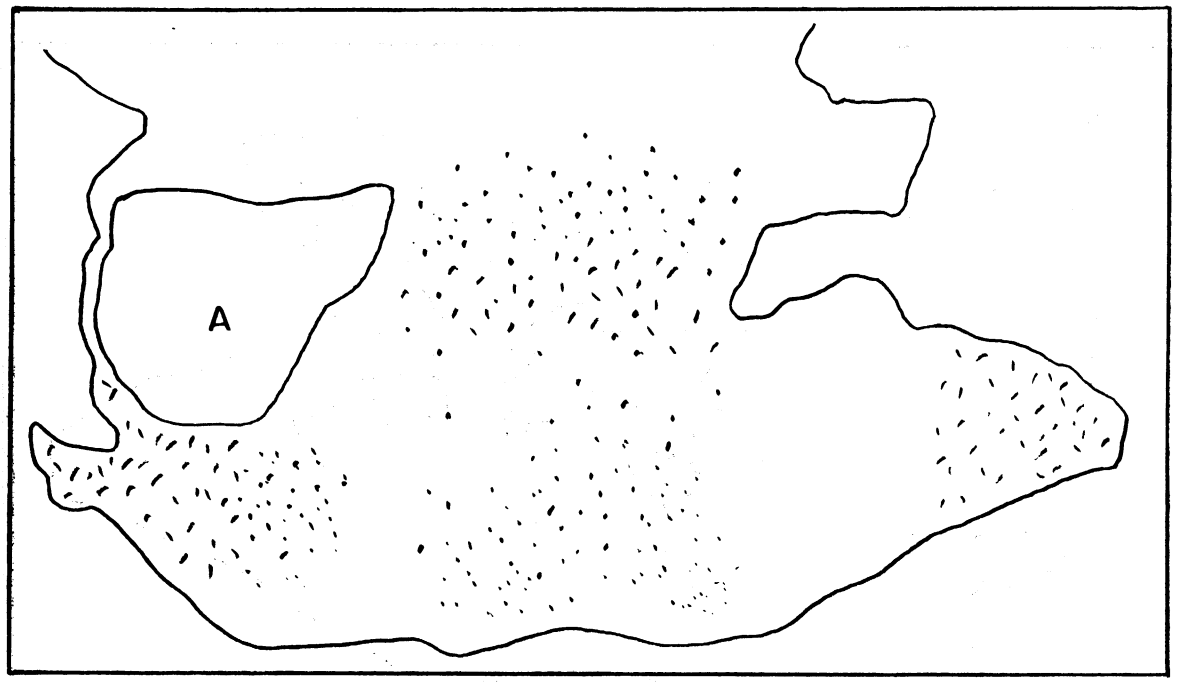


Figure 5: Event II. Rock A detached from cave ceiling, Older Guano deposition, initial occupation. = Occupation = Guano deposit

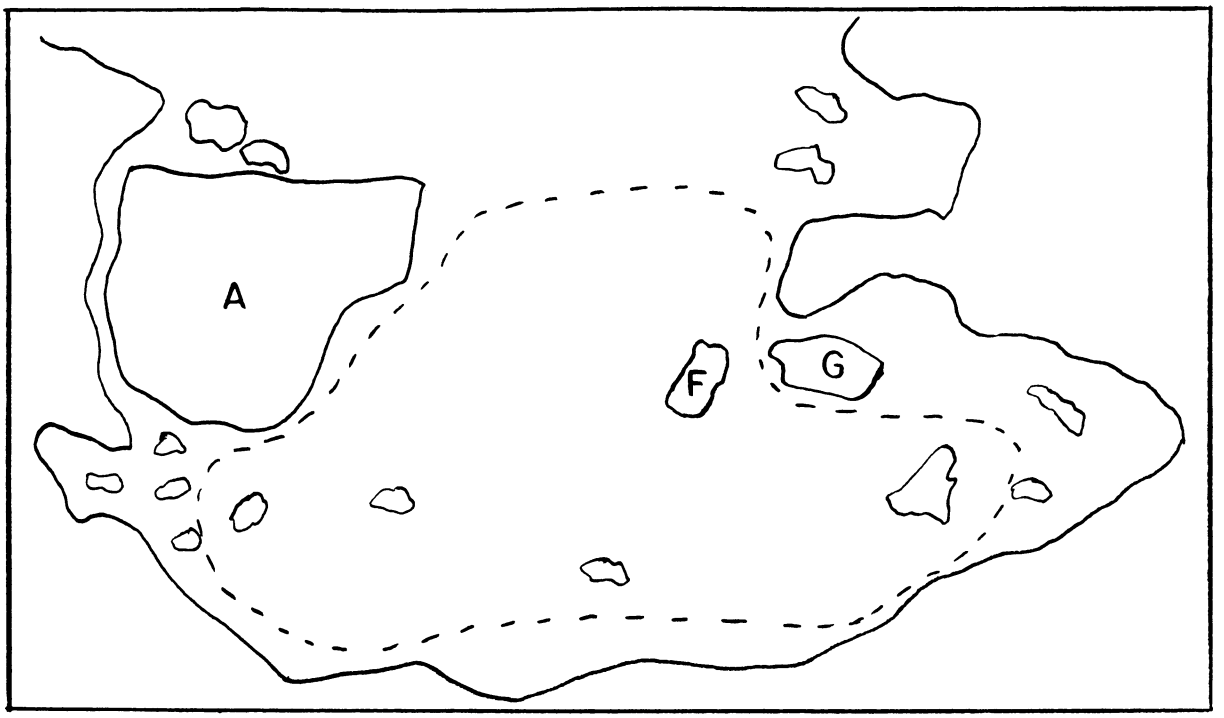


Figure 6: Lovelock Cave, Event III. Principal period of human occupation of cave, beginning <u>circa</u> 2000 B.C. Rockfalls occur.

------ = Main occupation

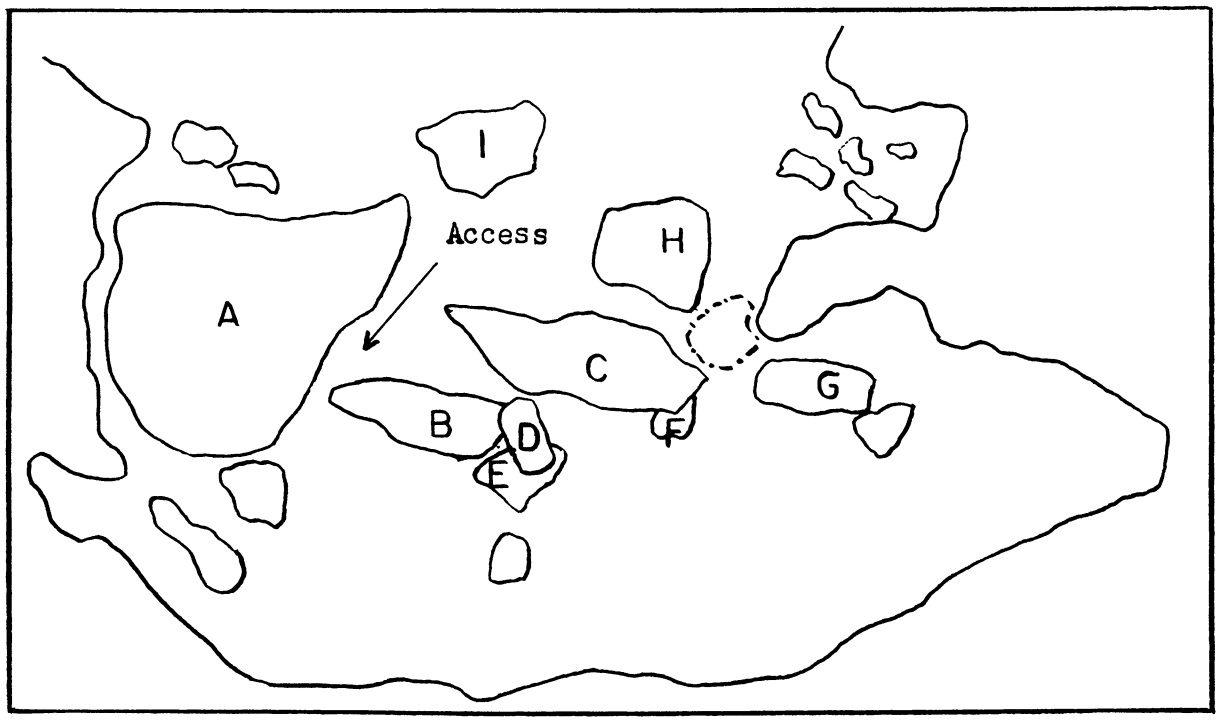


Figure 6: Lovelock Cave, Event IV. Massive rockfall, rocks B,C,D,E,G. Rock indicated by dotted line blasted by guano miners in 1911.

—·—·— = Rock rubble

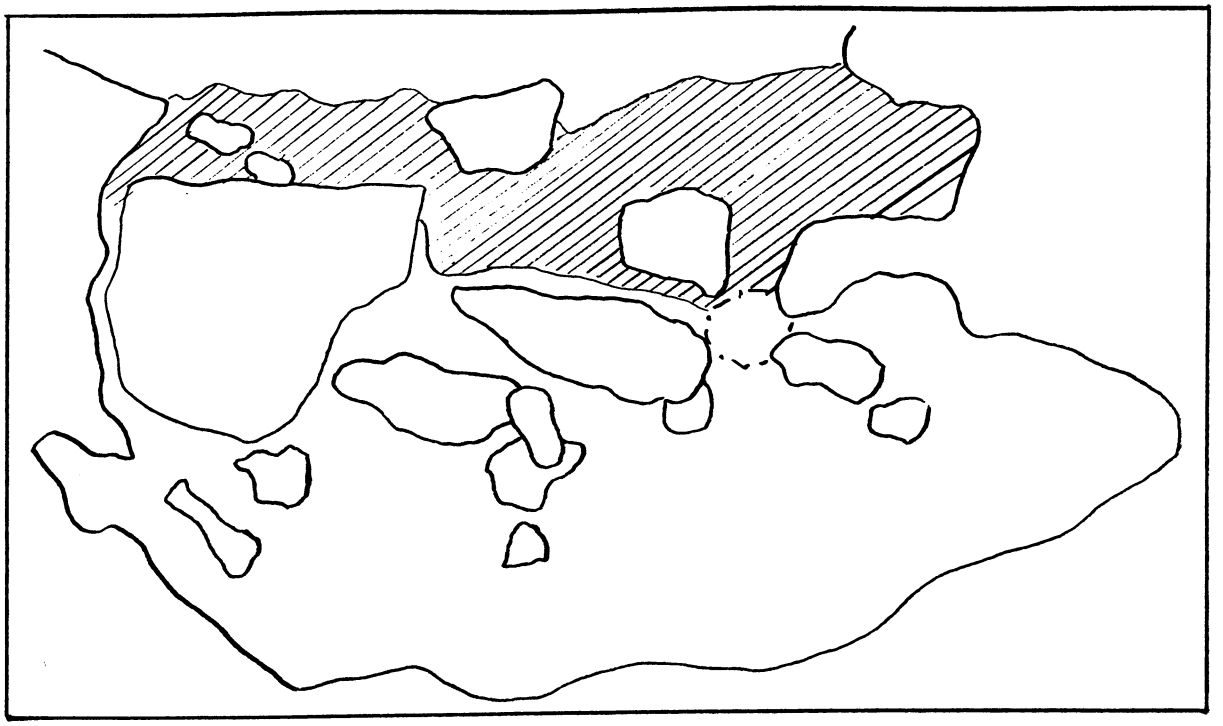


Figure 7: Lovelock Cave, Event V, circa A.D. 500. Human occupation shifts to outer rockshelter. "Later Guano" accumulates in interior of cave.

///// = Occupation

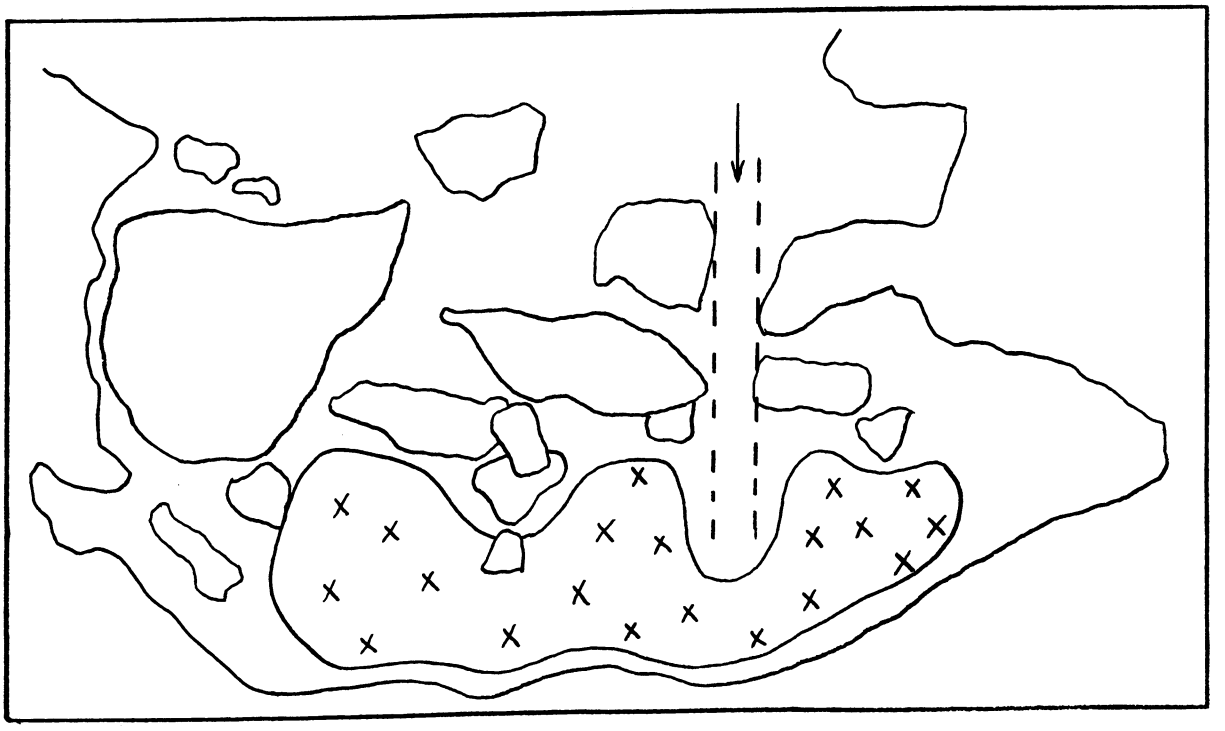


Figure 7: Event VI, A.D. 1911. Guano miners construct tunnel (indicated by dotted lines). Major part of cave deposit mined for guano. Note "ramp" left by miners.

x x = Guano area excavations

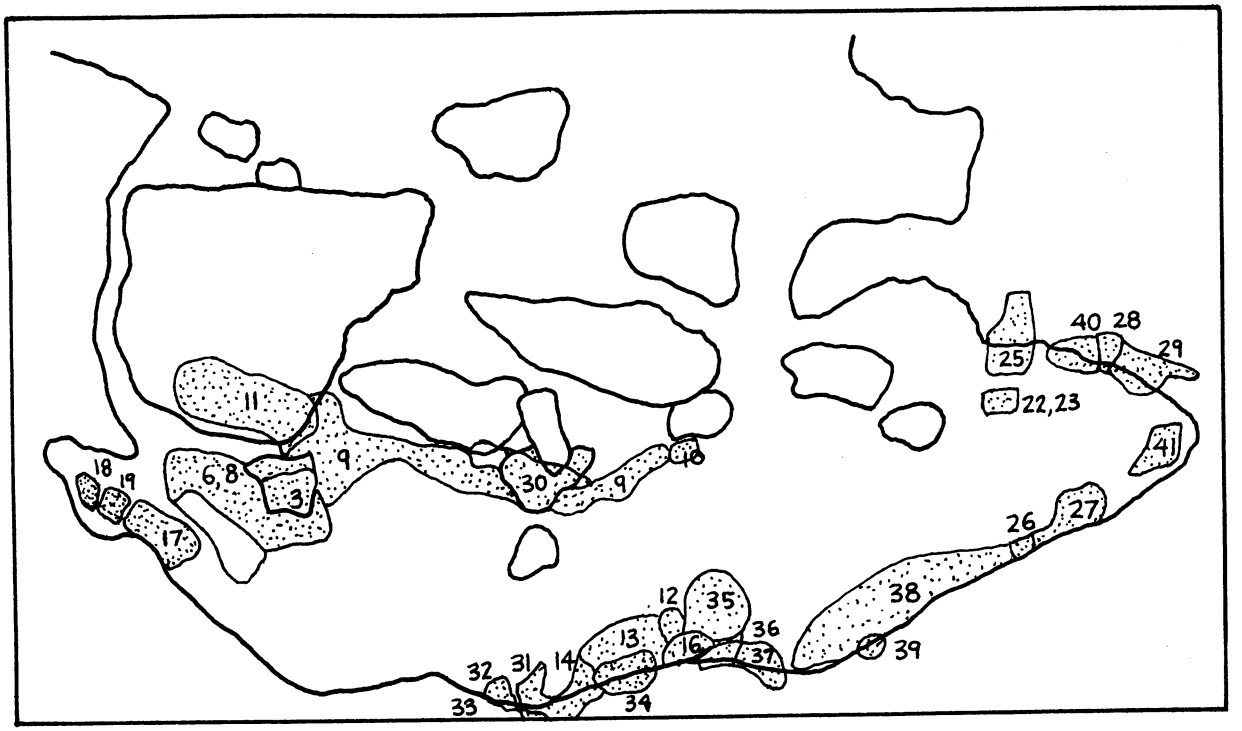


Figure 8. Lovelock Cave, Event VII. A.D. 1912, Excavations in cave by L.L. Loud (after Grosscup 1960, Figure 2). Note the lateral extent of lots near entrance rockfall.

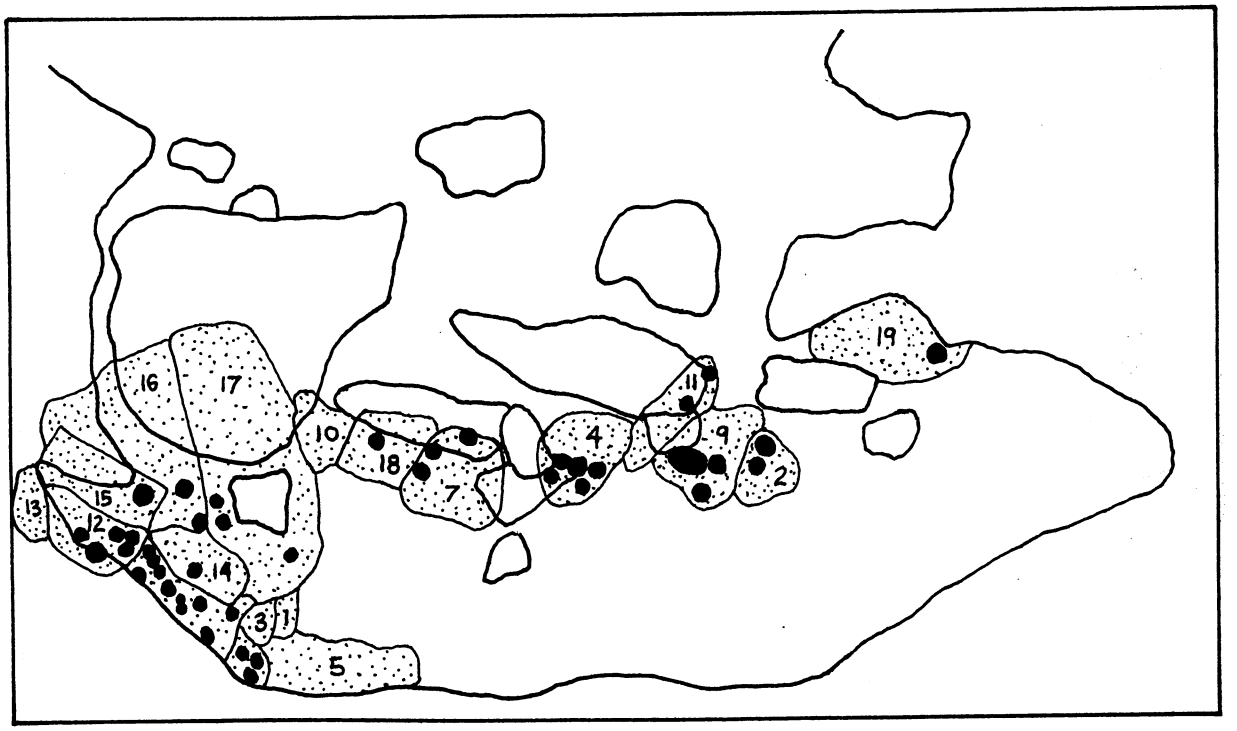
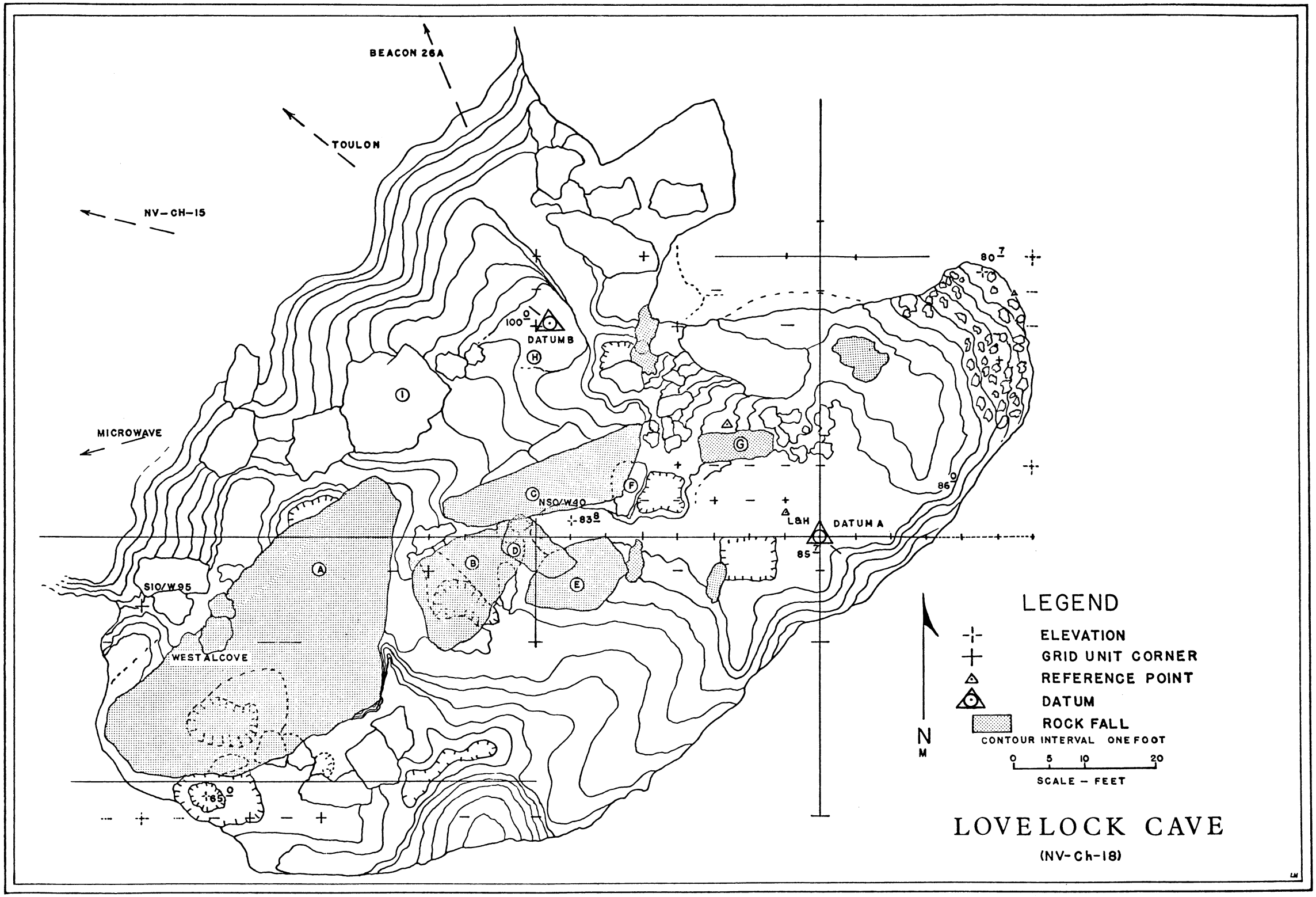


Figure 8. Lovelock Cave, Event VIII. A.D. 1924. Excavations in cave by M.R. Harrington and L.L. Loud. Cache pits recognized by Harrington are indicated by black dots. ● = Cache pits


BEACON 26A
TOULON
NV-CH-15
MICROWAVE
100
DATUM B
H
I
G
80 7
C N50/W40
F
83 8
L&H
DATUM A
86
85 7
A
B
D
E
S10/W95
WEST ALCOVE
65
LEGEND
ELEVATION
GRID UNIT CORNER
REFERENCE POINT
DATUM
ROCK FALL
CONTOUR INTERVAL ONE FOOT
0 5 10 20
SCALE - FEET
N
M
LOVELOCK CAVE
(NV-Ch-18)

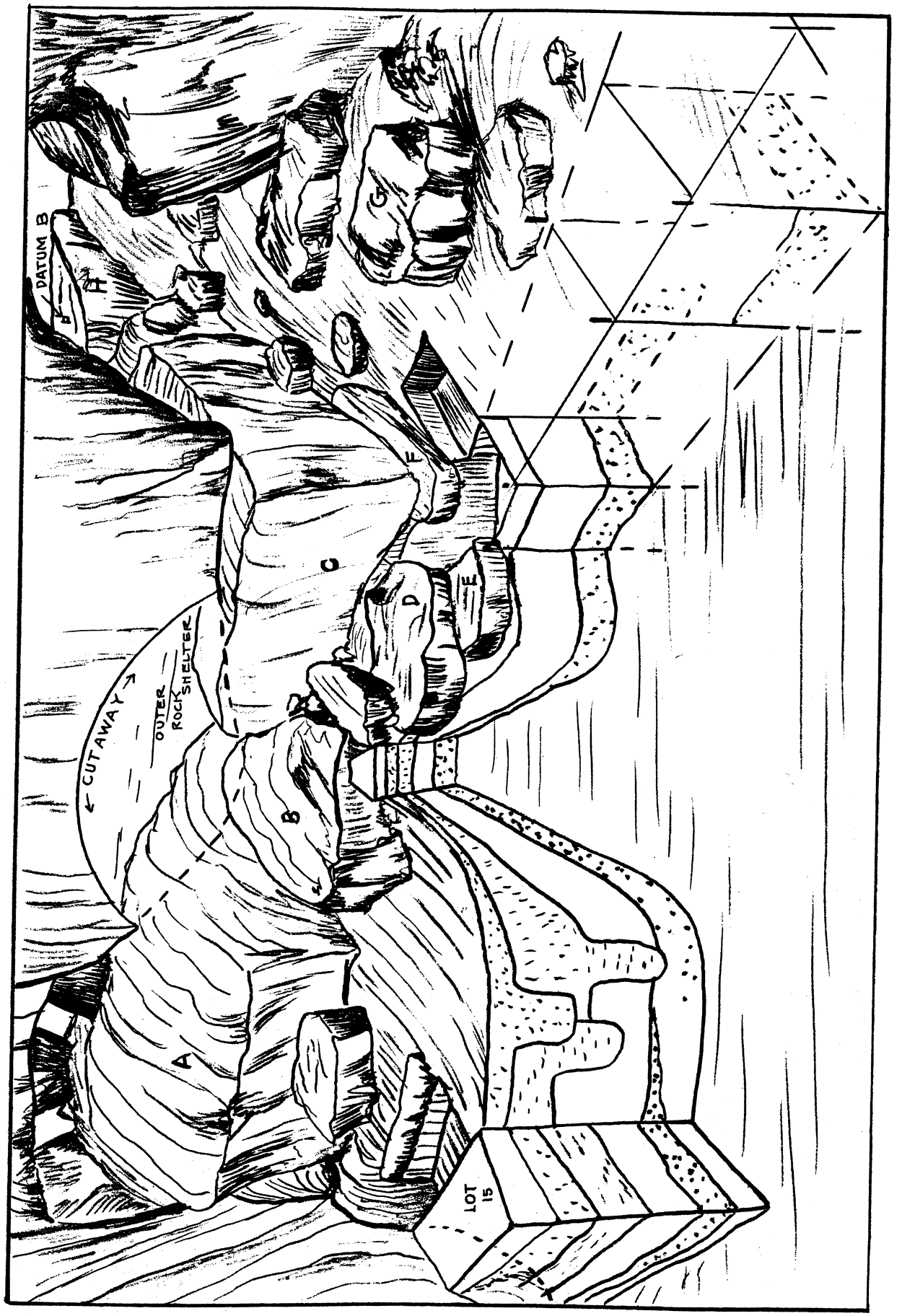


Figure 10: Lovelock Cave, interpretation to illustrate stratigraphy and relation of cave features.

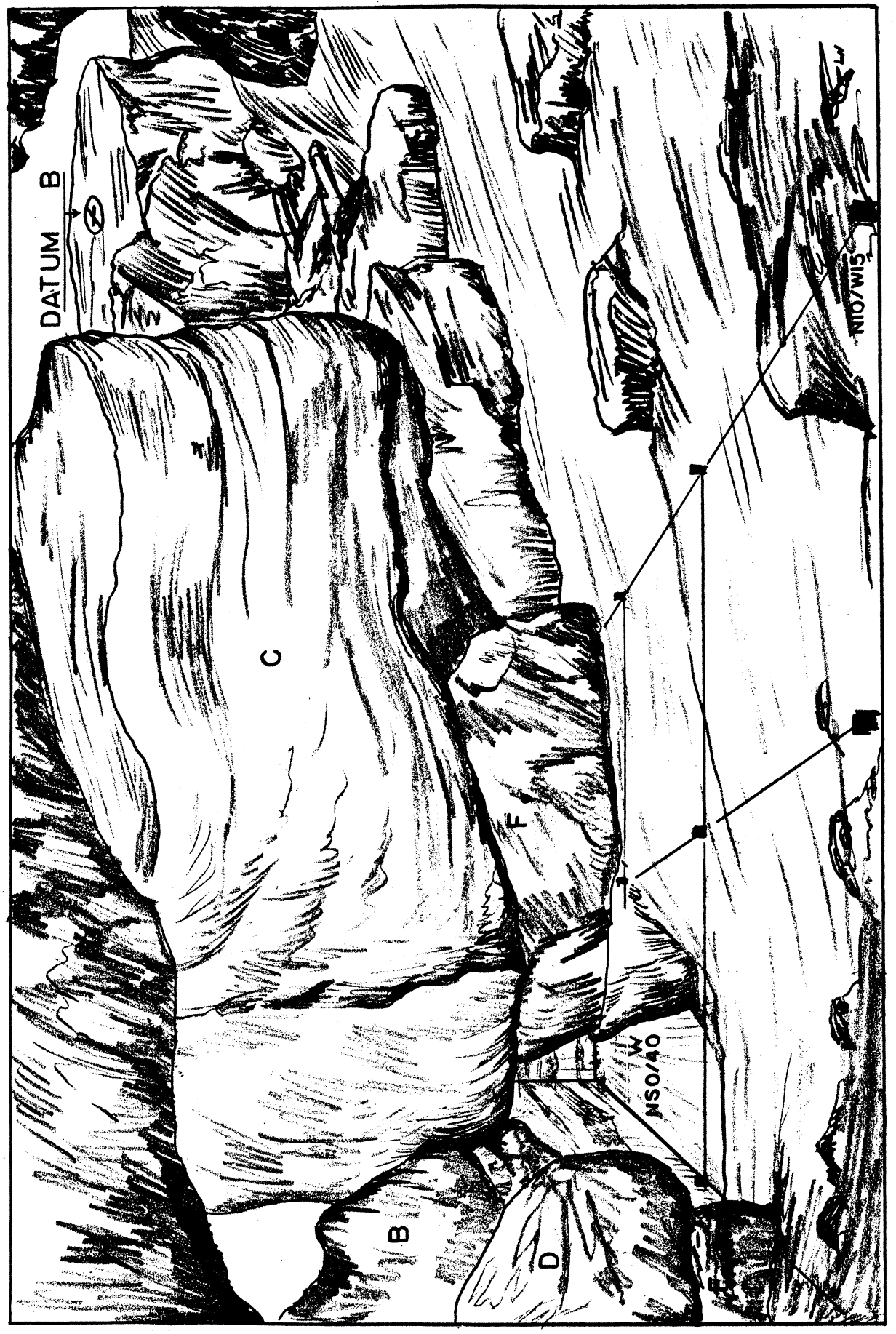


Figure 11: Lovelock Cave, NSO/W35; NSO/W40.

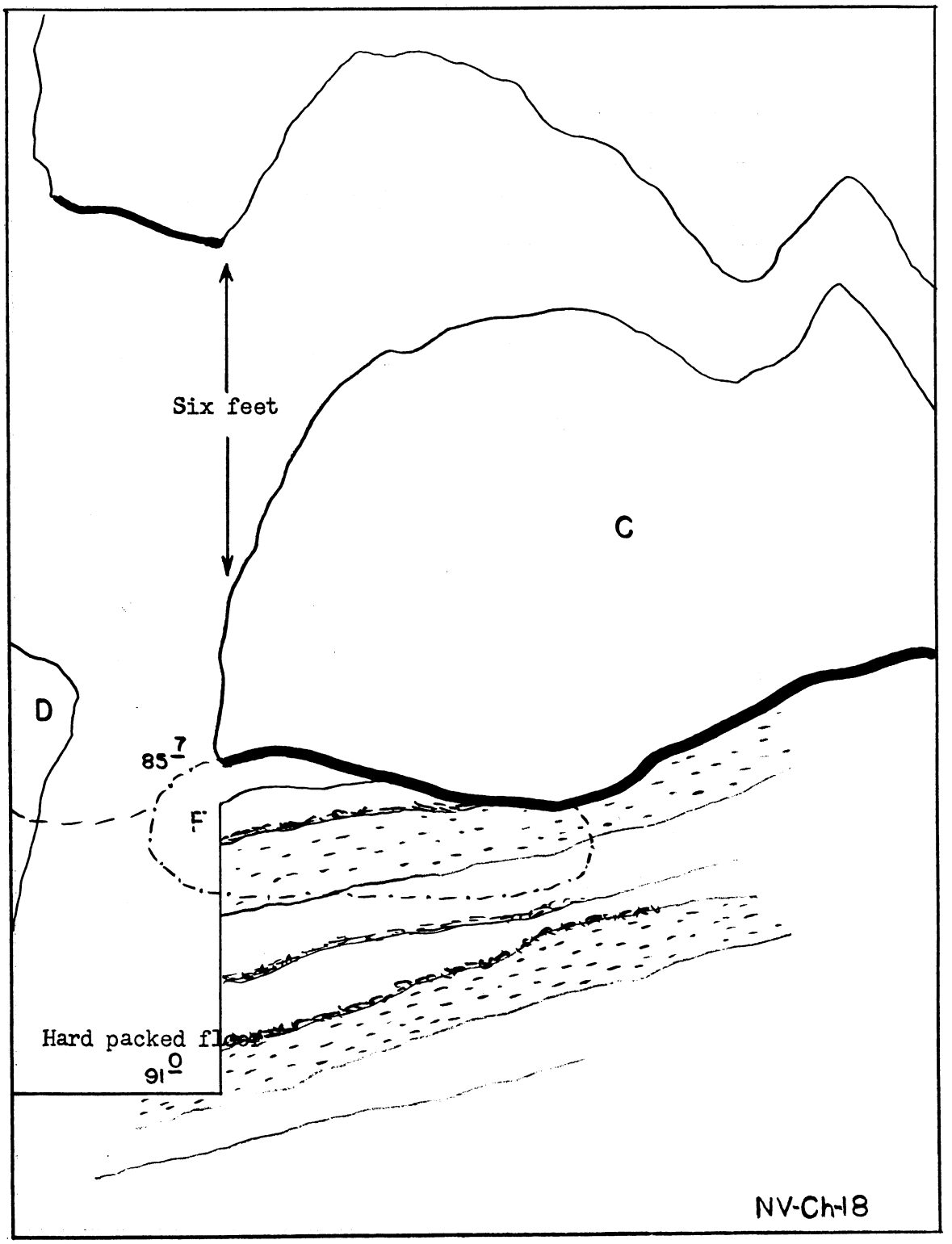


Figure 12: Lovelock Cave (NV-Ch-18) NS0/W40 and rock C, view west showing hinge displacement of rock C, which is resting on midden deposit.

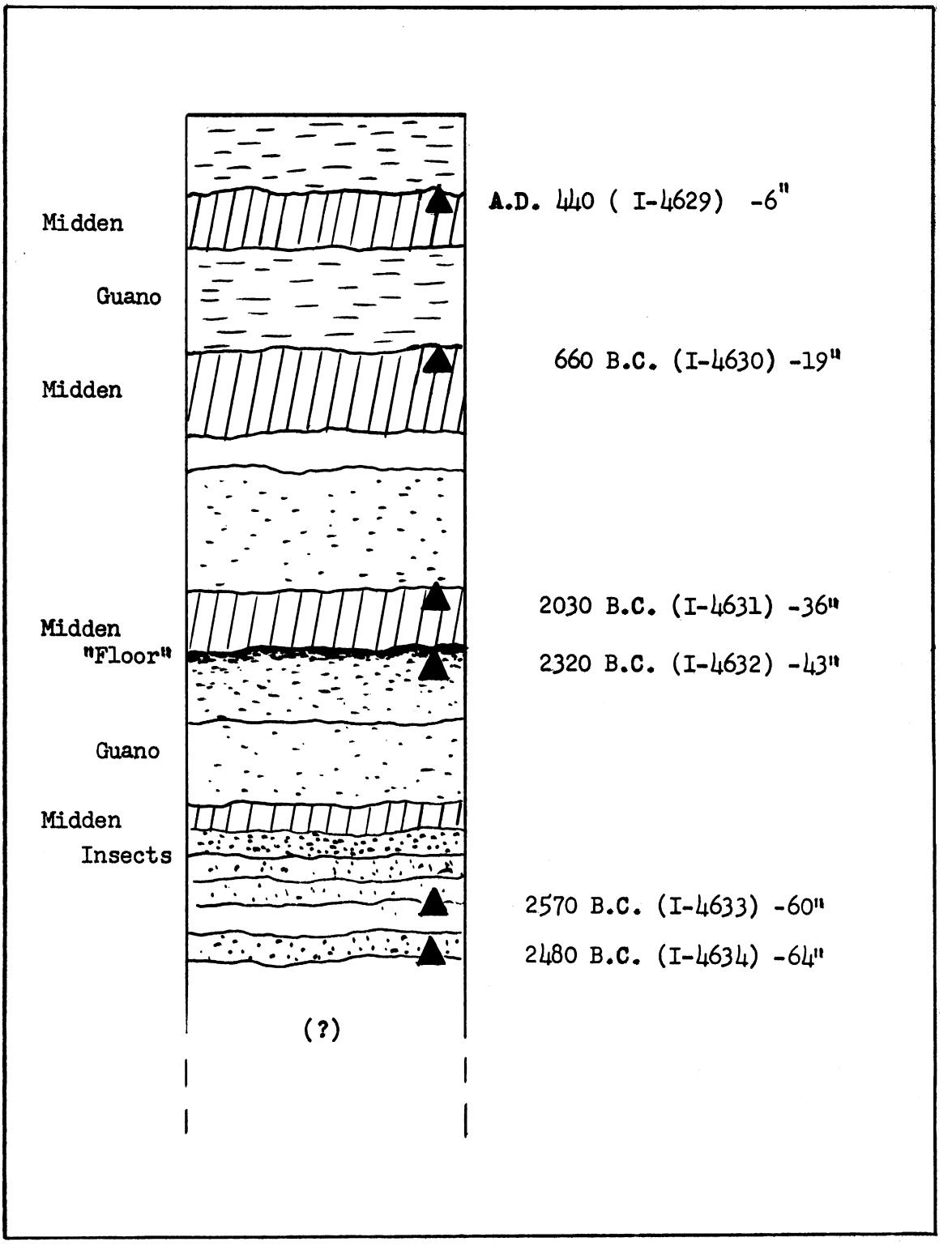


Figure 13: Lovelock Cave (NV-Ch-18) NSO/W35, depth 6-64", general stratigraphy and radiocarbon determinations.

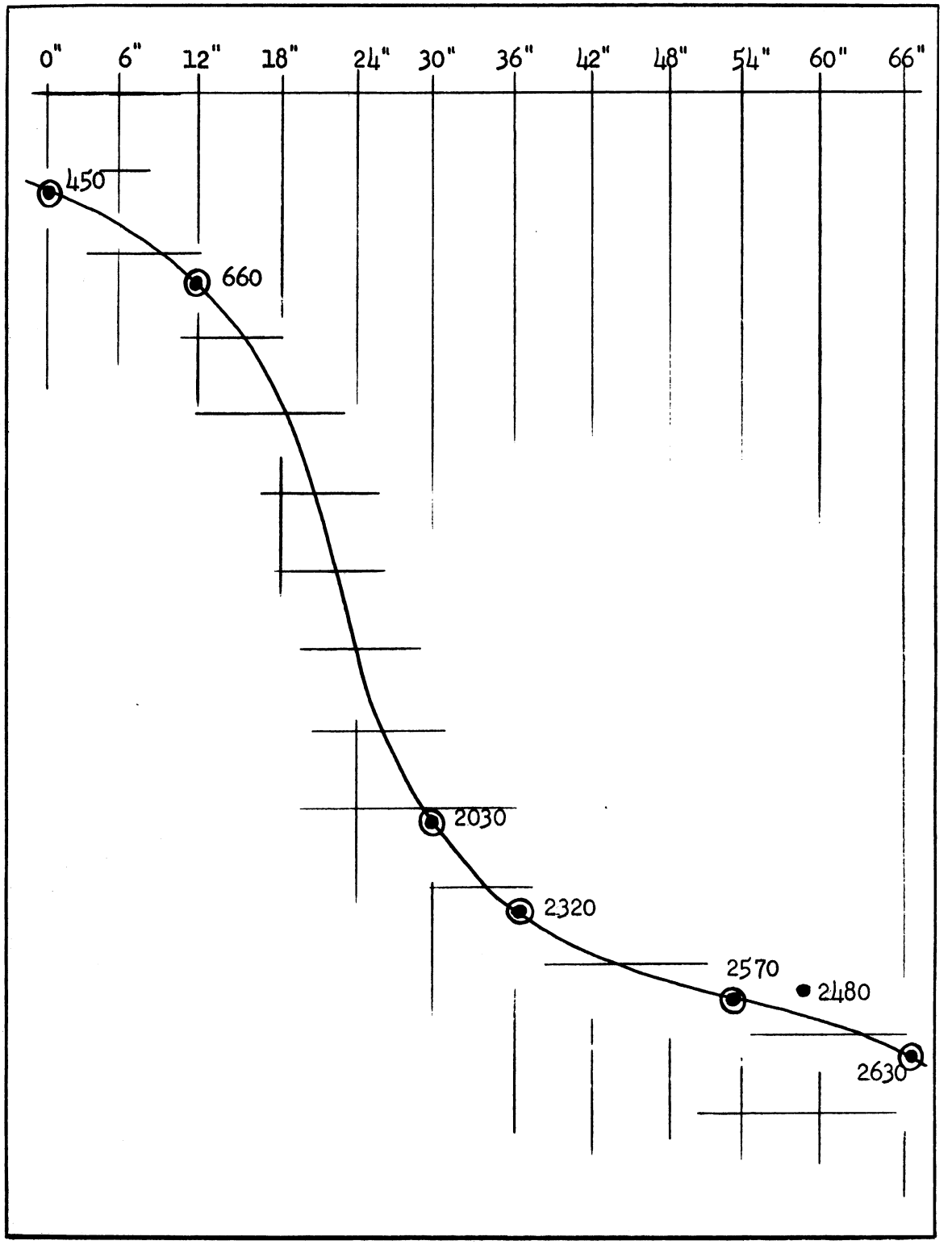


Figure 14: Graph of radiocarbon determinations, NS0/W35, Lovelock Cave, Nevada

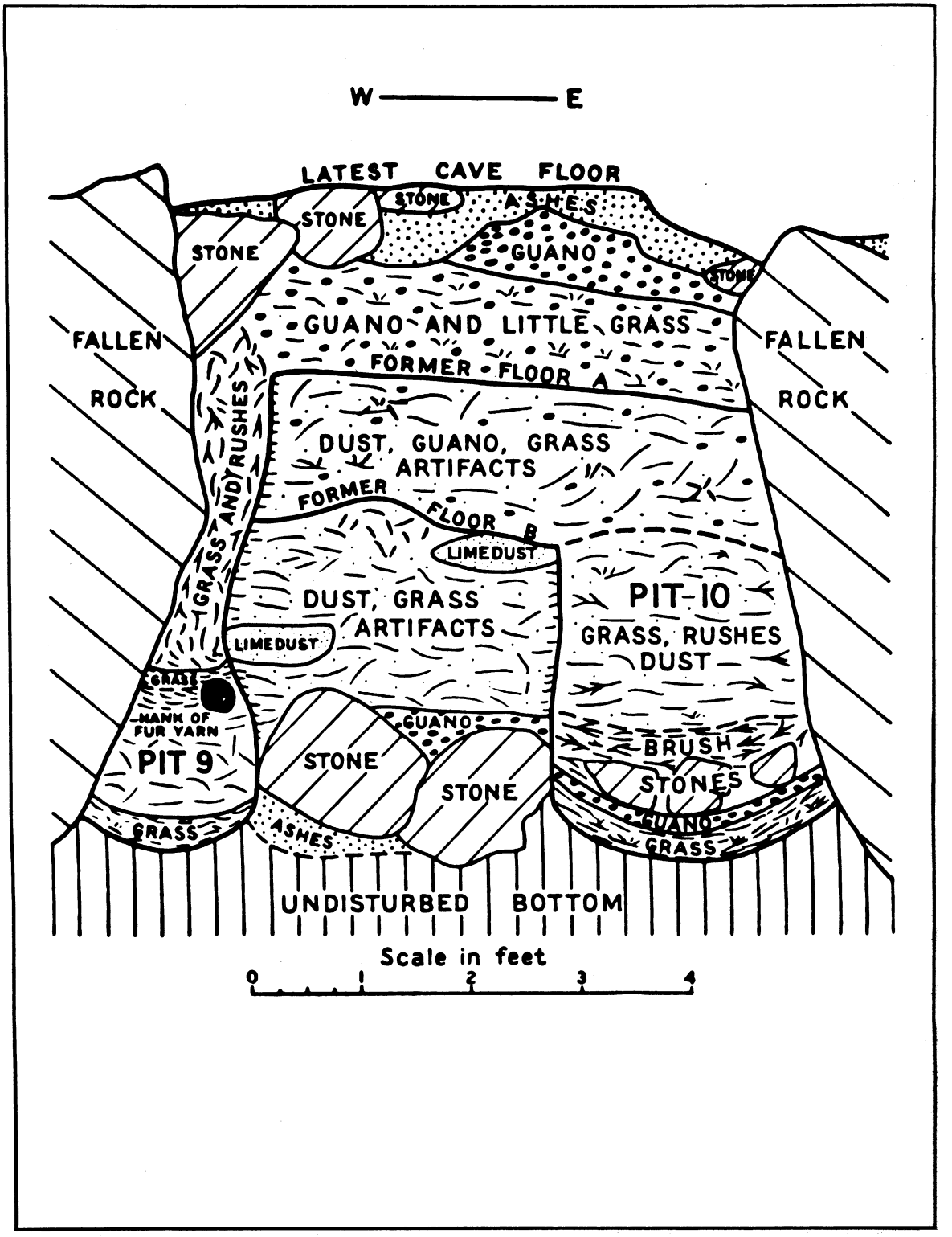


Figure 15. Lovelock Cave section showing Pits 9 and 10 (From Loud and Harrington 1929, Fig. 3)

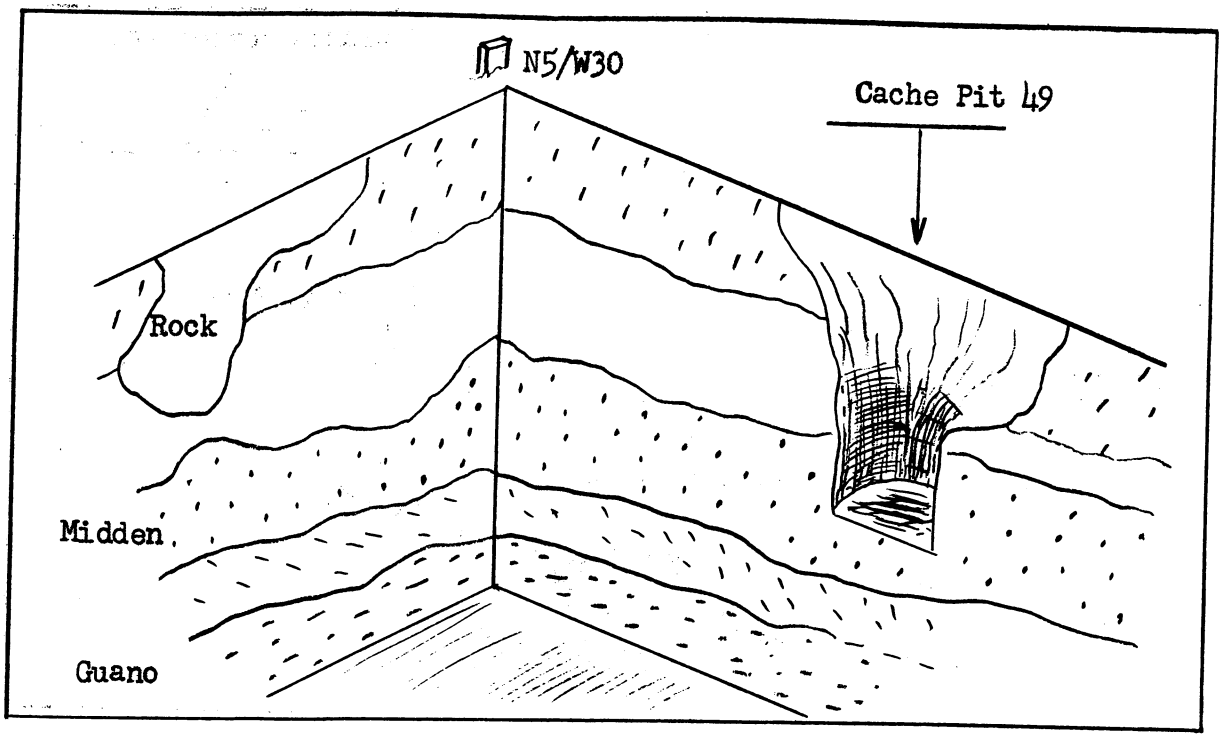


Figure 16: Lovelock Cave, NSO/W30, 1968 test unit.

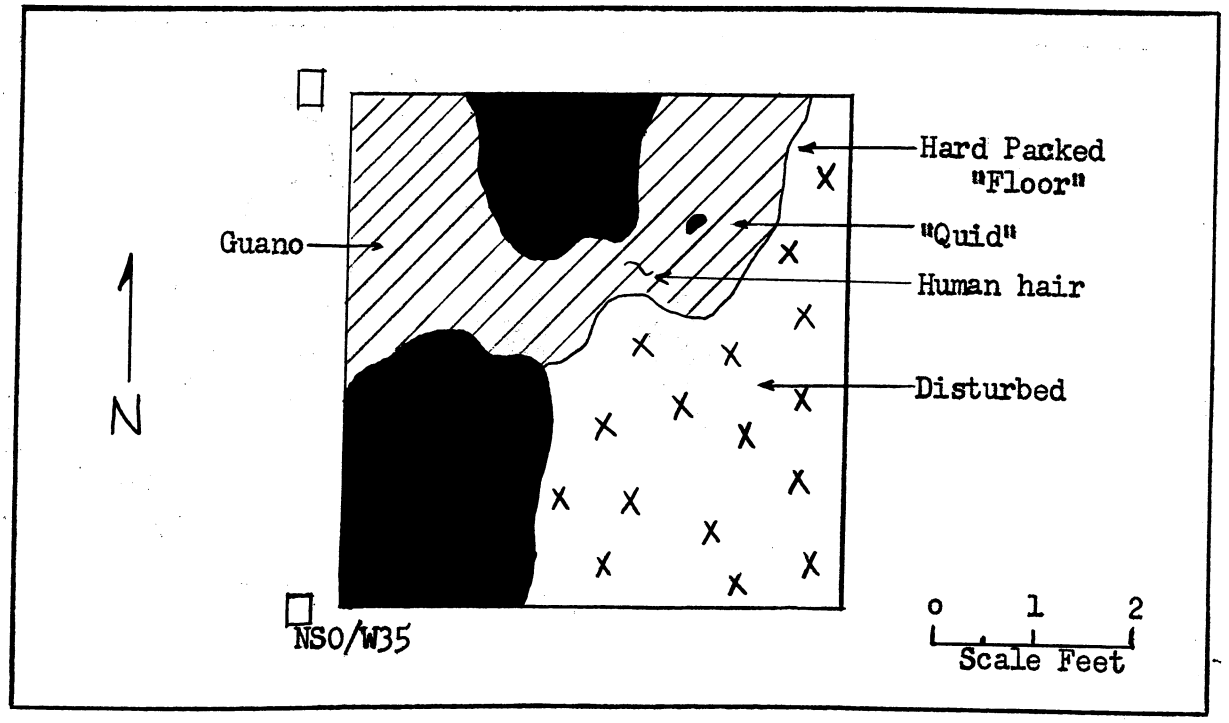


Figure 17: Lovelock Cave, NSO/W35, plan view, hard packed surface of Older Guano, depth 41-43".

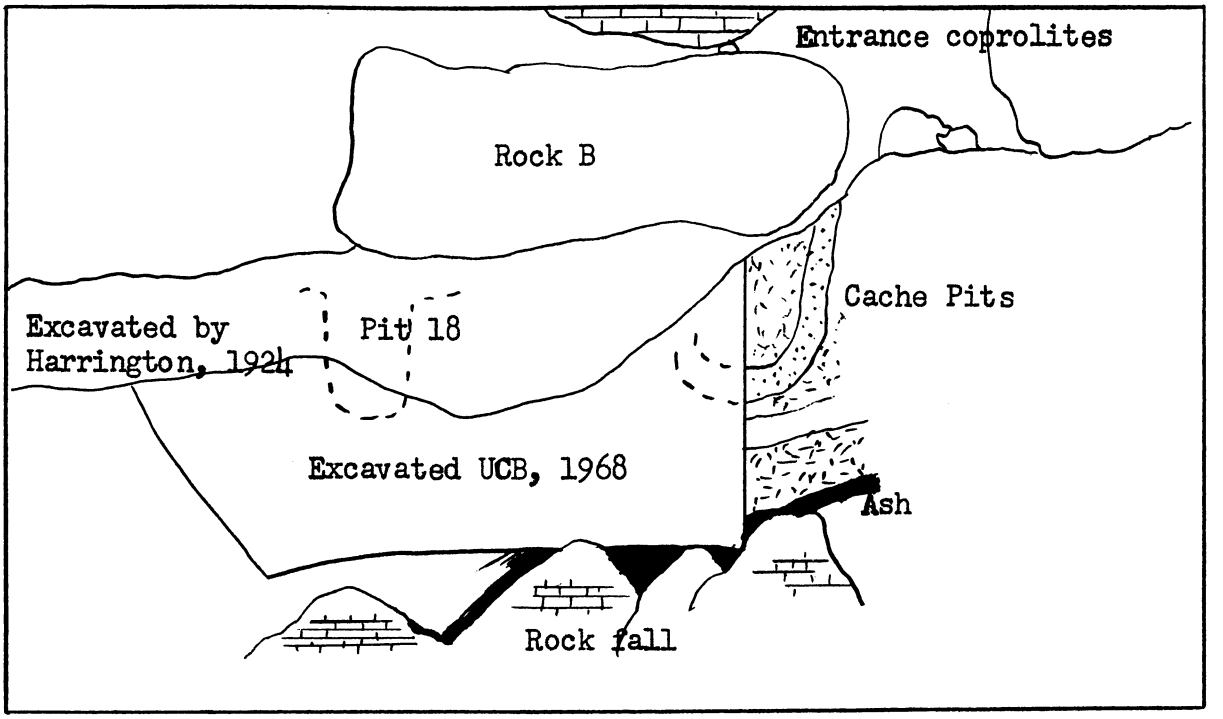


Figure 18: Lovelock Cave, S10/W50, west profile showing excavations in 1968.

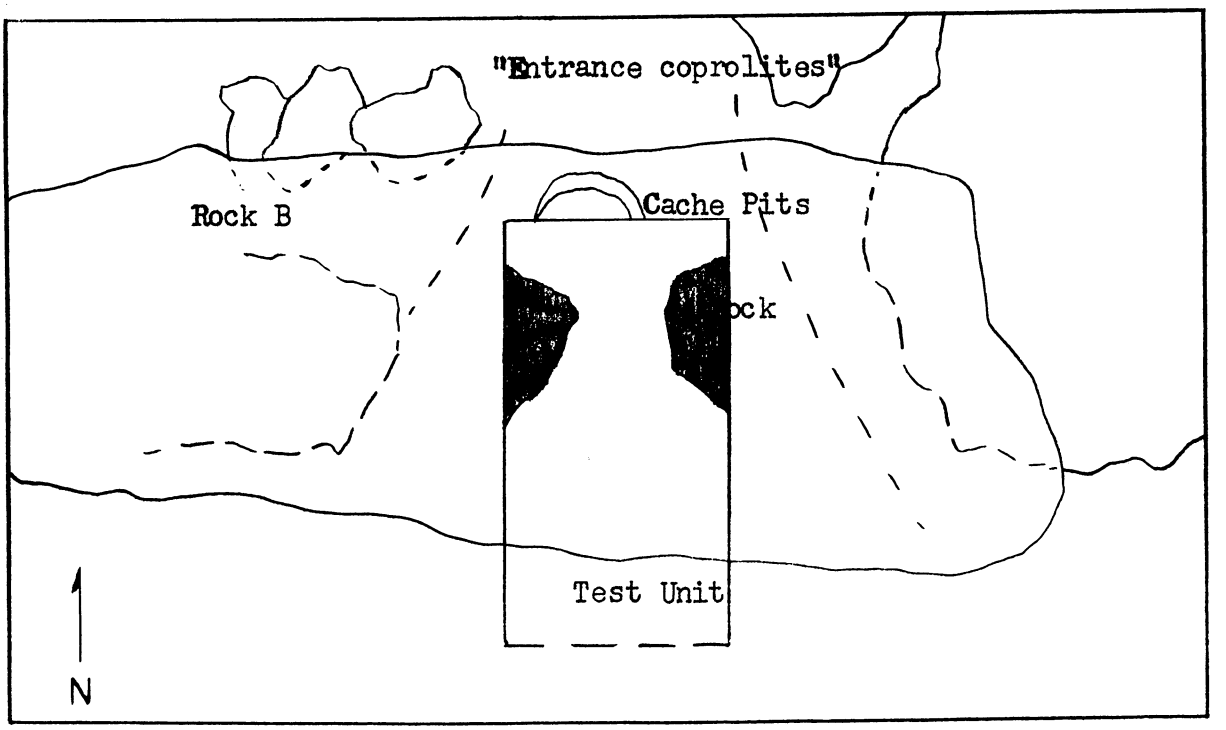


Figure 19: Lovelock Cave, S10/W50, plan view, excavations of 1968-69.

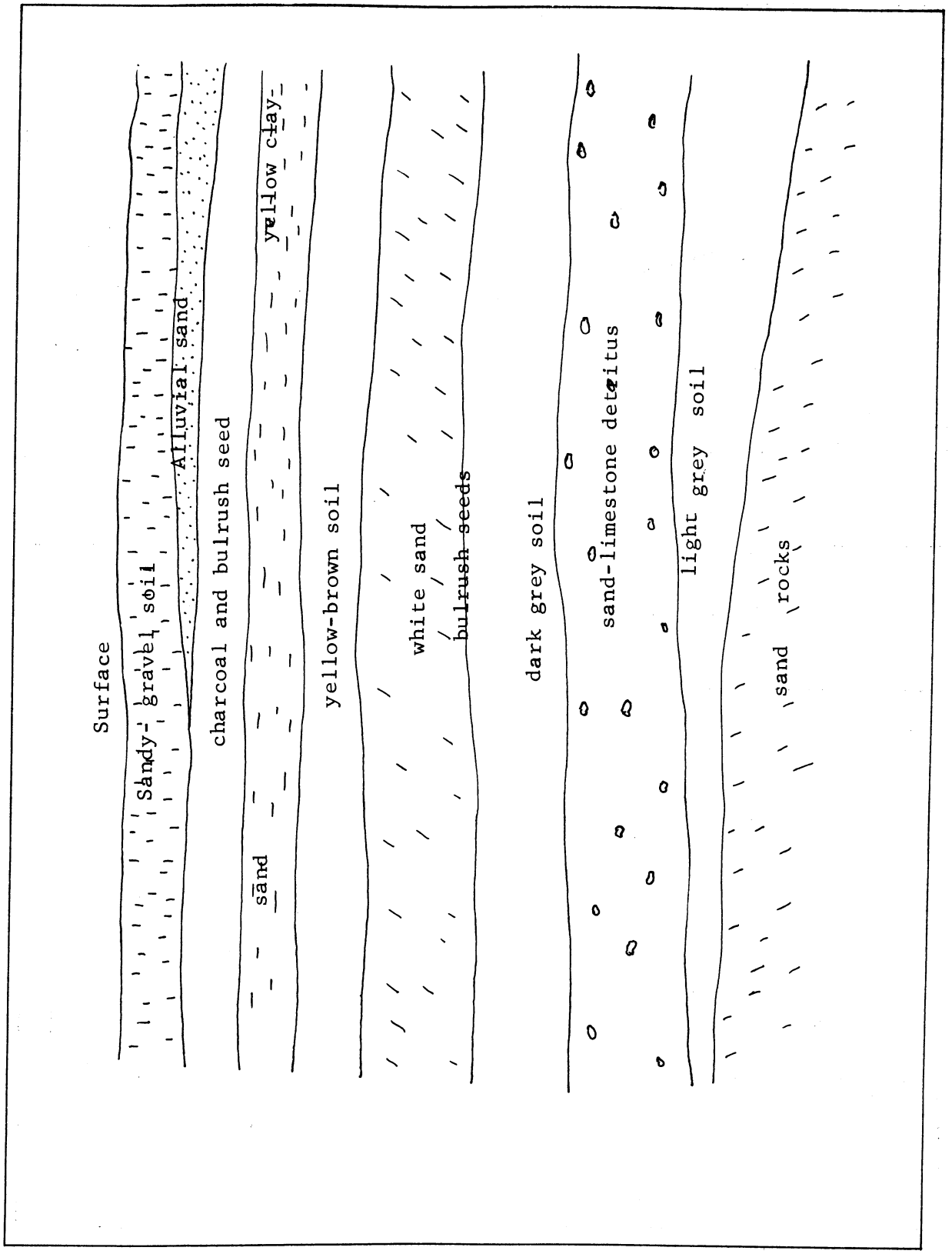


Figure 20: Lovelock Cave, WA area, S10/W95, west profile.

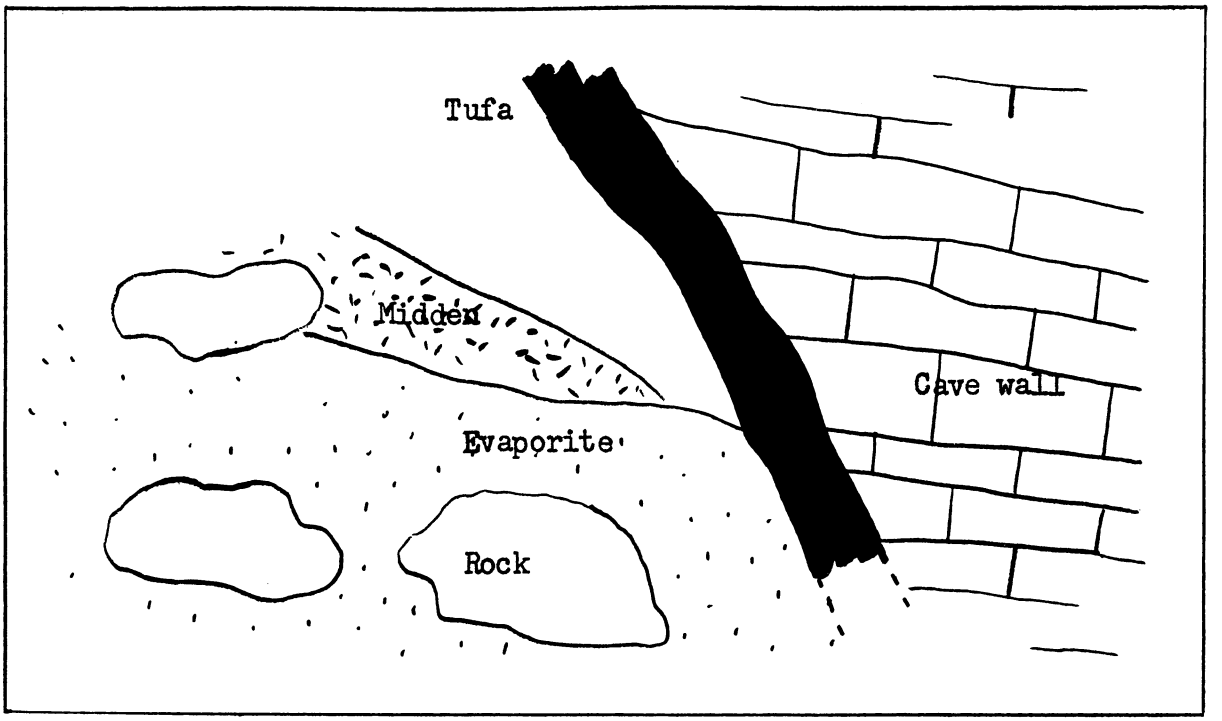


Figure 21: Lovelock Cave, N25/E25, contact of tufa and evaporite stratum.

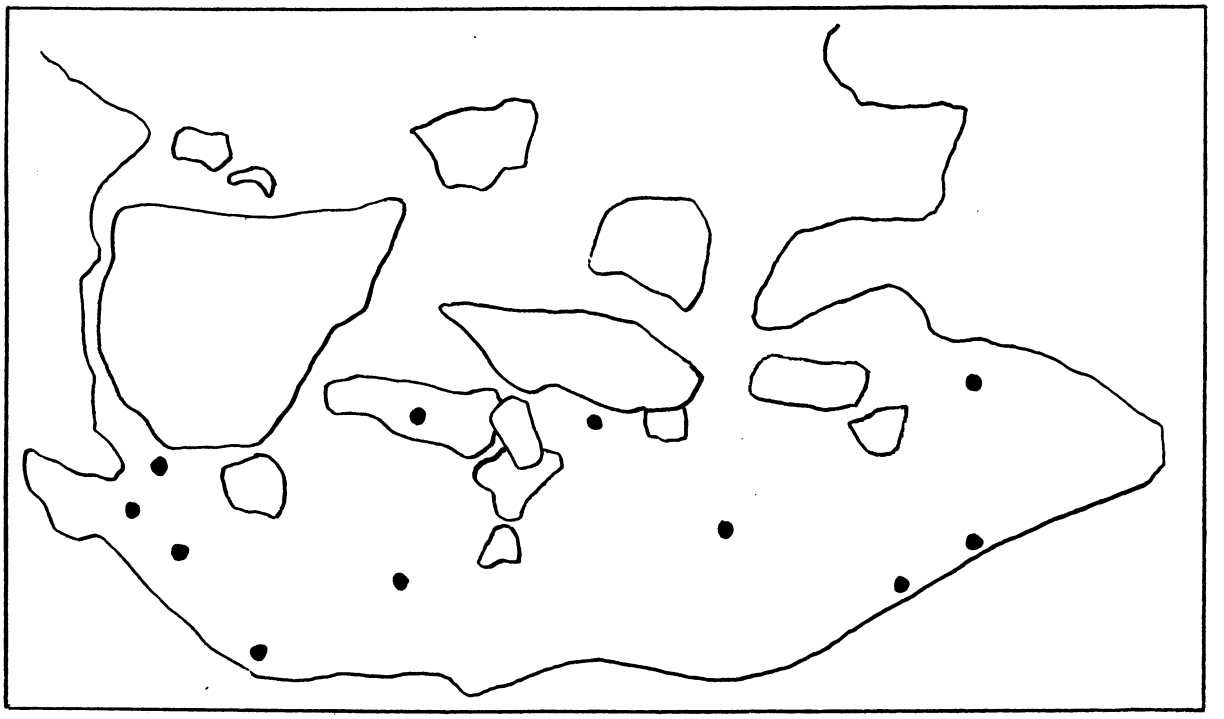
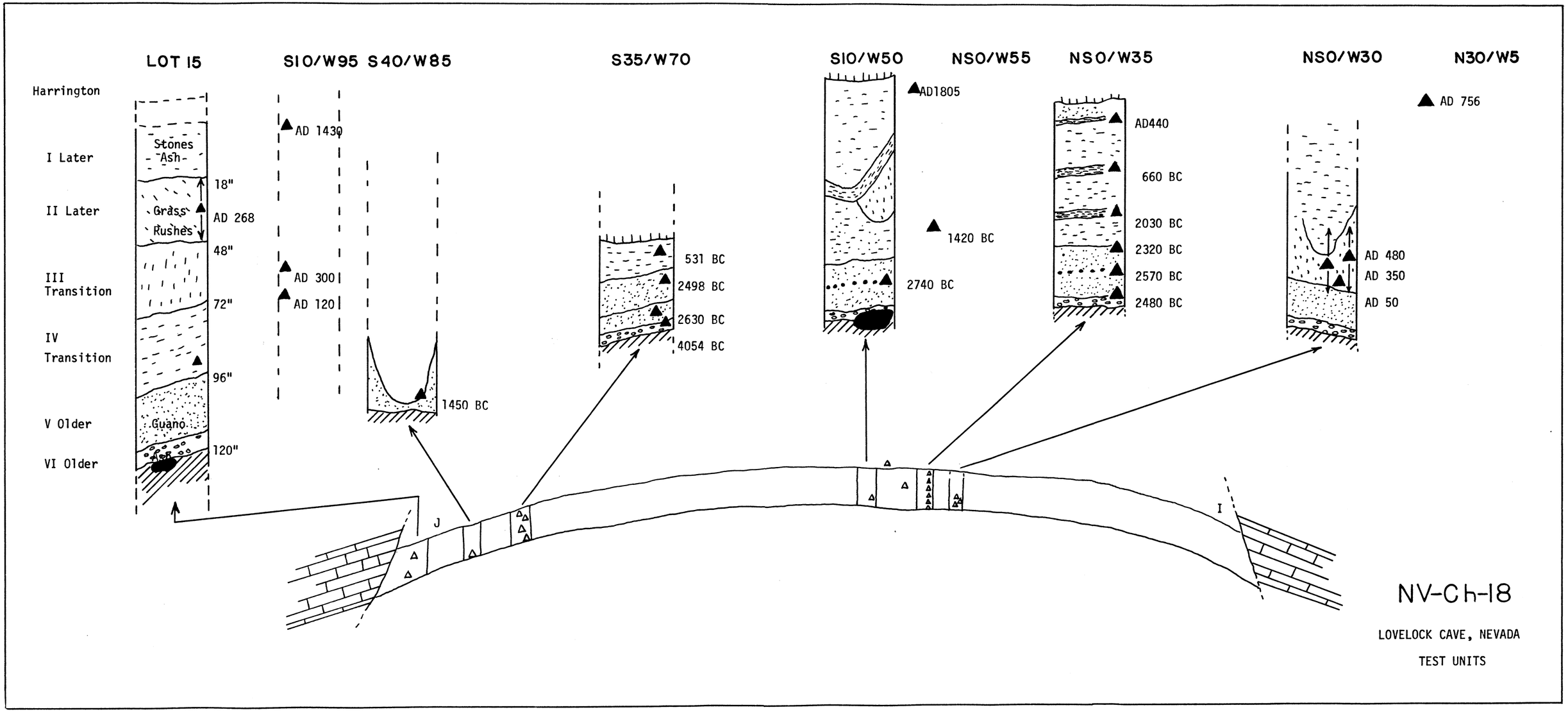


Figure 22: Lovelock Cave, occurrence of evaporite stratum, plan view. Samples obtained from sites indicated by dots.


LOT 15
S10/W95 S40/W85
S35/W70
S10/W50
N50/W55
N50/W35
N50/W30
N30/W5
Harrington
I Later
II Later
III Transition
IV Transition
V Older
VI Older
Stones Ash
Grass
Rushes
Guano
18"
48"
72"
96"
120"
AD 268
AD 1430
AD 300
AD 120
1450 BC
531 BC
2498 BC
2630 BC
4054 BC
AD1805
1420 BC
2740 BC
AD440
660 BC
2030 BC
2320 BC
2570 BC
2480 BC
AD 480
AD 350
AD 50
AD 756
J
I
NV-Ch-18
LOVELOCK CAVE, NEVADA
TEST UNITS

Explanation of Illustrations

(Photographs by L.K. Napton, unless otherwise credited)

Plate 1 Lovelock Cave and West Humboldt Range, Nevada, looking southwest from the Humboldt lakebed toward the cave formation, which is visible in the center of the photograph. Five distinct wavecut terraces are discernible on the mountain slope above the cave. The vegetation in the foreground (Atriplex and Distichlis) is typical of the lakebed area at present. The elevation of the peak, left center, is 4770 feet.

Plate 2 Lovelock Cave and the West Humboldt Range, Nevada, looking west toward Lovelock Cave from the Humboldt lakebed site (NV-Ch-15), photograph taken in 1924 by Mark R. Harrington. The vegetal cover aspect was significantly different than it is at present. Note the large stand of reeds (Phragmites communis) (below center), no longer extant in this vicinity. The Lovelock Cave formation is visible, left center. (Photograph courtesy of Dr. F. J. Dockstader, Museum of the American Indian, Heye Foundation, New York.)

Plate 3 Lovelock Cave, Nevada (NV-Ch-18), in Jurassic limestone unit Jal. Note the foliation of the unit. Wave erosion produced by Lake Lahontan is visible on the formation, to the left of center. The remains of the guano miners' dump, composed of material mined from the cave in 1911, are visible below the mouth of the cave. The West Alcove area of the cave is situated behind a rockfall, to the right of the cave portal.

Plate 4 Members of the University of California, Berkeley, field session in archaeology (Anthropology 196-B) reposing on rock H (the location of UCB datum B) during excavation of Lovelock Cave, spring 1969. Left to right: Dr. Albert Elsasser, David Clement, Professor R. F. Heizer, Gary Encinas, Monica Ley, Suzanne DeAtley, Ethel Chang, Jennifer Scharetg, Mark Estis. (Photograph courtesy Dr. F. H. Stross.)

Plate 5 Lovelock Cave, Nevada (NV-Ch-18), eroded face of hinge fold in limestone unit Jal. Note massive, detached lithic unit in upper right corner of the photograph. Beneath this rock unit is the north portal of the West Alcove. Rock A is situated below center, right, and rock I is in the lower center. The ancient Indian entrance to the cave (the source of the Lovelock Cave "Entrance" coprolites) is to the left, lower center. (Photograph courtesy Dr. F. H. Stross.)

Plate 6 Mr. Llewellyn L. Loud photographed with the remarkable find of 11 duck decoys from Pit 12, Lovelock Cave, Nevada. (Compare Loud and Harrington 1929, pl. 7.) This picture, taken by Mark Harrington in 1924, is one of the few existing photographs of Mr. Loud. (Photograph courtesy Dr. F. J. Dockstader, Museum of the American Indian, Heye Foundation, New York.)

Plate 7 Photograph identified "Deposit under large rock, Lot 15" taken in Lovelock Cave, Nevada, by Mark R. Harrington in 1924. Note the profusion of basketry, poles, vegetal debris, and artifacts. The area is under the edge of rock A, approximate grid location S35/W80. (Photograph courtesy Dr. F. J. Dockstader, Museum of the American Indian, Heye Foundation, New York.)

Plate 8 Lovelock Cave, Nevada (NV-Ch-18), in 1965, looking from the end of the guano miners tunnel toward the west end of the cave, both the tufa layers and smoke-stained ceiling. Part of the Jal. limestone hinge fold is visible in the cave ceiling. The large rock situated below center is located in grid unit S5/W15.

Plate 9 Lovelock Cave, Nevada (NV-Ch-18), cave midden. West end of cave and west crevice, prior to excavation, April 1969. Professor R. F. Heizer stands at the outfall of the west crevice. The base of massive rock A is visible, upper right. The area of Harrington's Lot 15 is in the lower left of this view.

Plate 10 Lovelock Cave, Nevada (NV-Ch-18), west end of the cave, excavations of 1969, in same view as Plate 9. Electrical apparatus and ventilating equipment is visible near grid unit S40/W85, in the process of excavation.

Plate 11 Lovelock Cave, Nevada (NV-Ch-18), "LX" area, grid location NS0/W35, photographed during excavations, 1969. Note stratification of deposit under massive rock C. Rock D is visible, lower left. Note smoke stain on the underside of rock C, which rests on rock F.

Plate 12 Lovelock Cave, Nevada (NV-Ch-18), grid location NS0/W35, west and north profiles. Length of rod, three feet. At the top of the slate is the first occupation midden layer, with successive alternating cultural and detrital strata. The Older Guano layer is visible at the base of the profile. (See Figures 13 and 16 for details of this section.) (Photograph by John Carroll.)

(Figure 13) Lovelock Cave, Nevada (NV-Ch-18) NS0/W35, north profile. Surface is base of rock C (85.7 feet), base is 90.0 feet, in reference to UCB datum A. The strata are underlain by the white evaporite deposit (not shown in pl. 12).

Plate 13 Lovelock Cave, Nevada (NV-Ch-18), NS0/W35, possible occupation level or "floor," depth 41-43 inches (see fig. 13), macerated vegetal fiber ("quid") (UCB 58:1302) *in situ* in the occupational level (see fig. 17) in the Older Guano layer, age *circa* 2000 B.C.

Plate 14 Lovelock Cave, Nevada (NV-Ch-18), west alcove, test excavations of 1968. The restricted occupation space on the top of rock A is demonstrated in this photograph. View looking south, into the alcove, grid location approximately S10/W95.

Plate 15 Lovelock Cave, Nevada (NV-Ch-18), west alcove, grid location S10/W95, depth six inches. Gun parts found in midden. Left to right: bullet mold, mainspring, tang screw, sear and bridle of percussion lock (photograph by R.F. Heizer).

Plate 16 Lovlock Cave, Nevada (NV-Ch-18), west alcove, S15/W100, depth 48 inches, Feature 6. Bulrush parcel containing feathers, *in situ* against the rear wall of the alcove. Note the carrying handle (lower right). (Photograph by John Carroll.)

Plate 17 Stillwater National Wildlife Refuge, near Fallon, Nevada, on the Truckee River. Photograph taken in 1952, showing aquatic vegetation in large, shallow lake typical of the Humboldt-Carson Sink wetlands in well-watered years. Looking east-northeast toward the Stillwater Range. (Photograph courtesy L. Worden, Manager, Stillwater Wildlife Refuge.)

Plate 18 Stillwater National Wildlife Refuge, near Fallon, Nevada. Millers Channel, August, 1952. Note the very dense, high stands of cattail (*Typha latifolia*) and roundstem bulrush (*Scirpus acutus*). This aspect is probably similar to conditions at Humboldt Lake (located some 25 miles north of this area) prior to dewatering in 1915. (Photograph courtesy of L. Worden, Manager, Stillwater National Wildlife Refuge.)

Plate 19 Humboldt Lake, Nevada, as it appeared in 1868, probably in July. This is the earliest photograph of the lake known to the authors. View is south-southeast from the vicinity of the present site of Toulon, Nevada, looking toward Lovelock Cave, located in the right middle distance at the foot of the West Humboldt Range. The wet plate negative from which this reproduction was made is believed to be one of a series taken by photographers who documented the eastward progress of construction of the Central Pacific Railroad, built by indentured Chinese laborers. The townsite of Lovelock was reached in August, 1868, and the station was named "Lovelock's" in honor of George Lovelock, who donated land for the station. (Photograph courtesy Nevada Historical Society and Southern Pacific Railway.)

Plate 20 Humboldt Lake, as it appeared in late May or early June, during the floods of February-June, 1952. This remarkable oblique aerial photograph (view north-northeast) shows the natural dam (foreground) and the drain channel cut in 1915. The lake reached flood stage in spite of the fact that a large amount of water passed through the drain channel, which was deepened in 1915, and inundated the flatlands below (west of) the natural dam. In prehistoric times, of course, prior to deepening of the drain channel, flooding would have been far more extensive. The flooded area of the Humboldt Lakebed site (NV-Ch-15), is visible in the upper right center. Lovelock Cave formation is located in the upper right center. The West Humboldt Range flanks the lake on the right, and the fringe of the Carson Sink and the Stillwater Mountains appear on the upper right skyline. (Photograph courtesy of Nevada State Fish and Game Commission.)

Plate 1

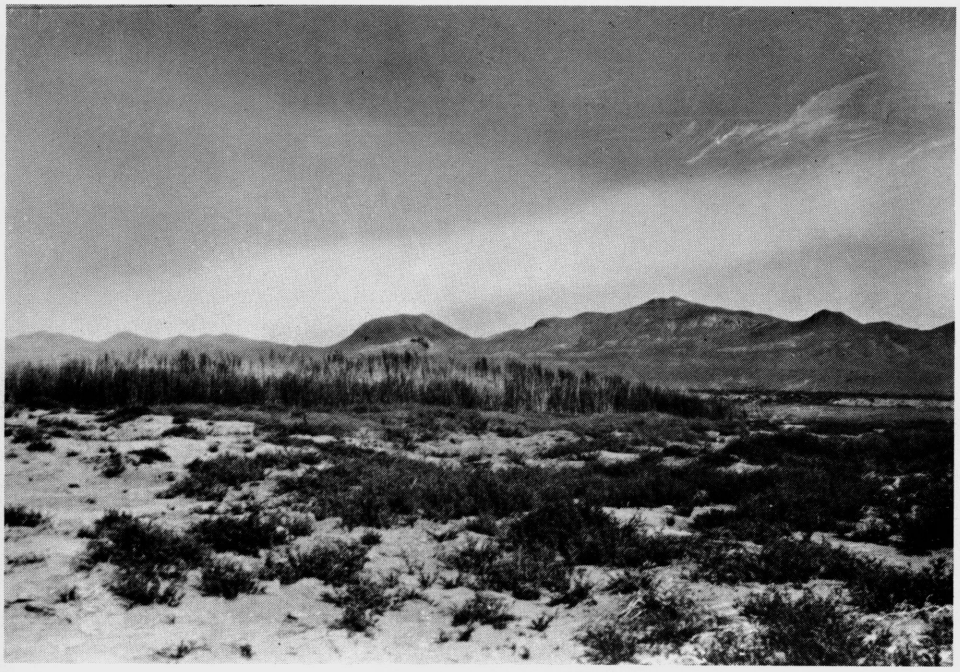
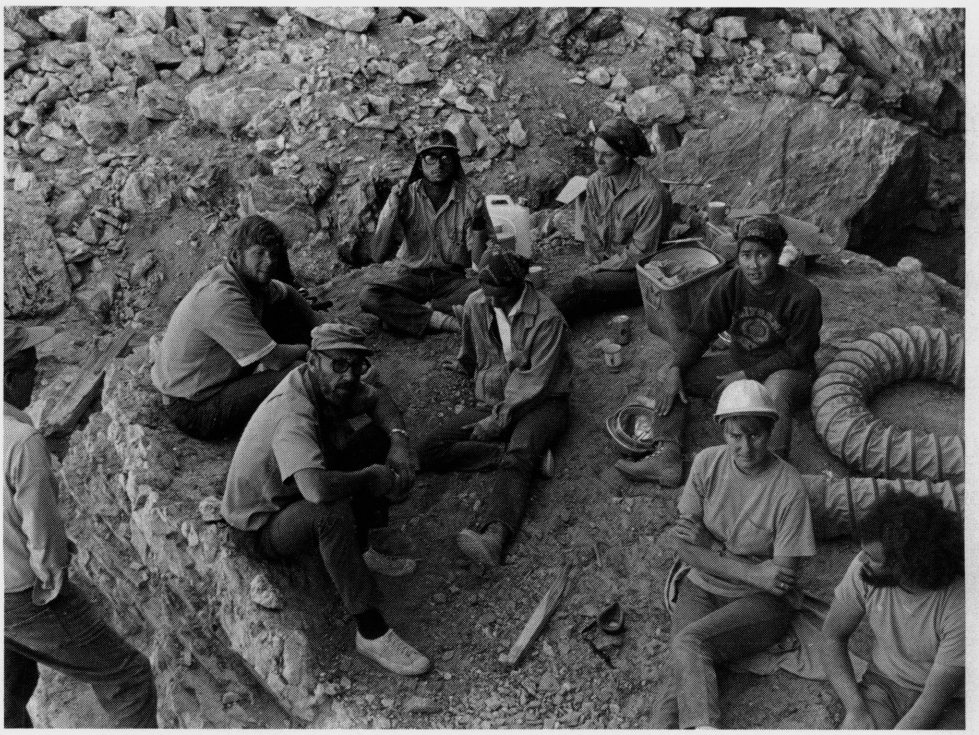


Plate 2

Plate 3



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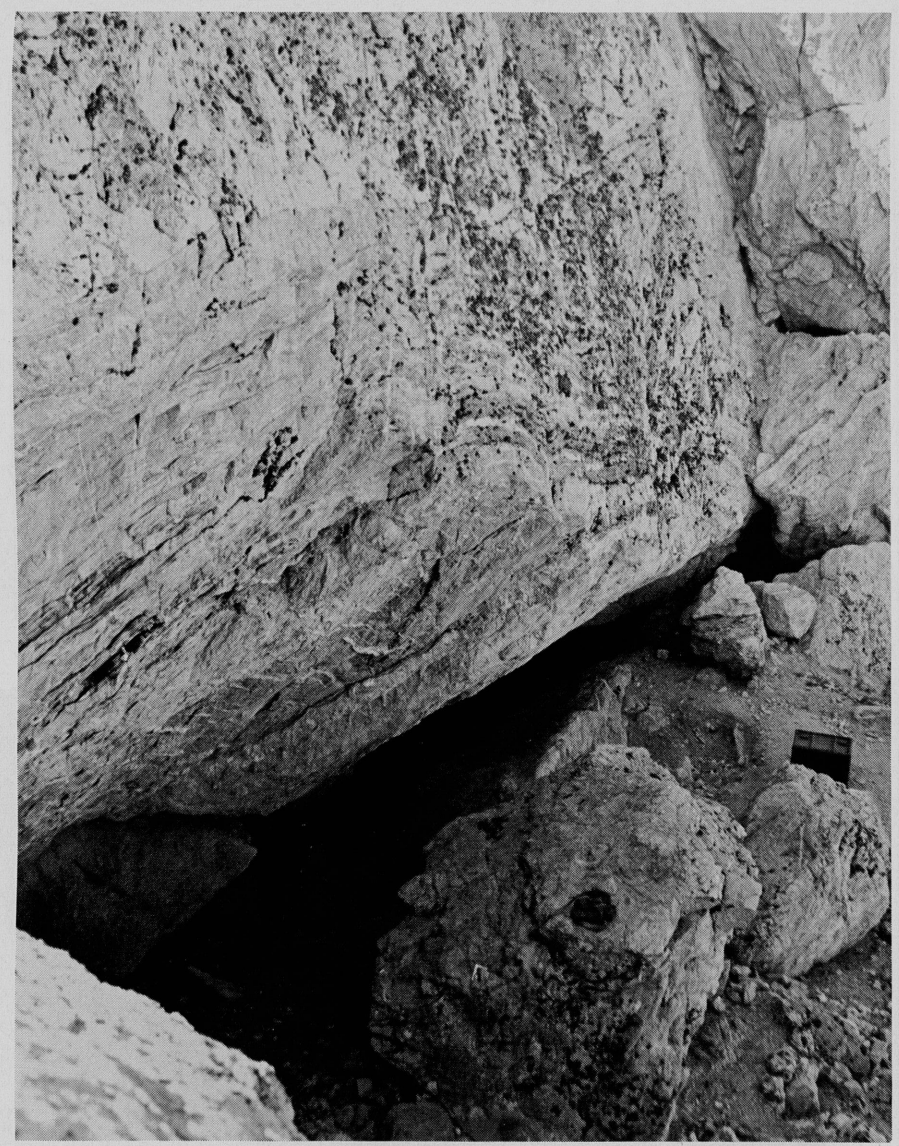
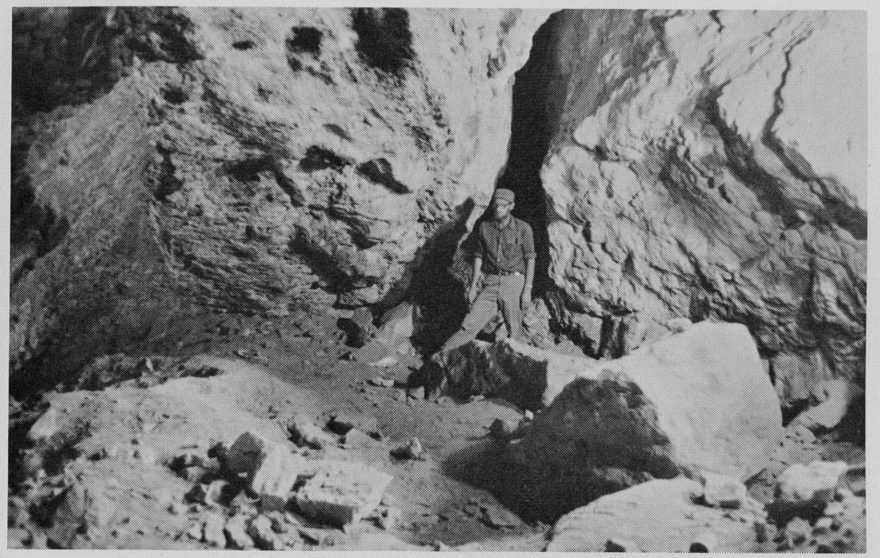


Plate 5

Plate 6

Plate 7

Plate 8



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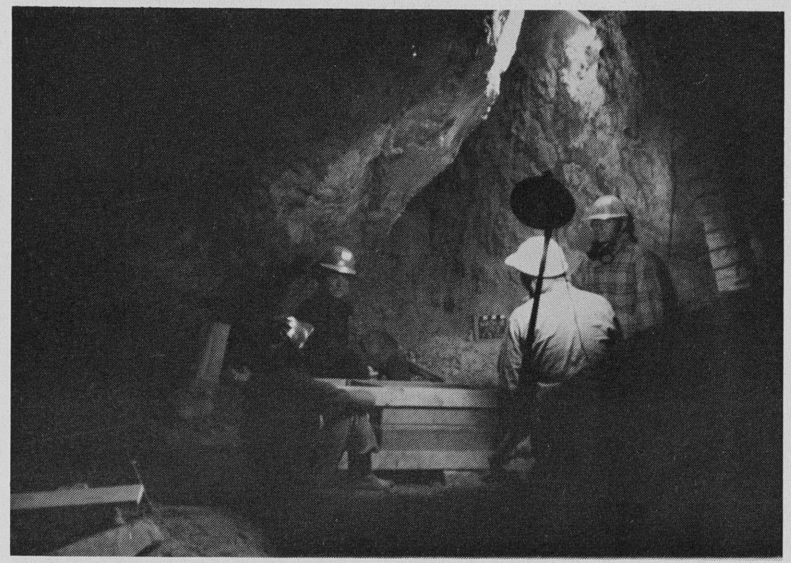

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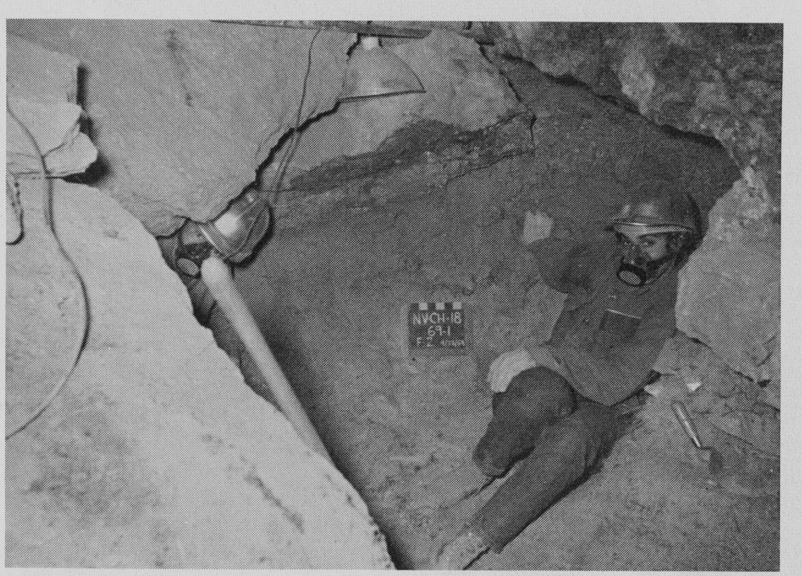

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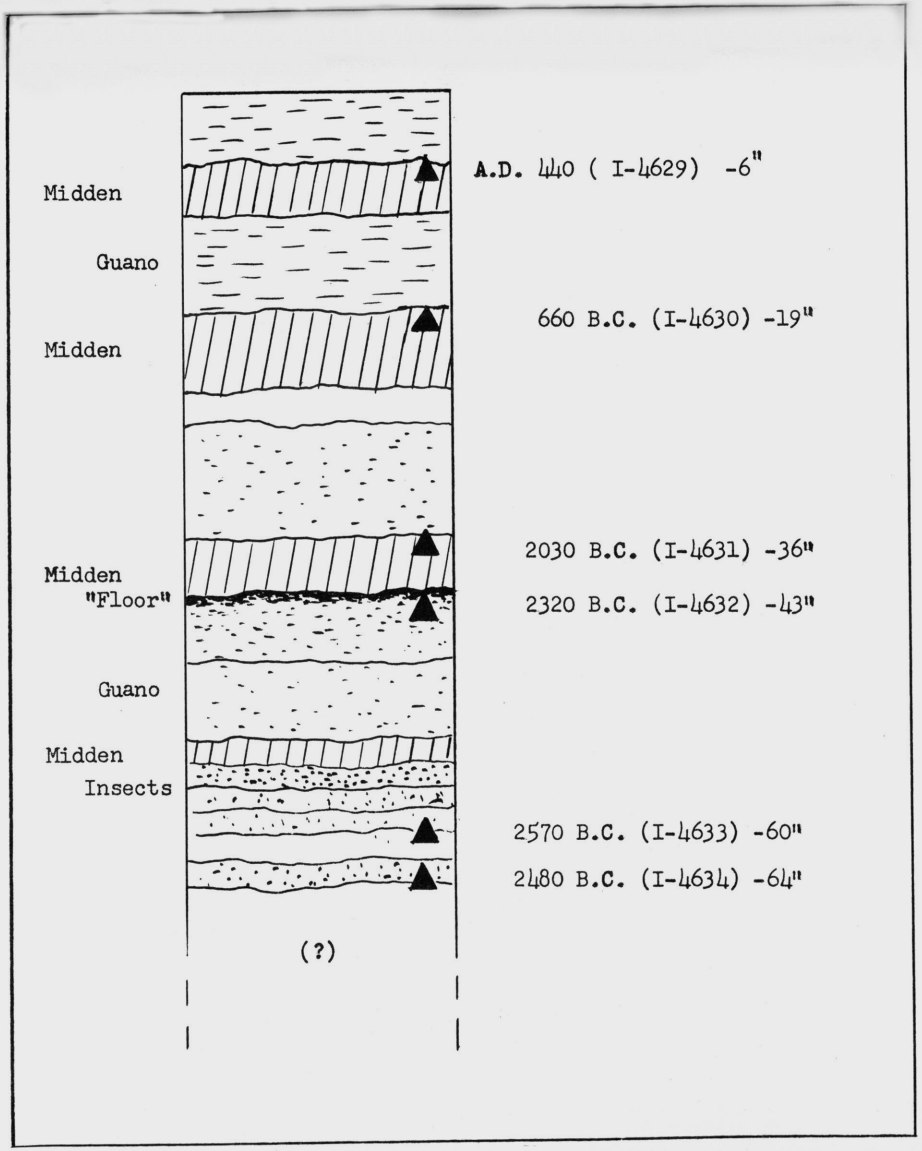
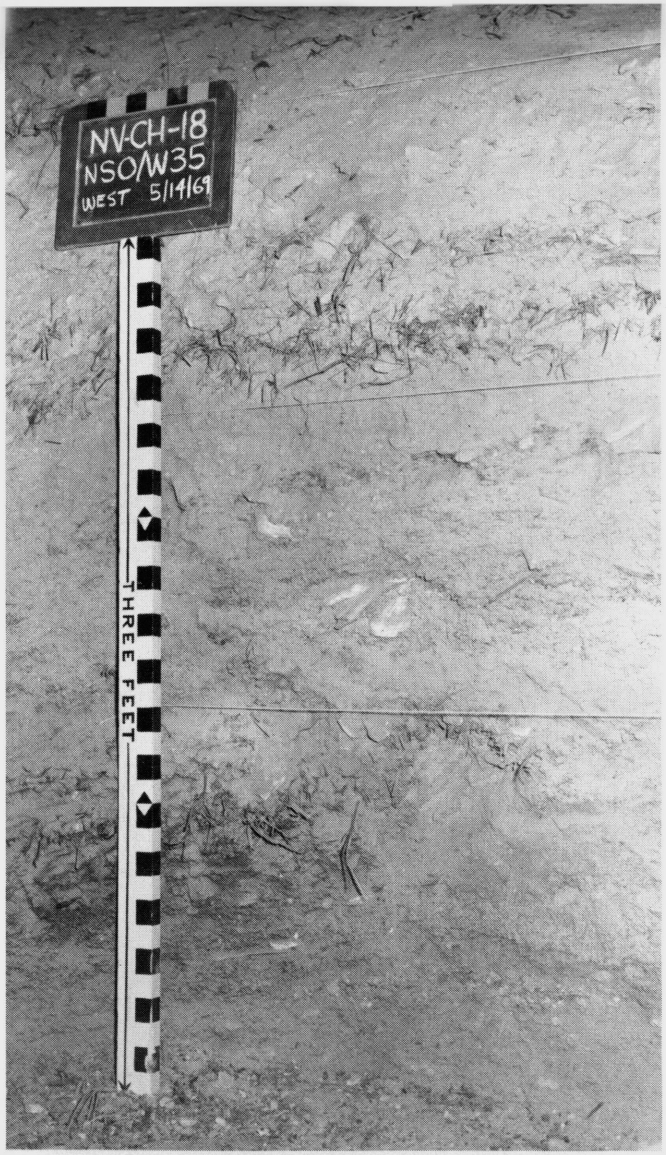


Figure 13: Lovelock Cave, NV-Ch-18, NSO/W35, depth 6-64", general stratigraphy and radiocarbon determinations.



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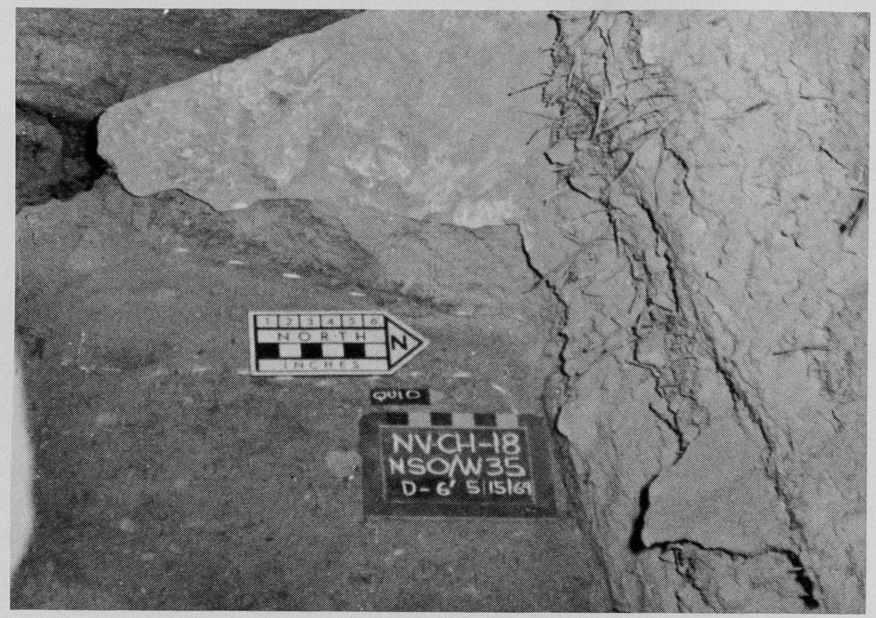

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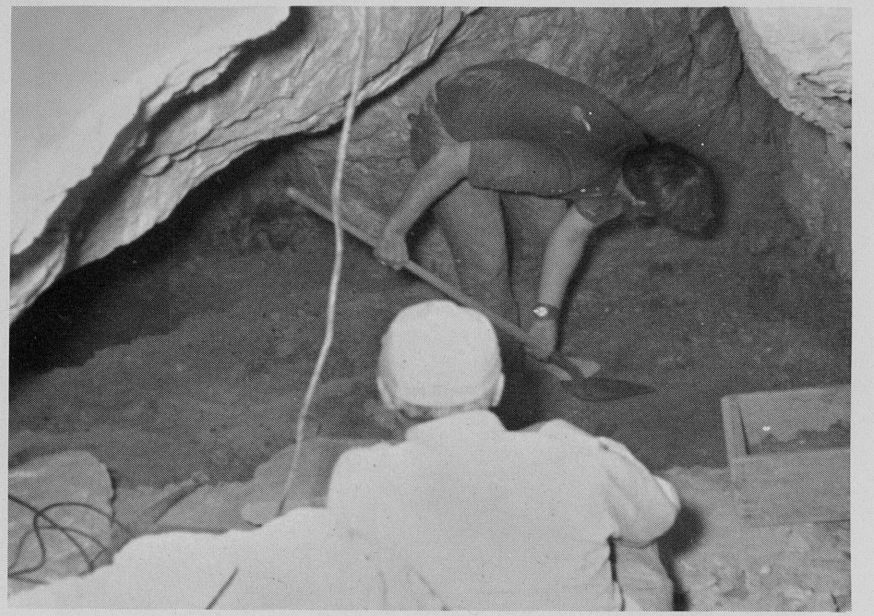

Plate 14

Plate 15

Plate 16

Plate 17

Plate 18

Plate 19

Plate 20

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Abbreviations Used

AA	American Anthropologist
AAnt	American Antiquity
DRI	Desert Research Institute
-SSHP	Social Sciences and Humanities Publications
GSA	Geological Society of America
-B	Bulletin
IJAL	International Journal of American Linguistics
ISUM	Idaho State University Museum
-OP	Occasional Papers
JM	Journal of Mammalogy
KAS	Kroeber Anthropological Society
-SP	Special Papers
MAIHF	Museum of the American Indian, Heye Foundation
-INM	Indian Notes and Monographs
NASR	Nevada Archaeological Survey Reporter
NMA	New Mexico Anthropologist
SAA	Society for American Archaeology
-M	Memoir
UC	University of California
-AR	Anthropological Records
-ASR	Archaeological Survey Reports
-PAAE	American Archaeology and Ethnology
-PZ	Zoology

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