PART IV: THE LACUSTRINE SUBSISTENCE PATTERN IN THE DESERT WEST

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Archaeological investigation of prehistoric occupation sites located in the Great Basin region of the western United States has disclosed a long and remarkably detailed record of cultural adaptation in surroundings that have been characterized as one of the New World's harshest environments. The "restrictive" aspects of the Great Basin environment have been stressed to such an extent that one has the impression that the entire region was a bone-dry desert occupied only by small groups of Indians who managed to eke out a precarious living by subsisting on an occasional antelope, deer, or mountain sheep, the seeds of various plants, or unpalatable foods such as locusts, ants, gophers, snakes and crickets obtained from the desert biome. This "marginal" subsistence adaptation was the economic basis of a lifeway that seems to have been shared by many inhabitants of the Great Basin (Steward 1938), but it is apparent that the desert-adapted existence has considerable time-depth in the region, for archaeological evidence found in sites such as Danger Cave, in western Utah, conforms to the putative Great Basin economic pattern--a ceaseless struggle to survive in an extremely arid habitat that has apparently remained almost unchanged during the last ten thousand years.

A rather different impression of life in the Great Basin may be obtained, however, from study of archaeological sites located in the western part of the basin. Sites excavated or investigated during the last half-century in the Humboldt and Carson Sinks in west-central Nevada give evidence of a regional subsistence pattern that was structured primarily on utilization of the resources found in and near the lakes and marshes located in the "sinks" or catchment basins of the Carson, Walker, Truckee, and Humboldt Rivers (Fig. 1). This lacustrine-adapted lifeway is in most respects virtually the antithesis of the stereotyped concept of the prehistoric "desert" lifeway. Unfortunately, details of the "limnosedentary" (Heizer 1967:1-20) or lacustrine subsistence pattern in the Great Basin are poorly known (Rozaire 1963). One reason for this is the fact that the "type-site" of the occupied lakeside caves (Lovelock Cave, NV-Ch-18, in Churchill County, Nevada), was excavated at a very early date (1912), and only after the uppermost cultural deposits in the cave had been almost completely destroyed by guano miners. Other lakeside sites (e.g. the Humboldt lakebed sites and Hidden Cave in the Carson Sink) have been investigated by competent archaeologists, but due to various circumstances detailed site reports have not been published, although preliminary notices have appeared (Heizer 1967; Clewlow 1968a; 1968b). Other lakeside sites, such as the caves along the shore of the now-extinct Winnemucca Lake, have been torn to pieces by relic hunters (cf. Roust 1958) or are incompletely reported.

The lakeside archaeological sites found in western Nevada provide detailed evidence that demonstrates that one of the areal subsistence patterns was based upon an overriding utilization of lacustrine resources, intensive exploitation of which can be traced from the Historic Period back through time to at least 2500 B.C., and, on the basis of less detailed evidence, to much earlier dates. Baumhoff and Heizer (1965) point out that there may have been an early lacustrine or riverine specialization throughout a large part of the Great Basin. It is possible that the resources of the rivers and lakes in the Basin may have been exploited, with varying intensity and efficiency, since the time that man first occupied western Nevada, southern Oregon, and eastern California. However, the origin and development of the lacustrine subsistence pattern is not well documented at the present time. The late or protohistoric phases of this pattern have been illuminated by recent investigations of ecological and paleobiological materials preserved in Lovelock Cave, Nevada, and we will now turn to consideration of the relatively recent, but nonetheless important evidence.

Lovelock Cave is probably one of the most widely discussed but least understood archaeological sites in western America. The first major archaeological site in Nevada to be excavated (Grosscup 1957), the cave contains a remarkable inventory of perishable material, and at present seems to be unmatched by any other known site for the quantity of human coprolites (desiccated excrement) contained in the cave debris. The Lovelock Cave collection housed at the University of California, Berkeley, includes more than 2000 coprolites, samples of which have been analyzed for information pertaining to the physiology and diet of the prehistoric population (Plate 5). Reports describing these analyses have been published (Ambro 1967:37-47; Cowan 1967:21-36; Tubbs and Berger 1967:89-92; Jones et. al. 1967:123-128, Roust 1967:49-88; Follett 1967:93-116; Heizer 1967:1-20; Dunn 1968:222; and the reports in this volume), but at present, in order to obtain a comprehensive view of the archaeological, ecological, coprological, and historical data pertaining to Lovelock Cave, the reader must have access to a dozen separate publications, some of which are out of print. The following discussion is not intended to be a complete review of this information, but rather is designed to fill at least partially the need for an interim synthesis of recent investigations at Lovelock Cave, and to serve as a means of expressing a few of our first thoughts regarding the lifeway of the Lovelock population in relation to published ethnographic data and to the lacustrine subsistence pattern in the desert west. These remarks are necessarily tentative, but in view of the fact that some phases of the Lovelock Cave research project will continue for at least two years, we trust that it is not inappropriate to set forth as part of this interim report a few interpretations based on our present limited information.

Preliminary analysis of fifty Lovelock Cave coprolites and detailed identification of the food items contained in the desiccated fecal material has clearly demonstrated, by reconstruction of the prehistoric diet, the lacustrine subsistence adaptation at Lovelock Cave. Extended analysis during 1967-68 of coprolites processed during 1965-66 has revealed that prehistoric utilization of lacustrine or littoral resources was much more intensive than preliminary analyses indicated (Cowan 1967; Ambro 1967; Roust 1967). Indeed, it is difficult to appreciate the fact that large, relatively sedentary human populations living in parts of prehistoric Nevada were sustained largely by lacustrine resources, since the lacustrine subsistence pattern is manifested in the "Sonoran" (Hall 1946:35, Fig. 4) or "Artemisian" (Dice 1943:45-46) biotic province, which, as we have stated, is one of the most arid environments in the continental United States. In the Humboldt-Carson sink area near Lovelock Cave, local rainfall averages less than five inches per year, an amount well within the minimum annual precipitation recorded in the driest deserts of the world, yet the material culture of Lovelock Cave (Loud and Harrington 1929; Grosscup 1960) and the food items contained in the coprolites deposited by the prehistoric residents of the cave reveals that the subsistence economy and material culture was based almost entirely on utilization of lacustrine resources obtained from a large but ephemeral lake formed at the terminus of Nevada's longest river, the Humboldt. The Lovelock coprolites contain seeds of primarily xerophytic flora (Amaranthus sp. and Atriplex sp.) gathered from plants growing on the hillside below the cave. Mammal hair found in the human excrement represents "Sonoran" fauna (Douglas; this volume)(cf. Hall 1946), which in the past may have ranged near the lakeshore, rather than in their present habitat in the high mountains.

During the early phases of the Lovelock coprolite analysis project, Ambro (1967:44) proposed that most of the subsistence items found in the coprolites were obtained from three primary gathering areas surrounding the site, the most important of which was the nearby Humboldt lakeshore. This conclusion is correct, but intensive or "extended" analysis of the coprolite constituents reveals that during the time of year when the fecal specimens analyzed by Cowan and Ambro were deposited in the cave, the lacustrine biome furnished as much as 90% of the major foods consumed by the Lovelock population.

Extended Coprolite Constituent Suites: The "extended" identification and tabulation of the constituents of a sample of fifty Lovelock coprolites (Table I) is the result of intensive study of the coprolite components by several scientists. More than eighty specific constituents were identified in the fifty fecal specimens (cf. Plate 6). The seeds, feathers, molluscan remains, charcoal, bones, insects, hair, pollen, lithic debris, fish scales, wood fragments, grass stems, aquatic tubers and other items contained in the fifty coprolites processed by Ambro and Cowan have been studied and identified, and detailed reports of these findings are in preparation. The significance of some of the more important coprolite constituents listed in Plate I may be briefly summarized as follows:

Bird remains contained in the coprolites have been identified to genera and in some cases to species (Napton and Brunetti, this volume) but it has not been possible to determine how many feathers of each species occur in a given coprolite, or how many individual birds are represented.

Bone debris is for the most part either icthyoid (mostly Gila [Siphateles] bicolor (cf. Follett 1967:93-116]) or avifaunal (Ziegler personal communication, 1967). A number of small spherical objects were found in statistically significant association with fish remains (cf. Plate 6). It may be that these "spheroids" are derived from Siphateles bicolor, but this must be confirmed by further analysis.

Insect remains included coprophagous insects (Okumura, personal communication, 1968) and at least one louse (Jellison, personal communication, 1967). Fly eggs (Diptera) also are present in a few of the "entrance" coprolites. Pollen grains are scarce in the entrance coprolites, although only ten of fifty palynological samples were examined (Napton and Kelso this volume). Samples of plant fiber, tissue, stems, and leaves subsume only six genera: Typha, Distichlis, Scirpus, Elymus, Suaeda, and Phragmites (Cooney and Schwartzkopf, personal communication, 1967). Analysis of additional floral material found in the cave is in progress.

Vegetal specimens have proved difficult to identify. Some of the diminutive vegetal fragments may be pieces of aquatic tubers, but available comparative material has not verified this tentative identification. The possibility that the human coprolites contain tuber fragments is interesting in view of the fact that Loud and Harrington (1929:95) found in Lovelock Cave six artifacts which they identified as digging sticks, so one might expect that tubers or roots would be found in the coprolites and perhaps in the cave refuse. Pine nut fragments are probably Pinus monophylla seeds obtained from pine stands in the Stillwater Range. Fragments of pine or pinyon nuts occur in only three of the fifty coprolites. A few pinyon hulls were found in the cave midden.[1]

A single grain of gunpowder found in one of the entrance coprolites is of modern manufacture and represents contamination of the site by recent visitors. Paper fragments observed in the components of two interior coprolites are the result of drying segregated coprolite components on paper towels, a practice that has been discontinued in the Berkeley laboratory. Human and other mammal hair found in several coprolites is discussed by C. L. Douglas (this volume).

Interpretations: In recent years the technique of coprolite analysis has advanced far beyond the mere identification and tabulation of food items. (See, for example, the detailed study of the contents of human coprolites collected by R. S. MacNeish from caves in the Tehuacan Valley, Mexico [Callen 1967:261-289]). At present it is possible to study coprolites for information pertaining to (1) the kind and quantity of individual foods, (2) the season when the site in question was occupied, (3) the local ecology, and (4) the nutrient yield of the prehistoric diet. These and other ecological, biological, and sociological ramifications of the constituents of the Lovelock Cave coprolites will be discussed in subsequent articles. By means of midden and coprolite analysis it is possible to reconstruct much of the prehistoric adaptative system manifested at Lovelock Cave. This point can be illustrated by consideration of two prominent food items found in the Lovelock coprolites--the seeds of bulrush (_Scirpus robustus_) and the common cattail (_Typha latifolia_).

The abundance of cattail and bulrush seeds in the coprolites suggests that aquatic flora was a very important food source. _Scirpus_ seeds--uniquely preserved and uniquely demonstrable (by their presence in the fecal material) as dietary elements--can be studied in reference to the Lovelock Cave artifact assemblage, revealing some interesting facts that apply not only to reconstruction of the Lovelock culture, but to interpretation of regional archaeological sites as well. As we have stated, bulrush or tule seeds are abundant in the interior coprolites, dated _circa_ A.D. 740. The hulls of these seeds are sometimes broken or crushed, but microscopic examination of these fragments discloses no evidence that the seeds were milled or ground, as by means of a mano and metate. It is possible, however, that the seed hulls could have been crushed, cracked, or broken by use of a mortar and pestle. Bearing this in mind, one may discover by examining the pertinent archaeological literature of the western United States, that the interpretative sections of reports describing the archaeology of some open-air occupation sites frequently contain statements to the effect that absence or scarcity of milling implements in the artifact assemblage of the sites in question indicates or "proves" that the prehistoric inhabitants of the sites did not exploit vegetal resources. The reader will doubtless recall speculation of this sort made in reference to whether the bison-hunters of the Llano and Plano cultures did or did not make use of vegetal resources, for the available artifact assemblages of these cultures rarely, if ever, include recognizable seed grinding implements. Therefore, it is interesting to observe that the material culture of Lovelock Cave contains only six "shellers" (seed grinding manos) and no metates (Loud and Harrington 1929:107). The scarcity of these implements could be taken to indicate minimal exploitation of vegetal foods. Nevertheless, almost all of the coprolites found in the cave contain quantities of apparently unmilled Scirpus seeds. Thus, at this Great Basin archaeological site, scarcity or absence of milling implements gives virtually no information as to the extent of exploitation of vegetal resources. Indeed, to make inferences on the basis of negative evidence (in this case, an apparent absence of seed milling implements) that seeds and other vegetal food were not eaten, or were minor dietary items, can only lead to grossly incorrect assessments of ancient economies (cf. Davis 1960:15-21; Gabel 1967). The Lovelock Cave coprolites, on the other hand, provide detailed evidence of the extensive use of vegetal foods. The perishable cultural materials preserved in Lovelock Cave includes some 10,000 artifacts and tons of utilized vegetal material. If almost all of this material had been destroyed by moisture and decay, as is usually the case in open-air occupation sites (cf. Hole and Heizer 1965:74-75), one would perforce base his appraisal of the Lovelock Cave subsistence economy on the available lithic artifact assemblage, which in this case consists of 91 projectile points (Clewlow 1968a:93, Table 2), six shellers (Loud and Harrington 1929:107), and a few knives and other implements (Grosscup 1960). Given the data provided by this assemblage, it would be logical (and not unprecedented) to categorize Lovelock Cave as a site occupied by members of a "hunting culture", whereas the coprolites and other perishable material found in the cave demonstrates that the subsistence economy was in fact structured upon gathering of diversified (primarily lacustrine) resources, hunting perhaps playing a minor role in the economy.[2]

Another point to consider in reference to Lovelock Cave is that a single site or type of site (i.e. caves) may not necessarily adequately represent regional culture patterns or even local adaptive systems, although this tacit assumption underlies much of the large-scale cultural reconstruction based on excavation of specific archaeological sites located in the Great Basin. Lovelock Cave, for example, is but one aspect of the lacustrine subsistence pattern centered around Humboldt Lake. An altogether different type of occupation site, which was occupied at the same time as Lovelock Cave, has been revealed by investigation of the Humboldt "lakebed" site (NV-Ch-15) located 2.5 miles northwest of Lovelock Cave on the bed or former shoreline of the now-extinct lake. Loud (1929:130) found more than 300 milling implements or "objects for the preparation of food" on the eroded surface of the lakebed sites. Similar milling implements have been found elsewhere in the Humboldt Valley (cf. Elsasser 1958:26-51; Cowan and Clewlow 1968:195-236). Only brief descriptions of the archaeology of the Humboldt lakebed site have been published (Heizer and Clewlow 1968:59-88), but it is without doubt one of the most important archaeological sites in the western Great Basin. The archaeology of Lovelock Cave, located a scant two miles from the main lakebed occupation site, cannot be understood without knowledge of the lakeshore sites (cf. endnote No. 8) for, as Rozaire (1963:74) states:

> Materials found associated with shore features such as at Lake Mohave . . . and near Fallon (Grosscup 1956) cannot be equated to a lake-side cultural tradition . . . though they are indicative of separate and diagnostic complexes. This situation is all the more evident when one finds that extensive comparable stone tool assemblages tend to be lacking in significant quantities in the pertinent cave sites.

Lovelock Cave can be compared with Danger Cave, Utah, located some 250 miles northeast of the Humboldt Sink. Radiocarbon dates from these two cave sites indicate that the upper strata of both caves accumulated at about the same time; moreover, both sites may have been occupied during autumn. (The earlier occupation of Danger Cave, dated _circa_ 8400 B.C., of course predates use of Lovelock Cave by man.) Danger Cave coprolites of human origin contain seeds of _Allenrolfea_ sp. (pickleweed or "burroweed"), the hulls of which are said to be abraded and striated, probably as a result of the seeds having been milled with stone implements (cf. Fonner _in_ Jennings 1957:303; see also Jennings 1968:137-138). Milling striae might be expected on seeds found in the Danger Cave coprolites, since the lithic inventory includes 810 "milling implements and handstones" (Jennings 1957:209-214). Thus, coprolite analysis provides an unprecedented opportunity to reconstruct ancient dietary regimes, but this approach is most effective when used in conjunction with analyses of the midden contents, material culture, and cultural ecology of appropriate sites.

Cultural Ecology and Lovelock Cave: The lacustrine specialization in the Humboldt and Carson Basins can be considered in the light of the "Desert Culture" or "Desert Archaic" concept, the details of which are well-known (cf. Jennings and Norbeck 1955:1-11; Jennings 1956:59-127; 1957; 1964:149-174; 1968:134 ff). Danger Cave and the recently discovered Hogup Mountain Cave in Utah have produced well-preserved artifact assemblages, faunal and vegetal remains, and coprolites which _in toto_ suggest that the human population of these sites subsisted on resources taken from an extremely arid ecological zone (Fry 1968b). A sample of forty-three Danger Cave coprolites, including a total of six fecal specimens from Danger Cave Level I (dated _circa_ 8400 B.C.) have been studied by Fry, and, as he puts it (1968a:46), there were - -

> no major changes in dietary patterns for a period of 9,000 years . . . There apparently was no need for cultural adaptation to major climatic change.

Fry summarized the salient points of the controvery that has centered around the problem of whether or not there was, from 5000 B.C. to 2500 B.C., an "Altithermal" period, a climatic regime of general aridity that resulted in depopulation of the Great Basin (Antevs 1948). The Altithermal may not have effected parts of Utah, for as Fry (1968a:16) notes:

> There is no longer any doubt that man was present throughout postglacial time in the Utah section of the Great Basin. Danger Cave (Jennings 1957) and Hogup Mountain Cave (Aikens _et al_ 1968) were both occupied during the time equivalent to Antevs' Altithermal.

Evidence from archaeological sites in western Nevada indicates that this particular part of the Great Basin was re-occupied _circa_ 3000 B.C. following an occupational hiatus of unkown length, but it will be necessary to determine whether the apparent hiatus and reoccupation is a concomitant of local, areal, or regional climatic or ecological alterations. (See Bennyhoff [1958] for a comprehensive summary of Great Basin cultural chronology.)

One of the essential factors involved in investigation of cultural manifestations is a detailed study of the local environment or "micro-environment", as Aschmann (1958:23-40), Swanson (1966a, 1966b), Malde (1964:123-129) and others have pointed out. (The concept of "microenvironment" is discussed by Odum [1959:139-143]. The term is often used to define an abstract level of analysis in studies of the cultural ecology of human groups in relation to external, localized environmental factors.) The relationship of microenvironmental variations and specific cultural manifestations in the Great Basin is in many cases difficult to assess--one simply lacks the necessary data. Lovelock Cave is an exception to this generalization, for analysis of coprolites found in the midden of the site furnishes ineluctable proof of prehistoric exploitation of the resources of a local microenvironment by a human group during a specific time-period.

The search for general (perhaps too general) explanations of cultural and climatological events in the Great Basin has to some degree obscured the details of local subsistence economies and technologies as they may be manifested at specific occupation sites. Variations in these interdependent systems may occur as a result of different cultural "responses" in local microenvironmental niches.

One of the most important archaeological sites to receive the <u>kind</u> of paleoenvironmental analysis that can elucidate the effects of microenvironmental and seasonal ecological variations is Star Carr, an occupation site in England. Excavation of this mesolithic lakeside site provided empirical evidence of the local effects of seasonal ecological and subsistence variations within a specific habitat, and helped to clear the way for archaeological investigation of cultural and social parameters that may be influenced by the immediate ecological context of a specific occupation site. At present there is a lingering reluctance among many Anthropologists to discuss cultural manifestations in terms of "environment", due to the deterministic use of the term by nineteenth century students of man and nature. Today, through "environmental archaeology" and "cultural ecology" it is possible to turn from the polemics of environmental, cultural, technological, climatological, historical, and biological determinism (and the ambiguities of possibilism) to study man and his specific social, cultural, and physical environments.

On the basis of his ethnographic study of environments and aboriginal social organizations in the Great Basin, Steward (1938:260-262) observed that a given environment does not necessarily "determine" anything, for the lifeway of humans living in a certain locality or habitat, or at a particular occupation site, is a product of an extremely complex interaction of cultural, environmental, and social factors. In _Theory of Culture Change_, Steward (1955:103) observes:

> There are several biotic zones [in the Great Basin] which set the basic conditions for a society equipped only with very simple hunting and gathering techniques.

The effects of the minimal precipitation that prevails throughout much of the Great Basin are discussed by Steward in reference to the abundance of xerophytic vegetation in the intermontane valleys of the region:

> In the Great Basin, the streams end in saline marshes or lakes. In the vast sandy areas between the streams, the quantity of edible plants depends directly upon rainfall, which varies from year to year and from place to place. These plants only afforded small quantities of food for the Indians.

Steward does not discuss in detail the lacustrine or wetlands resources of the region, in spite of the fact that, as La Rivers (1962) points out, lakes and marshes are common today in the intermontane valleys of northern Nevada, and in the past probably covered a much larger area.

The importance of the seeds of hydrophytic plants in the diet of prehistoric Great Basin native populations was not demonstrated, of course, until the Lovelock coprolites were analyzed; therefore, these data were unavailable for consideration by Steward in his discussions of Great Basin vegetal resources.

The economic importance of pinyon nuts (_Pinus monophylla_ in the northern part of the basin; _Pinus edulis_ in the south) has been iterated countless times by almost all students of Great Basin native cultures. According to Steward (1955:104) pine nuts "were the most important of all food species." Steward (ibid) continues:

> Since there was greater rainfall in the piñyon-juniper belt than in the valleys, this zone afforded more seeds, roots, and grasses, and it had more game, especially deer.

Minimal precipitation is certainly an important hydrologic factor in the Great Basin, but it would be fallacious to assume that local precipitation entirely controls the water-supply in river valleys such as the Humboldt, where it is apparent, on the basis of coprolite analyses, that the valley riverine and lakeside biome probably afforded more "seeds, roots, and grasses" than the piñon-juniper zone of the high mountains.

When Steward speaks of the "typical Shoshone family living in the pinon area of Nevada," he evokes a picture of small groups of Indians who foraged for "rodents, insects, larvae" etc., during the spring and summer and visited the pine-nut country in the fall. Steward (1955:107) concludes:

> Shoshonean society was affected not only by the erratic and unpredictable occurrence of practically all principal foods and by the limited technical skills for harvesting and storing most of them, but it was also shaped by the predominant importance of wild vegetable products, which put a premium upon family separatism rather than upon co-operation.

Elsewhere, (ibid:115) Steward remarks that "the Shoshoneans were constantly on the verge of starvation, especially at the end of winter," whereas Spencer and Jennings (1965:279) state:

> There are few places in the world with fewer natural resources for human use than the Shoshone region of Nevada, yet archaeological excavations indicate that people with a way of life like that of the Shoshone have lived in the Great Basin for about 10,000 years.

The lifeway of the Shoshone, as depicted by Steward, is somewhat reminiscent of the sterotyped concept of the day-to-day existence of the African Bushmen. Richard Lee (1965:191) notes that "an observer planning to live with Bushmen is led to expect -- from the ethnographic literature--that the Bushmen lead an arduous and exacting way of life, in which the problem of getting food is an overwhelming daily concern." To the surprise of everyone but the Bushmen, Lee found that two-thirds of the vegetal diet of the Kung Bushmen consists of the mongongo nut, which, according to Lee, "because of its abundance and reliability, resembles a cultivated staple crop such as maize or rice." Lee remarks (ibid:194) that "if the Bushmen were living close to the starvation level, then one would expect them to exploit every available source of nutrition."

The uniformity and apparently highly "selected" character of the constituents of the Lovelock Cave coprolites analyzed by Ambro and Cowan led the latter to conclude that the Lovelock population did not exist at the starvation level. We do not know, of course, if all prehistoric Great Basin Indians enjoyed a plentiful food supply, but Steward implies that the Shoshone did not.

Lee (1965:201) turns from this provocative study of the subsistence economy of the Kung Bushmen to consider the subsistence base of other tribes of hunter-gatherers:

> It remains to be considered whether the Kung Bushmen are exceptional among hunters and gatheres in that they have an unusually reliable subsistence base in the form of the mongongo nut.
>
> A brief survey of the living hunting and gathering peoples indicates that the Kung are quite typical of the general picture.

Lee continues:

> Even the lowly Shoshoneans of the Great Basin who, because of scarce resources, were forced to exist at the "family level of organization" possessed a superabundant staple in the form of piñon nuts (Steward 1955).. ...[Pinyon] nuts were so abundant that quantities could

> be collected and stored sufficient to last through the winter. Furthermore, the winter encampments typically consisted of 20 or 30 families living in one locality.

Lee concludes that "the subsistence base of the Shoshone was more secure than their ethnographer was prepared to allow."

Data included in the recently published volume Man the Hunter (Lee and DeVore 1968) helps to document the fact that "hunters do not live by meat alone." Sometimes this conclusion may be realized merely by improving the existing techniques for recovering archaeological data (see, for example, Struever 1968:353-362; Lee and DeVore 1968:281-289), or by studying neglected sources of information, such as coprolites.

Much of the recent awareness of man as an integral part of the ecosystem has come about by studying the past through the techniques of cultural ecology, following the methodology outlined by Stewart (1955) and others. Steward's cultural-ecological study of the Great Basin Shoshone indicated that fragmentation of Shoshone society into nuclear family units was due to (1) the erratic and unpredictable occurrence of practically all principal foods, (2) the absence of technical skills for harvesting and storing sufficient foods, and (3) the difficulty of gathering staple wild food by organized collection techniques. It would seem, in the light of the lacustrine subsistence adaptation in the Great Basin, that the problem which remains to be investigated through the methods of cultural ecology is why the Shoshone seem to have been so poorly adapted to life in the Great Basin region. The prehistoric village sites located on the shores of Humboldt Lake attest to the fact that population units considerably larger than the basic nuclear family were able to live in this area in close proximity to each other for extended periods of time. The apparent absence among the Shoshone of "technical skills" for the preparation of vegetal and animal foods stands in marked contrast to the relatively efficient food collection and preparation techniques used by the Northern Paiute.

The apparently "marginal" aspect of the Shoshone existence could have been due to their recent arrival in the Great Basin region, or to relatively transitory ecological factors such as diminution of their food supply by drought, or might be the result of unsuccessful competition with other Great Basin social aggregations for the lacustrine food resources found in the intermontane valleys (cf. Cowan 1967).

The diet of the prehistoric Shoshones may or may not have included large quantities of pinyon nuts. It is evident that an adequate understanding of man's adaptation in the Desert West can not be attained unless the details of the prehistoric subsistence economy are well understood. Was the pinyon-nut harvest really as important in the past as it was in prehistoric times? Was it more or less important than exploitation of lacustrine resources? These questions probably can not be answered through ethnographic research, but it might be possible to do so through archaeological investigations.

The inhabitants of Lovelock and Hidden Caves lived some 30 miles from a source of pinyon nuts, but very few nut hulls are found in the middens of either of these sites or in the human feces recovered from the middens (cf. Endnote Number 1). This situation would seem to indicate that these caves were not inhabited by the Shoshone, if one accepts the ethnographic information that pinyon nuts were the primary economic staple for these people. If these are non-Shoshone sites, and if the evidence for pinyon-nut subsistence is to be found in sites located elsewhere in the Great Basin, it is implicit that some other social aggregation occupied the lakeside caves from at least 1000 B.C. to Historic times, and the Shoshone may have exploited the resources of a different niche or habitat in the Great Basin. (See Dice 1955:227 for a discussion of the term "niche" as it is used here).

The possibility for multiple niche resource utilization in the Great Basin is illustrated by the fact that there are at least six "microenvironments" or microhabitats existing at the present time within a few miles of Lovelock Cave. These include such diverse habitats and plant associations as (1) alkali playas (2) lacustrine or wetlands (3) shadscale-phreatophytic flora (4) riverine and floodplain (5) xerophytic terrace or hillside zone (6) piñon-juniper zone (cf. Billings 1949:87-109). Billings (1945:89-123) lists fifteen such "associations" in the Carson Desert near Lovelock and Hidden Caves. Hall (1946:32-34) mentions eight "floral belts" or plant associations and lists the types of mammals commonly found in these zones.

The six microenvironments mentioned above are of course only illustrative. Detailed ecological studies are to be made in connection with further work at Lovelock Cave. Investigation of archaeological sites found in each of these intergrading zones might produce evidence indicating that different subsistence items were collected in each "zone". Moreover, there could be differences in the artifact inventories from zone to zone, just as there are variations in the relative quantity of faunal remains, projectile points, and milling implements found in Lovelock Cave and in the nearby Humboldt Lake-bed sites.

Analysis of coprolites from a dry cave located in the mountains of western Nevada might reveal that pinyon nuts were a major food source and this evidence could be construed as an example of a totally different lifeway than that reflected in the coprolitic and cultural material found in the lakeside caves. Nevertheless, such disparate cultural phenomena could have been produced, during a single year, by a single bank of transhumant, semi-sedentary, or "restricted-wandering" Indians. Investigation of the cyclic aspect of Great Basin native subsistence economies is one of the most challenging problems in Western prehistory.

Turning to consideration of Lovelock Cave in the light of the lacustrine subsistence pattern, it is interesting to observe that recent ecological changes in the vicinity of Humboldt and Winnemucca Lakes have produced microenvironmental conditions that could be described as "Altithermal" in character, while in the Stillwater marshes located a few miles from Lovelock Cave on the south side of the Humboldt Range (Plate 4), abundant water, flora, and fauna provide an optimal habitat or biome that is essentially "Medithermal" in character---yet these ecological extremes exist at the same time in adjoining valleys in the Western Great Basin.

Grosscup (1963:67-71) has given much thought to the effects of climate and ecology in western Nevada, which, in his opinion, is "a restrictive environment." As he points out, "Little is known of the effect of changes in moisture conditions on the local flora and fauna, including man." He discusses the possible ecological effects that might have resulted from desiccation or replenishment of lakes in the western deserts of Nevada, and suggests that the creation of Lahontan Dam, located less than fifty miles from Lovelock Cave--

has not changed the local flora greatly, even over a fifty year period. The shores of Lahontan Reservoir support a stand of willow, but the permanent water supply does not appear to increase markedly the amount of grass available or encourage lush vegetation of any sort. Nor does it appear to have had much effect on the mammal populations in the area. Certainly the area would become more attractive to migratory birds. Perhaps large mammals would also be affected in that more drinking water would be available, but unless there were increased amounts of grass or other plants for grazing or browsing, the increased water supply would be of little value.

The preceding remarks illustrate a number of interesting points. For one thing, it is true that the shoreline of the Lahontan reservoir does not support a well developed hydrophytic flora. On the other hand, the Stillwater Wildlife Management Area, located 15 miles southeast of Fallon, Nevada, and only 20 miles from Lahontan Dam, includes a 25,000 acre wetlands area that supports a really impressive array of lacustrine flora and fauna. The water in these marshes has an average depth of two to three feet. The area is densely covered by extensive stands of _Typha_, _Scirpus_, _Juncus_, and _Cyperus_. The Stillwater wetlands attract large flocks of migratory and resident waterfowl. Flights of more than 300,000 birds occur in September and November, and more than 150 species of birds have been observed within the management boundaries (Napier, personal communication, 1967).

The deep-water Lahontan Reservoir has failed to sustain emergent tule associations due to frequent drawdown of the impounded water, and to the fact that swamps or emergent floodplains suitable for growth of hydrophytic flora have not developed along the perimeter of this artificial impoundment (cf. Robel 1962:221-224; Harding 1935:87-90). The level of Lahontan Reservoir fluctuates because the water is used to supply the Newlands and Stillwater irrigation projects (Giles _et.al_. 1953:1-9; Groves 1953:188-197). Migratory birds do not nest at Lahontan Reservoir due to the scarcity of suitable marsh flora, particularly _Scirpus_, which provides both nesting cover and food for many Anseriformes (Steel _et.al_. 1957:38-41).

The amount of grass and browse available for big-game forage in the vicinity of the desert lakes is an important factor in their habitat. Bighorn sheep, which are well represented in the Lovelock osseous assemblage (Loud and Harrington 1929:35), today range in the upper Sonoran of Boreal zones in Nevada (Hall 1946:35ff). However, as Lundelius (1964:26-31) points out, the former distribution of large fauna such as bighorn sheep was extremely variable.[3] In prehistoric times bighorns might have ranged in the West Humboldt Mountains or near the valley lakes (cf. Bailey 1923: 66-86), hence, the local availability of water and grass could have been very important to animals and indirectly to man. In any case, the failure of artificial impoundments to support lush mesophytic vegetation is contrasted in western Nevada by the tule-swamp marshes and shallow "Typha-tule" wetlands such as those that have developed over the course of centuries in the river basins and the desert sinks of western Nevada.

Grosscup (1963:67-71) states:

> Local precipitation increases would appear to be more important to the local plant and animal populations than changes in the amount of precipitation and runoff in the Sierra Nevadas or the mountains of north-central Nevada.

In our opinion this might be agreed to if Humboldt Lake had been entirely fed by local runoff or by streams issuing from the nearby Stillwater Mountains, but this was not the case: most of the lakewater was supplied by the longest river in Nevada, the Humboldt, which rises in the Ruby and Independence Mountains some 200 miles northeast of the lake. Antev's (1938:41-47) study of long-term variations in the Humboldt Valley water supply revealed that local rainfall, which is influenced by climatological conditions in mountain ranges west of the valley, did not entirely determine the amount of water available to man, animals, and vegetation in the vicinity of Humboldt Lake. The level of the lake was controlled by the local hydrologic cycle (which includes evapotranspiration, infiltration, and other factors) and by the amount of water derived from precipitation falling in the mountains far to the east of the Humboldt Basin (cf. Hoyt 1936; Houston and Boardman 1947; Langbein 1964:37-39; Aschmann 1958:23-40).

According to Hall (1946:55):

> Rainfall has no direct effect, to which I can point, on the geographic distribution of mammals in Nevada. If wider annual fluctuations between the maximum and minimum fall occurred, it is expectable that there would be appreciable effects. Through regulation of the number and size of streams and lakes, regulation of amount of soil-moisture, and regulation of the kind of flora, rainfall indirectly has great importance.

Hall (1946:59ff) discusses the fluctuations in ancient Lake Lahontan and observes that "the effect of the lake may have been to increase the number of mammals."

One of the most important factors influencing the Humboldt Basin hydrologic cycle is that the Carson and Humboldt Sinks lie in the rain-shadow of the Sierra Nevada range. The climatological effects of this physiographic situation have been described by Brown (1960) as follows:

> Nevada lies just east and to the leeward of the Sierra Nevada Range, a massive mountain barrier which has a marked influence on the climate of the State. One of the greatest contrasts in precipitation found within a short distance in the United States occurs between the western, or California, slopes of the Sierras and the valleys [i.e., the Humboldt] just to the east of this range. The prevailing winds are from the west, and as moist air associated with storms from the Pacific Ocean ascends the western slopes of the Sierras, a large portion of the original moisture falls as precipitation. As the air descends the eastern slope, it is warmed by compression, so that very little precipitation occurs. The effects of this mountain barrier are felt not only in the extreme western part, but generally throughout the State, with the result that the lowlands of Nevada are largely desert or semi-desert.

One of the phenomena produced in western Nevada by the Sierra Nevada rainshadow effect is that over a 25 year period only 4.3 inches of precipitation (mean annual total) was recorded at Lahontan Dam. During the same quarter-century a mean annual total of only 5.76 inches of precipitation was measured in the vicinity of the town of Lovelock. The sparse rainfall in the Humboldt-Carson Sink area (about the same amount that is recorded annually at weather stations near Las Vegas, Nevada [U.S. Weather Bureau 1952]), would eventually have produced an extremely arid environment, but this was not the case in the lower Humboldt Valley--the lake provided a habitat in which man could exploit many different food resources, some of which, such as fish and waterfowl, would not be thought of as foods normally abundant in arid regions.[4]

Early Phases of the Lacustrine Subsistence Pattern: Grosscup (1963) and Rozaire (1963) have commented upon the early--*circa* 8000 B.C.--radiocarbon dates produced by analysis of organic material found in cave sites adjacent to Winnemucca Lake, Nevada. According to Orr (1952; 1956) some of these caves contained fish and vegetal remains that have a radiocarbon-ascribed age of 8400 B.C. The presence of fish remains in these caves suggest that lacustrine food sources were in use at this early date. Unfortunately, the supposed spatial and temporal association of some of the archaeological evidence found in these caves is by no means clear. Orr (1956) states that carbonized remains of a human foot were found in association with the bones of a fossil horse and a fossil camel in Level IV of Fishbone Cave; however, the evidence seems to be ambiguous. Sears and Roosma (1961:669), who studied the palynology of the cave, acknowledge that Level III contained horse and camel bones, but suggest that "these may have been dug up from the layer below" (Layer IV). Perhaps this material could be dated accurately by the radiocarbon process (as was recently done in order to determine the age of comparatively recent human remains from Chimney Cave [Orr and Berger 1965:1466-1467]), rather than relying on dates which were obtained from vegetal and faunal materials that might or might not have been of the same age as the human remains.

Convincing evidence that western Nevada was occupied by man at an early date was found by Heizer in Leonard Rockshelter, which is located at the base of a spectacular cliff near Humboldt Lake. The site is eight miles east of Lovelock Cave and is situated at a slightly higher elevation. Atlatl foreshafts recovered from the oldest cultural deposits (the "Humboldt Culture") gave a radiocarbon date of 5088 ± 350 B.C. (Heizer 1951:93).

Two obsidian flakes were found in one of the deepest layers in the rock-shelter, a guano deposit which is radiocarbon-dated at 9249 B.C. (Heizer 1951:94). Fish remains and fragments of matting made from Scirpus fiber were found in the upper layers of the deposit. Beyond the evidence from Leonard Rockshelter we do not know when or where the early occupants of western Nevada began to make use of lakeside resources. Evidence that is gradually accumulating through investigation of open-air occupation sites in the Black Rock Desert of northern Nevada (Clewlow 1968b; Tuohy 1968:6-9) suggests that exploitation of lacustrine resources probably began at a very early date, perhaps developing as a co-tradition with the better known bison-hunting cultures of the high plains.

Evidence of a relatively late, well-developed lacustrine subsistence adaptation has been found in the middens of many archaeological sites located in the western Great Basin. These sites include Hidden Cave, the several Winnemucca and Pyramid Lake caves, Humboldt Cave, Lovelock Cave, Ocala Cave, and Leonard Rockshelter (Figure 1). (See also Baumhoff 1958: 14-51; Heizer 1956:50-57; and Grosscup 1956:58-64). Tommy Tucker Cave, located near Honey Lake, California, on the extreme periphery of the western Great Basin, is another important dry cave (Fenenga and Riddell 1949:203-214). Riddell (1956:1-25) states that the cultural material found in the cave deposit is equivalent in time "to part of the Transitional Period and all of the Late Period of Lovelock Cave". (For a discussion of these "periods" see Grosscup [1960].) Cultural debris found in the cave includes artifacts made of round and triangular tule, evidence of burials, "gill nets", and fish bones (Siphateles sp.). Post-contact material was found in the surface debris, and Riddell mentions that the cave was occupied within memory of living Honey Lake Paiute.

The early development and persistence of the lacustrine subsistence adaptation is revealed by evidence contained in the lower-level cultural strata in Hidden Cave, near Stillwater, Nevada, some forty miles southwest of Lovelock Cave (Roust and Grosscup n.d.; Roust and Clewlow 1968). Coprolites found in the so-called "Thirty-two inch midden" in Hidden Cave were spatially associated with cultural debris that gave a radiocarbon date of 1094 $\pm$ 200 B.C. (Grosscup 1958:19), but the date was not obtained directly from the fecal material. Roust (1967:49-88) analyzed seventy-four human coprolites recovered from the Thirty-two inch midden. Food items included bulrush and cattail seeds, fish bones (Siphateles bicolor) and the bones, skin, and feathers of waterfowl (cf. Napton and Brunetti, Part II, Table 1, this volume). Ambro (1967:37-47) has discussed the striking similarities (revealed by coprolite analysis) of the food habits of the prehistoric occupants of Lovelock and Hidden Caves. The early date obtained from organic material found in the Thirty-two inch midden in Hidden Cave would seem to indicate that the lacustrine subsistence adaptation was established at this site as early as 1000 B.C. Radiocarbon dates of cultural material indicate that Lovelock Cave was occupied circa 1218 B.C. (Grosscup 1958), if not considerably earlier. Continuity of the lacustrine subsistence adaptation may be demonstrated by the contents of the Thirty-two inch midden coprolites, the Lovelock "interior" coprolites (dated A.D. 740), the Lovelock "entrance" coprolites, which probably represent occupation of this site during the Historic Period (cf. Ambro 1967).

Ethnographic data (Hopkins 1883; Loud and Harrington 1929; Stewart 1941; Scott 1966; Heizer 1968) indicates that lacustrine resources formed a large part of the Northern Paiute diet during the Historic Period. If, as Spencer and Jennings (1965:99) suggest, the Southern Paiute and Gosuite are the cultural inheritors of the Desert Culture, one could suggest that the Northern Paiute cultural heritage may be found in the lacustrine subsistence pattern. Heizer (1967:9, Map 1) has pointed out that many of the differences between the southern and northern groups of the Northern Paiute could be due to the fact that the southern bands lived near the desert lakes. Future archaeological investigations in Nevada and Oregon will probably produce coprolites and other cultural material that should reveal the "Lahontan" or lacustrine subsistence adaptation in the area occupied by the southern bands, and a "Sonoran" adaptation in the territory recently occupied by the northern bands of the Northern Paiute.

Cultural Change and Cultural Continuity in the Lacustrine Subsistence Pattern: It has long been supposed that there was an occupational hiatus between the termination of the Late Lovelock Cave occupation and the arrival of the Northern Paiute in the Humboldt-Carson area. This interpretation, based on archaeological and ethnographical data pertaining to Lovelock Cave, has been summarized by Grosscup (1963:70) as follows:

> We are still uncertain whether Lovelock Culture is the parent of Northern Paiute culture or whether Northern Paiute culture is intrusive into this particular part of the Great Basin. Present evidence supports the latter possibility rather than the former.

> As far as I can interpret our present archaeological evidence, there is a gap of some 500 years between the latest Lovelock material and what little we know of prehistoric Northern Paiute, or Dune Springs, culture. . . there is no major change or difference between economic activities of the Lovelock people and the Northern Paiute.

This view of Lovelock prehistory rests on two major premises: first, artifacts (i.e. projectile points) representing the late prehistoric and protohistoric period in the Great Basin were not found in Lovelock Cave, however, much of the upper-strata of the site was destroyed or removed in 1911-1912 during commercial guano-mining operations. The few projectile points found in the cave by Loud and Harrington were attributed on typological grounds to prehistoric periods of cave occupation; post-contact or caucasian trade items were not found in the cave during the excavations of 1912 and 1924. The second premise depends on interpretation of certain ethnographic data. In 1929 Loud and Harrington published extracts from <u>Life Among the Piutes</u>, written by Sarah Winnemucca Hopkins (1883), who recounted a folk myth describing a protracted local war between the Northern Paiute and an unknown people who were competing with them for control of the resources of Humboldt Lake. While it is not unlikely that such warfare occurred, Hopkins' narrative gives the impression that the Humboldt Valley was occupied in earlier times by a non-Northern Paiute population. This account and the archaeological evidence (or the lack of it) contributed to the conception and perpetuation of the belief that there was a considerable gap between the Lake Lovelock and Northern Paiute occupation of the Humboldt Basin.[5]

The first empirical evidence indicating that the lakeside caves were occupied or utilized during the Protohistoric and Historic periods came to light in 1937 in Humboldt Cave, excavated by Heizer and Krieger (1956). Cache No. 1, which the Indians had constructed in the uppermost strata of the cave, contained the following artifacts: 3 burlap sacks, 2 pair of trousers, 1 canvas ore sack, 5 strips of cloth, 1 cord made of <u>Apocynum</u> fiber, 1 fishline with composite bone hooks, 1 chert blade, 1 steel arrowhead, and 1 bundle of eagle feathers. The cache includes useful items derived from both the European and aboriginal material cultures. These artifacts imply very late use of Humboldt Cave, but more to the point, the <u>kind</u> of use that had been in vogue for centuries; that is, storage of useful items in cache pits dug in the dry lakeshore cave deposits. Other Humboldt Cave cache pits - thirty in all - were depositories for prehistoric material such as rope, tule mats, hafted stone knives, dried fish, grasses, cattails, basketry, etc. The contents of Cache Pit No. 1 and other information obtained by excavation of Humboldt Cave led Heizer and Krieger (ibid:88) to conclude:

> We believe that the upper twenty inches of refuse deposit in Humboldt Cave were in all probability left by the Northern Paiute, though we have no definite proof of this.

Additional evidence of late occupation or utilization of caves located in the Humboldt-Carson area was discovered in 1939 in Hidden Cave (NV-Ch-16), but this evidence, consisting of two large and rather unusual fish nets, was not studied until 1965. Richard Ambro (1966:101-135) examined both nets and found that they had been patched or repaired with cotton string and cloth of European manufacture, indicating that the native inhabitants of the area had used Hidden Cave for storage purposes in post-contact times.

It is likely that Indian use of the Humboldt lakeside caves dwindled to an occasional visit in the years following European contact (cf. Cowan 1967). However, Pyramid Lake, which was not discovered until 1844, was not frequented by Europeans until relatively recent times. Thus, one would expect that some of the caves near the shore of this lake might contain post-contact goods and other evidence of recent occupation. Tuohy (1967:4-5) excavated a small cave near the lakeshore and found in the cave debris "a calf's skull, a torn sleeve from a red wool shirt [and] a twill-work mat fragment." (Coprolites found in this cave are now being analyzed at Berkeley.)

Tommy Tucker Cave, located some thirty miles northwest of Pyramid Lake, was also occupied in historic times (Riddell 1956). Fenenga and Riddell (1949:213) state:

> Tommy Tucker Cave is situated in territory occupied in historic times by a Northern Paiute band, the Wadadökadö. The upper levels of the cave may well represent occupation by these peoples in the years just before 1860.

(Heizer[1967:9, Map 1] and Kroeber [1957] place the Wadadökadö in Oregon, rather than in the vicinity of Honey Lake, California.)

The archaeological evidence discussed in the preceding paragraphs suggests that some of the lakeside caves were in use well into historic times, but the available evidence from Lovelock Cave seemed to indicate that this site had not been occupied during the late Historic Period.

Coprolite analysis and archaeological salvage work carried out since 1956 at Lovelock Cave has provided new evidence bearing on the problem of cultural continuity in the lakeside cave sites. When the guano deposits were removed from Lovelock Cave in 1911, residual material screened from the guano was dumped on the hillside in front of the cave. (Plate 1). This material consisted of soil, stones, grass, artifacts, pieces of wood, human and animal bones, tule, cattail stalks, and other debris of no commercial value (Loud 1929:2-3). The dump is still in existence, but the perishable component of the debris has largely disappeared (after having been exposed to the elements for less than fifty years) leaving only pieces of stone, bone fragments, and ash. Part of the dump was screened in 1965 by members of a University of California field party. More than seventy projectile points were recovered, including Desert Side-notched and Cottonwood Triangular points, both of which occur in relatively late times throughout the Great Basin and California (Baumhoff and Byrne 1959:32-65; O'Connell 1967:129-140). Clewlow (1968a:89-101) states that the recent types of projectile points found in the dump "may be seen as an argument against an earlier conclusion that the cave was not in use in late prehistoric or protohistoric times." He is justifiably cautious, however, in stating:

> It must be emphasized . . . that while the points indicate that the cave was occupied in late times, they do not reveal evidence as to the origin of the occupants . . . The occupants of the cave in late times may not have been the physical descendants of the earlier occupants.

The 1965 salvage of the Lovelock Cave dump material increased the known projectile point inventory from 21 specimens found by Loud and Harrington to the present total of 91. Clewlow cogently observed that the ethnic affiliations of the protohistoric occupants of Lovelock Cave can not be demonstrated by projectile point typology. However, the typological attributes of the projectile points found in the dump help to dispel the impression that the cave was not occupied during the Late Period. This conclusion is supported by other evidence. For example, Loud and Harrington (1929:2) state that the uppermost strata in Lovelock Cave consisted of a layer of bat guano three to six feet deep (Plate 4). They wrote:

> It was <u>during</u> the removal of this guano that the first Indian objects were found in the cave, and they were many - - baskets, beautifully woven nets, sandals, and numerous other articles. [Underscore mine].

It would appear that the bat guano was not culturally sterile. However, the Loud and Harrington report (1929) also includes a statement by John Reid to the effect that according to one James Hart, who removed most of the bat guano from Lovelock Cave, "All of the Indian objects began to appear about four feet below the surface of the guano." It is apparent, however, that not all of the guano deposit was culturally sterile, since the artifacts found in the dump outside the cave were evidently screened from the guano layer. (Loud and Harrington [1929:32] salvaged from the dump debris a partly complete "mummy" and dozens of human bones. Loud [1929:29] states that "several thousand specimens were also obtained by working over the dump left by the guano crew"). It is possible that the few remaining portions of the rockshelter deposit in front of Lovelock Cave might contain evidence of the most recent occupation of the site, but much of the deposit has already been destroyed by untrained enthusiasts in search of "relics" (Plate 2).

Interpretation of the Late Period occupation of Lovelock Cave is complicated by the fact that the site was apparently discontinuously occupied from season to season and from year to year. Also, there may have been long periods of time when the site was not in use due to failure of the nearby lakeside resources. In any case, it is evident that the supposed hiatus between the end of Lovelock Cave occupation and the beginning of Northern Paiute occupation of the Humboldt Basin is more apparent than real. The lithic evidence which was collected by Heizer and his associates and reported upon by Clewlow indicates that Lovelock Cave was occupied by man during the Protohistoric period. This conclusion is supported by data obtained through analysis of the Lovelock coprolites.

Radiocarbon dates of sample coprolites indicate that the Lovelock Cave entrance feces were probably deposited about A.D. 1800. The interior specimens are at least ten centuries older, but the constituents of these two fecal accumulations are strikingly similar. Moreover, although there are some significant differences between the material cultures of the Late Period occupants of Lovelock Cave and the Historic Northern Paiute, (Heizer and Krieger 1956:86ff), the subsistence economy reflected in the Lovelock entrance and interior coprolites is closely paralleled by many features of the ethnographically documented subsistence economy of the southern bands of the Northern Paiute.[7]

Occurrence in Lovelock, Ocala, and Humboldt Caves of waterfowl decoys (Heizer and Krieger 1956), and northern Paiute manufacture of quite similar artifacts (Loud and Harrington 1929), (Pls.7, 8, 9, this volume) has been interpreted by some observers as a key trait linking the material cultures of the occupants of the lakeside caves and the Northern Paiute, but many of the specific types of artifacts present in Lovelock Cave are not represented in the ethnographically documented Northern Paiute material culture, as Heizer and Krieger (1956) point out.

The Lovelock Cave coprolites contain avian remains, including numerous feathers, many of which have been identified as contour feathers of Fulica americana, the common coot or mudhen (Napton and Brunetti, this volume). Some of the non-ichthyoid bones contained in the coprolites have been provisionally identified as the bones of coot (Ziegler, personal communication, 1967). This evidence indicates that mudhens formed part of the diet of the latest occupants of Lovelock Cave. (This could only be assumed on the basis of the meager data provided by the Lovelock Cave midden remains.) Scott (1966:23ff) has published a brief account of a Northern Paiute mudhen drive. The manufacture of decoys representing mudhens and other waterfowl has been discussed by Heizer and Krieger (1956:13ff) and is a trait that is common to both the Northern Paiute and the Lovelock Cave cultures, and could indicate either a direct historical continuity, as some observers believe, or a remarkable parallel or duplication between the material cultures of the Lovelock population and the Northern Paiute. Coprolite analysis has revealed several prehistoric dietary and culinary traits that are known to have been part of the Northern Paiute culture. It may be that the subsistence economy of the prehistoric Lovelock population and that of some Northern Paiute bands represent essentially unrelated duplicative adaptations to the specialized "lacustrine" habitat in the desert west.

Humboldt Basin might have been occupied in prehistoric times by one or more populations that were displaced, absorbed, or replaced by the Northern Paiute, as some observers have suggested. These people might have been Paiute or non-Paiute. Different social aggregations could have shared the lacustrine resources through transhumance; their material cultures and subsistence economies may have been practically identical; and they may have discontinuously resided at the same occupation sites ("serial occupation" [Napton 1965]). The social or "tribal" affiliations of these groups were probably based upon linguistic (dialect) variations, political or kinship bonds, or on other criteria that lie beyond the scope of archaeological investigative techniques.

One point remains, however, and it is this: the physical evidence obtained from the lakeside archaeological sites is superior both in quantity and quality to the archaeological data recoverable from most areas of North America; areas in which the supposed relationships between archaeological cultures and locally resident aboriginal groups have been "demonstrated" on the basis of far less adequate evidence. Comparison of archaeological and ethnographic data has not verified beyond doubt the apparent socio-cultural continuity between the late lakeside populations and the historic Northern Paiute, due to the fact that it is extremely difficult to make detailed comparisons of these cultures. The most unusual aspect of the situation is that controlled comparisons are limited not so much by the paucity of the archaeological evidence, but rather by the inadequacy of the available ethnographic data. Given the evidence that is now available, however, it seems highly probable that the members of one or more of the Northern Paiute bands that occupied the Humboldt-Carson Sink area were descendents of the occupants of some of the lakeside cave and village sites. This conclusion is of course tentative, but it is a hypothesis that can be tested by appropriate ethnographic and archaeological research, such as coprolite analysis.

It would appear, on the basis of data obtained through coprolite analysis, that there is considerable similarity between the subsistence regime of the occupants of the lakeside caves and that of many Northern Paiute bands (cf. Endnote No. 7). Loud and Harrington (1929:152ff) state that the Northern Paiute bands of western Nevada were identified on the basis of differences in their subsistence economies; e.g. the "Squirrel-eaters" of Granite Spring valley, "Cat-tail-eaters" of the Stillwater area, "sucker-eaters) of Pyramid Lake, etc. Humboldt Lake is within the territory that is believed to have been occupied by the Küpadökadö band of the

Northern Paiute (Kroeber 1957:209-214), but as Loud and Harrington (1929:152) and Heizer (n.d.) point out, sai'i or sai-duka'a ("tule-eaters") is the name given to the former occupants of the lower Humboldt Valley. As Heizer (1967:8) notes, the names of nearly all of the Northern Paiute bands are suffixed by dökadö, meaning "eaters." Küpa refers to "ground-squirrel" eaters (Heizer n.d.). This sytem of band designation suggests that the Northern Paiute material culture and language may have been relatively homogenous, bands having been identified on the basis of observable differences in their respective subsistence economies, which of course could vary with the season or from year to year. Stewart (1955:115-116) states that the "food-named" bands in the Great Basin "did not designate definable groups but were merely applied to whoever happened to be in the locality." It is obvious, however, from the contents of the Lovelock Cave coprolites, that the inhabitants of this site consumed meals made of several types of food, primarily bulrush seeds and tubers, cattail seed, fish, birds, and various mammals. Bulrush seeds are found in 49 of the 50 coprolites processed by Cowan and Ambro(Table I). Hence, the name sai-duka'a ("tule-eaters") would have been appropriate for the prehistoric occupants of Lovelock Cave. The continuity of the dietary regime displayed by the contents of the Lovelock interior and entrance coprolites, compared to ethnographically documented dietary regimes of the local Northern Paiute bands, could represent the definitive factor uniting the "archaeological past" and "ethnographic present" in the Humboldt-Carson sink area of western Nevada.

Traits of the Lacustrine Subsistence Pattern: The lacustrine pattern in the western deserts of Nevada may be seen as a prolonged and increasingly intensive exploitation of lake, riverine, and marsh or wetland resources. The earliest manifestation of this pattern probably developed through use of the resources of the post-Lahontan lakes that covered most of western Nevada and parts of Oregon and California (Russell 1885; Morrison 1961, 1964). As Rozaire (1963) has suggested, the lacustrine pattern may have been a persistent tradition through time. The "optimal" character of the lacustrine biome in the "deserts" of Nevada made lakeshores attractive to man, if for no other reason than the fact that lakes and marshes -- ephemeral though some of them may have been -- probably offered the most plentiful and varied food supply in the western part of the Great Basin.

Early hunters in the western Great Basin would have been drawn to lake and marsh areas by big game and other types of food found around the lakeshores. Many of the early bison kills on the Rocky Mountain piedmont were made on the shores of small lakes or ponds --Blackwater Draw, New Mexico, is an example of this type of kill site (Sellards 1952). Indeed, as Jennings (1968:77) points out, most of the known kill sites of the "Llano Complex" are associated with fossil bogs and marshes. The initial phase of lacustrine subsistence adaptation began with occasional use of aquatic resources. Later, increased use was made of wildfowl, seeds, and fish, and specific techniques for obtaining these foods gradually developed. There is a great deal of food potentially available in and around a desert lake or marsh, but efficient exploitation of these resources required development of specialized techniques and technology, e.g., bird and fish nets, winnowing baskets, milling implements, and special types of projectile points. (Barrett [1910] describes a special type of "ringed" arrow used in hunting waterbirds.)

The time from 5000 B.C. to 2500 B.C. seems to be poorly represented in the Nevada archaeological record. The true importance of Leonard Rockshelter becomes evident when one realises that it is the only well-stratified site in the state of Nevada that has produced a radiocarbon date for culturally associated material that is older than 9000 B.C. The site lies above the shoreline of Lake Lahontan, so it is possible that the inhabitants of the site made use of lacustrine resources.

The late phases of the lacustrine pattern are well-documented archaeologically, but persisted long enough to be made part of the ethnographic record only at Klamath Lake, Oregon (Barrett 1910:239-292), and Humboldt Lake (Scott 1966; Heizer n.d.). The Lutuami (Modoc and Klamath) Indians who lived around Upper Klamath and Tule or Rhett Lakes in Oregon were studied early in the present century by S. A. Barrett (1910).

> The Klamath and Modoc people possess a specialized culture, due largely to the extensive use of tule in the making of houses, basketry, and various utensils.
>
> . . . .
>
> In large part this specialization is the outcome of habitat in a restricted and unusual environment of large, shallow, inland lakes.

There are striking parallels among elements of the Plateau-related Lutuami of Klamath Lake, the material culture of the Northern Paiute of Humboldt Lake, and artifacts from Humboldt Cave (Heizer and Krieger 1956:80). The apparent resemblance may be indicative of a parallel --but not duplicative--adaptation to the resources of the tule marsh habitat. Development of this specialized "tule culture" (as Barrett characterizes it) in Oregon and Northern California may be seen as one of the local manifestations of the lacustrine pattern. The similarities between Northern Paiute and Lutuami material cultures are numerous but superficial. Barrett's brief description of modern Lutuami artifacts collected in 1907 antedates the first excavations in Lovelock Cave, and Loud and Harrington (1929:88) made only a single comparison between the artifacts of the Klamath Lake and Lovelock Cave cultures. Recent investigation by O'Connell and Ambro (1968) of archaeological sites in Surprise Valley, in northeastern California, helps to clarify cultural relationships between the southern and northern lake districts (cf. Cressman, 1956:375-513).

Regional or areal manifestations of the lacustrine subsistence pattern may be elucidated, and inter-relationships examined, by detailed analysis of the total available culture traits, for as Meighan (1959:404) observes:

> It is apparent that in a region of simple technology and slow change, real understanding of cultural development and cultural relationships cannot be obtained from study of artifacts alone, nor from trait-list comparisons. Only an environmental-functional study which considers the available nonartifactual evidence can provide a basis for systematizing the many variants of the simpler cultures.

Traits of the protohistoric and historic phases of the lacustrine subsistence pattern include:

1. Semi-sedentary occupation of lakeside villages.
2. Brush and tule thatched houses (Wheat 1959); house pits (Heizer and Krieger 1956:187, Pl.33:a).
3. Intensive use of lacustrine food sources.

4. Boats, rafts, or "balsas" made of wrapped tule culms (Scott 1966).
5. Waterfowl decoys made of skins mounted on prepared tule bodies (Loud and Harrington 1929; Heizer and Krieger 1956:76).
6. Seasonal harvest of food items, e.g. communal mud hen drives using boats and nets (Hopkins 1883).
7. Preparation of seeds by parching on mats using hot coals; cattail seed harvest, preparation of seeds by exposure to flame (Loud and Harrington 1929).
8. Intermittent occupation of lakeside caves; caches and inhumations in caves.
9. Extensive use of aquatic plants in manufacture of artifacts.
10. Use of specialized artifacts for efficient exploitation of lacustrine resources.

These ten traits hardly form a definitive list, yet taken together they comprise a series of "macrotraits" that cannot be duplicated, for example, by macrotraits of the Northern Plains cultures, or by archaeological evidence found in the caves in Utah or Kentucky. However, Heizer and Krieger (1956:82) have pointed out that twined-rush bags, mats, and sandals found in caves in Kentucky are quite similar to specimens from Humboldt Cave. Many minor utilitarian artifacts are widely distributed geographically and chronologically and in most cases are virtually useless as diagnostic criteria. The lacustrine pattern could be subsumed, with almost all of the other evidence of man's cultural activities in the Great Basin region, under the rubric "Desert Archaic", but the archaeological evidence found in western Nevada probably can be more profitably interpreted on a less abstract level of analysis.

The tentative list of traits of the lacustrine pattern in the western Great Basin probably could be expanded to include traits based on archaeological and ethnographic evidence obtained from the entire Great Basin region. Application of appropriate statistical techniques in a controlled analysis of the total cultural pattern (not merely by recording the presence or absence of various culture traits) would be very useful in revealing the principal characteristics of the prehistoric lacustrine subsistence pattern and its relation to historic occupation of the Great Basin.

Seasonality of Prehistoric Occupation in Lovelock Cave: We had hoped that through coprolite analysis it would be possible to fix with some precision the season or seasons during which Lovelock Cave was occupied or visited by man. The palynological information available at the present time is suggestive; further investigation should provide useful data. We have tried to ascertain the time of year when the cave was occupied by determining the period of "maximum availability" of some of the more important or plentiful food items (Table 2). Tabulation of these food items indicates that most of the constituents of the Lovelock Cave entrance and interior coprolites were probably obtained during early autumn. The different "meal types" discerned by Cowan (1967:21-35) through examination of the coprolite constituents might reflect intra-seasonal variations. Inter-group differences may be due to the time span separating the entrance and interior groups, while intra-group differences may reflect progressive variation in seasonal availability of specific food items.

The principal differences between the entrance and interior coprolites may be attributed to ecological alterations or to cultural factors, e.g. change in food habits over time, while the apparent "meal types" that may occur in the two groups probably reflect short-term seasonal variations, implying that many of the foods were consumed soon after they were gathered. Some intra-group differences can be attributed to an even more mundane cause--variation in meal pattern due to food preferences of individual occupants of the cave. Coprolite analysis is capable of disclosing such nuances within a general subsistence pattern, however, as Heizer (1967:1-20) observes, almost all of the food items found in the coprolites could have been stored or cached. ("Carry-over" or storage of foods is indicated by the shaded areas in Table 2). Therefore, at present we are unable to fix precisely the time of year when Lovelock Cave was occupied, althought it is apparent that most of the food items were gathered in autumn, rather than during spring or summer.[8] The so-called "quids" (masticated vegetal matter) could have been produced during spring, when fresh plant stalks were available. The coprolite constituents indicate that occupation or utilization of Lovelock Cave apparently began in early autumn (the cave having been visited infrequently during the summer months) and continued through fall, winter, and early spring.[9]

Concluding Summary: Preliminary analysis (1966-1967) and extended analysis (1967-1968) of twenty entrance and thirty interior coprolites from Lovelock Cave, Nevada, supports the following tentative conclusions:

1. Coprolites from Lovelock Cave provide empirical evidence of local exploitation of resources obtained from the lacustrine biome in the Great Basin. The intensity of the lacustrine specialization is indicated by the fact that more than 90% of the identified dietary constituents found in two groups of coprolites from the cave were obtained from the lacustrine biome.[10]

2. Comparison of the archaeological and coprological remains found in Lovelock Cave illustrates the point that absence or scarcity of milling implements in the artifact inventory of certain archaeological sites does not necessarily demonstrate that vegetal food sources were not exploited. This fact is of some relevance to the question of whether the absence in sites of seed-grinding implements can be taken as proof that seeds were not collected and eaten. The "pre-milling stone" horizon of Southern California desert (discussed by Heizer 1964:122-123), which has been proposed on the basis of absence of flouring devices at a few sites, may be explainable through seasonal variation in the subsistence cycle, or may be due to some special cultural practice, so that the implements were not used at certain times or at certain sites, even though the people posessed them.

3. The Hidden Cave and Lovelock Cave coprolites indicate that lacustrine subsistence adaptation in the Humboldt-Carson-Stillwater area may have spanned at least three millenia--judging from radiocarbon dates ranging from 1094 B.C. to A.D. 1800. A radiocarbon date of A.D. 740 for the Lovelock Cave interior coprolites sustains this conclusion.

4. The late radiocarbon date of the Lovelock entrance coprolites (A.D. 1800) and the recent finds of Desert Side-notch and Rose Spring Corner-notch projectile points in the uppermost and latest levels of debris taken from Lovelock Cave indicates that the supposed hiatus between the Late Lovelock Culture and the historic Northern Paiute archaeological manifestations (the "Dune Spring Phase")[11] represents sampling error rather than historical fact.

5. The Lovelock Cave coprolite constituent suites and ethnographic data pertaining to Northern Paiute subsistence economies suggests that the ancestors of the Northern Paiute occupied or utilized the Humboldt-Carson Sink caves.

6. Detailed analysis of the coprolites from Lovelock Cave indicates that the major differences between the entrance and interior samples reflects local ecological change or change in food habits, while intra-group differences in the coprolites may be attributed to seasonal variation of available food items.

Epilogue: Problems to be answered by future investigations in the Lahontan Basin of western Nevada include (1) examination of the pollen content of the Lovelock Cave midden and determination of the extent to which the pollen spectra and other constituents vary in a more representative sample of human coprolites, (2) when and where did the lacustrine subsistence adaptation originate, (3) what are the principal differences or similarities between the Lovelock, Humboldt, and Hidden Cave coprolites and those from sites near Pyramid Lake, Nevada, and from Danger Cave, Utah; and (4) how might the effects of the lacustrine subsistence adaptation have been manifested in the physiology or distribution of the ancient human population. These are only a few of the questions that remain to be answered before we will be able to reconstruct adequately the complex record of the lacustrine subsistence pattern, the first evidence of which was discovered fifty years ago in the dust of Lovelock Cave.

NOTES

[1] Pine nuts (Table 1, item 38) are an example of an upper Sonoran or "Hudsonian" food item. Pinyon nuts are scarce in the coprolites analyzed by Cowan and Ambro, and only a few nut-hulls were found in the cave midden (Loud and Harrington 1929:10). Heizer (1951:92) found *Pinus monophylla* shells in Leonard Rockshelter. Beads made of "Digger Pine" nuts were found in Humboldt Cave (Heizer and Krieger 1956:77, Pl. 26:f). One pinyon pine nut was reported found in midden and coprolite samples from Hidden Cave (Roust and Grosscup n.d.). None were reported found in Danger and Hogup Mountain Caves, Utah (Fry 1968a). An analysis of coprolites from Glen Canyon, Utah, revealed a single occurrence of pine nuts (Fry 1968b:6). Of the fifty Lovelock coprolites analyzed by Cowan and Ambro, only 4 contained pieces of pinyon nuts.

The apparent scarcity of pinyon nuts in these Great Basin sites could be due to several causes, not the least of which might be the methods used in preparing them for human consumption. Pinyon nuts were eaten raw as well as roasted, but it is said that in Historic times pine nuts were pounded into flour and made into a sort of "bread". Pinyon nuts prepared in this way would probably be highly digestible, leaving little residual evidence in the feces. Even so, the statement that pinyon nuts were the principal food source in the Great Basin seems to find little support in the coprological and botanical evidence from Lovelock, Danger, and other Great Basin caves.

[2] This point is debatable, and may be amplified as follows: Wagon Jack Shelter (Heizer and Baumhoff 1961:134-136) contained an impressive fauna in comparison to the osseous assemblage recovered from Lovelock Cave. Bones found in Wagon Jack Shelter total 1,415. *Ovis canadensis* is represented by 130 bones, yet as Heizer and Baumhoff (*ibid*) point out, the minimum demonstrable number of individual animals represented is: deer, 1; antelope, 3; mountain sheep, 4. The difference in the faunal assemblages of these and other comparable sites may be illustrated by comparison of bird and artiodactyl bones:

Site	Avifauna	Artiodactyls	Projectile Points
Wagon Jack shelter (1)	57	1282	79
Lovelock Cave (2)	275	10	91
Humboldt Cave (3)	78	66	13
South Fork rock shelter (4)	5 (5)	2298	67

1. Heizer and Baumhoff (1961:129, Table 1).
2. Clewlow (1968a:93, Table 2).
3. Heizer and Krieger (1956:29, Table 1).
4. Heizer *et*. *al*.(1968:10, Table 2).
5. Heizer *et*. *al*.(1968:17) lists only five bird bones. Four are modified into bone tubes, one (possibly a duck ulna) is an awl.

These simple statistics indicate that scarcity of artiodactyl bones in Lovelock Cave is inconsistent with the total that might be expected based on the number of projectile points. Recent tests in Lovelock Cave (Heizer 1967) resulted in recovery of very few bones of artiodactyls, but several dozen bird bones were found. The bones of big game animals could have disappeared from the cave faunal assemblage as a result of scavenging by coyotes, or from some other cause, or it is conceivable that hunting was not a major activity of the Lovelock people during the time that the cave was occupied. The scarcity of animal bones could reflect (1) efficient "field" butchering of big-game animals (2) unusually complete use of animal bone as food (prepared by pulverization) or in the manufacture of artifacts, or (3) the possibility that deer, mountain sheep, and antelope were not readily available during the season of cave occupation (cf. Heizer 1967:6). The apparent scarcity of the bones of large animals in the Lovelock Cave midden suggests that few of the larger mammals were taken, but it is likely, in view of the large number of projectile points found on the lakebed sites near the cave, that absence of bones of ungulates in the cave is essentially "negative evidence" that probably has very little relation to the actual or relative amounts of ungulate meat actually consumed by the prehistoric Lovelock population.

The number of species of mammals found in the state of Nevada has been estimated by Hall (1946:56):

> The number of mammals caught by us in certain areas where traps were set for several successive nights in the same place gives some basis for estimating the total number of mammals in the state. Over the whole of Nevada, I guess that the average population is about 20 mammals per acre.

[3] Orr (1952:14) reports finding mountain sheep dung in Level I of Crypt Cave, a low-altitude site on Pyramid Lake, Nevada. It would be interesting to know the criteria on which this identification was based, as well as the amount of excrement present.

[4] Humboldt Lake has been drained in modern times, so that the river now flows across the Humboldt Sink in a drain ditch and empties into Carson Sink. During the years from 1915 to 1960 the Humboldt Sink was a dry, alkaline, alluvial desert (Heizer 1967), but since 1960 the lake has gradually been refilling. Under modern irrigation methods a large part of the river is diverted to irrigate alfalfa fields. Much of the alkali in

the soil is removed and the mineral-charged water is drained into deep canals, and then is pumped into the Humboldt Sink. Water flow in the lower Humboldt River has been regulated for a number of years by Pitt-Taylor and Rye Patch reservoirs near Lovelock. During the decade from 1936 to 1945 the Humboldt River filled Rye Patch dam nearly to capacity (169,000 acre-feet) (Houston and Boardman 1947:5); however, La Rivers (1962:164) notes that the reservoir was completely emptied in 1954, 1955, and 1961.

[5] The problem of cultural succession in the Humboldt Basin has recently been discussed by Heizer (n.d.). According to Northern Paiute folklore, a people "different" from the Northern Paiute were displaced from the Humboldt Basin by a Northern Paiute band (Hopkins 1883). Many students of Nevada prehistory have dismissed this story as mere folklore. Heizer (n.d.) suggests that the story may reflect an actual historical incident.

It is not unreasonable to suppose that several Humboldt Basin caves were serially occupied by various social aggregations. The differences between the material culture in the lakeside caves and that of the historic Northern Paiute of Humboldt Basin could be investigated through cultural-ecological analysis of local population successions. Territorial conquest tales, whether folklore or myth, are widespread among North American Indian tribes. Loud (1929:162) was of the opinion that this myth "should be regarded as an attempt by the Northern Paiute to explain the archaeological remains of a cultural period preceding their own." If this myth recounts an actual incident, one might speculate that the *Saidukah* (Heizer n.d.) or *Sai-duk'a* (Tule-eaters) (Loud and Harrington 1929:152) occupied the Humboldt Basin and the lakeside caves during the protohistoric period. Population pressures prior to 1750 might have caused a Northern Paiute band (perhaps displaced from the upper Humboldt River) to enter the territory of the Tule-eaters, only to be supplanted in turn by Caucasians. Cowan (1967:21-35) has commented on the violent encounters that occurred between the Northern Paiutes and caucasians at Humboldt Lake. It is likely that such clashes were part of the cause of *local* termination of lake-side occupation, but another factor leading to decimation of the local Northern Paiute was the caucasian as a disease vector. Scott (1966:26) has discussed the effect of cholera upon the native population.

[6] It is interesting to note, however, that projectile points such as Rose Spring Corner-notched, Cottonwood Triangular and Desert Side-notched points used during the late period in the Great Basin are not represented in the total inventory of 13 projectile points found in Humboldt Cave (Heizer and Krieger 1956:29). Nonetheless, as the evidence from Cache Pit No. 1 indicates, absence of late types of projectile points does not necessarily mean that the cave was unoccupied during the time when these types of artifacts were in vogue.

[7] Cowan (1967) suggests that the Northern Paiute diet is different from the "Lovelock" diet, a supposition which seems not to apply in the case of most Northern Paiute bands, if the dietary elements listed by Stewart (1941) are any criteria. The sterotyped Great Basin "Sonoran" diet based on collection of seeds of xerophytic flora, consumption of grasshoppers, rabbits, and so forth, as exemplified by dietary practices of many Shoshone tribes, was in general quite different from the "Lahontan" or lacustrine subsistence pattern. Nevertheless, there were probably local parallels between Shoshone and Northern Paiute lacustrine diets, e. g. as might be evidenced by archaeological remains found in Franklin Valley, Nevada.

[8] Jennings (1964:161; 1968:138-139) mentions the following differences between Danger Cave and Lovelock Cave:

> Many famous sites seem to have been more heavily used as cache or storage spots (for example, Lovelock) rather than as dwelling places. As a result, Danger [Cave] has a wider variety of utilitarian objects, whereas the cache sites contain perhaps more "valued" materials . . . Among the debris [in Danger Cave] were various scraps of wood and other plants which were used in perishable utensils.

The Lovelock Cave report (Loud and Harrington 1929) and to some extent the recent study by Grosscup (1960)are for the most part concerned with description of the artifact assemblages recovered from the cave in 1912 and 1924. Jennings (ibid) states that sixty-five species of plants were found in Danger Cave. This sort of analysis (which is the basis of "environmental archaeology") was not performed on most of the unmodified vegetal and osteological debris found in Lovelock Cave. Nevertheless, the cultural material found in Lovelock Cave is typical occupational trash of the sort that is usually found in man's dwelling places in the Great Basin region. Harrington (ibid:5) gives the following description of the Lovelock midden:

> The deposits [in Lovelock Cave] consisted of desert dust blown in from outside, fragments of stone of varying sizes fallen from the roof, lime dust from the same source, bat-droppings or "guano," all mixed with materials brought in by man or objects made by him, such as quantities of tule rushes and grass intended for bedding and other uses, sticks, arrow canes, pieces of broken baskets and worn-out mats, bones of food animals, bits of string and rope, hair, feathers, excreta, ashes, stray human bones, occasional implements of stone, wood, or bone, shell beads, sandals, and numerous other articles.

[9] It is probable that the archaeological site of Lovelock Cave (NV-Ch-18) was for the most part ancillary to NV-Ch-15, the Humboldt lakeshore site which is situated about 2.5 miles west of the cave at the point where the Humboldt River discharged into the lake. The latter site was probably a winter camp. Perhaps Lovelock Cave as well was utilized during these seasons and in early spring, when fluctuation in the lake level may have contributed to temporary abandonment of the lakeside villages. It is possible that many of the lakeside "open" and "sheltered" sites were not much used during summer, and occupation resumed each autumn. Perhaps it will be possible to work out the seasonal movements of the Humboldt Basin population by study of the fluctuations of the former Humboldt Lake, presence of migratory waterfowl, Scirpus and Typha seed bearing period, periods of intense winter cold, and other information (cf. Table 2).

[10] It is quite possible that the entrance and interior coprolites were deposited during the same seasons, regardless of the fact that the interior coprolites are 1000 years older than the entrance specimens. A larger sample of coprolites from Lovelock Cave is now being analyzed, and the resulting information should provide a much more detailed picture of ecological and cultural variations that occurred during the time span represented by the coprolites.