III. DIETARY - TECHNOLOGICAL - ECOLOGICAL ASPECTS OF LOVELOCK CAVE COPROLITES

Richard D. Ambro

The contents of refuse deposits and food caches in dry Great Basin cave or shelter sites, supplemented by inferences derived from artifact forms and direct ethnographic data, have yielded a good deal of information about prehistoric diet. However, it is questionable how accurately such observations reflect the ancient dietary patterns. Non-culturally deposited items in caves and inability to recognize food items in the refuse may possibly distort the picture.

Human coprolites, although they offer an obvious insight into these problems, have long been ignored or avoided. Loud, in his Lovelock Cave report, briefly mentions their presence but did not perform any intensive analysis of their contents (Loud and Harrington 1929:8). It is only recently that the potential of coprolite analysis has come to be fully recognized. Jennings, in his Danger Cave report (1957:302), provides the first detailed examination of such material for the Great Basin.

In the summer of 1965, a series of coprolites was collected from Lovelock Cave. Of these, fifty have been analyzed: thirty were from undisturbed refuse in the interior of the cave, while the remaining twenty were recovered from a crevice at the side of the old entrance. In the early 1950's, Norman L. Roust, then a graduate student at the University of California, analyzed fifty-one coprolites collected at Lovelock Cave. These coprolites were apparently from both the interior and exterior areas of the cave (see preface to Roust, Paper IV). Roust also collected and analyzed eighty-five coprolites from Hidden Cave in the Carson Sink area south of Lovelock Cave. These were recovered in two lots: eleven came from a pack rat nest built on the surface of the upper refuse deposit, and seventy-four were recovered from a "latrine" in the 32 inch midden, the two deposits being separated by a sterile layer of silt (Grosscup 1956; Roust and Grosscup n.d.).

It is hoped that by drawing on Roust's observations and the admittedly preliminary results of our Lovelock Cave coprolite analysis, the known contents of the cave refuse, and Roust's data for the Hidden Cave coprolites, this discussion will illustrate and clarify the basic features of lake-side economies of the adjacent Humboldt and Carson sinks over time, as well as point out the advantages and limitations of coprolite analysis.[1]

---

[1] I am indebted to Mr. Roust for his cooperation and permission to draw upon his data for this paper.

Plant remains (seeds and fiber) account for approximately 20 to 35 per cent of the total sample weight for the five lots from the two caves. The most common seed observed in all lots is that of the bulrush (Scirpus). Although less common, the seeds of the cattail (Typha) are frequent in the 1965 Lovelock Cave samples, especially those from the entranceway. Scirpus and Typha account for over 90 per cent of the seed weight in the sample. Roust also observed Typha in his interior specimens as well as small quantities of the seeds of Panicum capillare (old witch grass). Panicum was also noted in one specimen from each lot from Hidden Cave, but none was observed in the interior sample collected in 1965. Piñon nuts were observed in only one coprolite from the 1965 Lovelock Cave interior lot, and in one from the 32 inch midden in Hidden Cave. In addition, other plants of relatively lesser importance were observed. Roust notes the presence of Linum (wild flax), Elymus triticoides (squaw grass), Panicum capillare (old witch grass), Phragmites (arrow cane), and Oryzopsis hymenoides (wild millet) at Lovelock Cave, and Elymus and Panicum at Hidden Cave. Our examination of Lovelock Cave coprolites disclosed not only evidence of Linum but also seeds tentatively identified as those of Atriplex (salt bush), Distichlis (salt grass), Avena (wild oats), Salsola, Centaurea (star thistle), Eriogonum, Amaranthus or Chenopodiaceae (saltbush), and Equisetum (horsetail), as well as others not yet identified.

The majority of fibers observed in all lots are tentatively identified as those of Typha and Scirpus, with an occasional instance of small amounts of fiber of many of the miscellaneous plants noted above. Possibly such minor elements represent unseparated chaff or adventitious inclusions, or plants which were gathered as dietary supplements, seasoning, or perhaps even for medicinal purposes.

Although no examination of the plant materials found in the refuse deposits of Lovelock Cave was ever undertaken by a qualified botanist, an examination of materials from the two midden strata in Hidden Cave indicated that parts of the major, and many of the minor, plants were recoverable by careful screening (Roust and Grosscup n.d.). Since no caches of seeds were discovered, only occasional mullers provide evidence of the general occurrence of seeds in the diet, while the coprolites suggest the importance in the diet of the seeds of plants whose stems were frequently used for making matting and other textiles. Loud, in his discussion of the refuse from the rock shelter outside Lovelock Cave, mentions the presence of stripped Typha seed heads, felted Typha down, and the preparation of the seed food by the ethnographic Northern Paiute. However, the presence of Typha seed in the coprolites undoubtedly suggested their use and prompted the discussion (Loud and Harrington 1929:8). The fibrous quids, frequently encountered in refuse, may be the discarded tougher portions of stems and root sections of plants utilized as food. If the roots of Typha were chewed to extract the starch, the fibrous outer sheath would be expectorated.

In all the samples of cave and shelter coprolites analyzed by us and by Roust, the major faunal component by weight is fish bone. Practically all the bones recovered were those of the small finger-sized chub (Gila bicolor), although remains of the Lahontan speckled dace (Rhinichthys osculus robustus) and Tahoe sucker (Catostomus tahoensis) were also noted in some of the 1965 Lovelock Cave coprolites (see Follett, Paper VI).

Correlation of charcoal to seeds and fish suggests that while fish were apparently prepared by parching in both caves, only at Lovelock were seeds also parched at times.

Bird remains account for less weight than fish bone in all samples except for the Hidden Cave rat nest and Roust's Lovelock Cave samples. The bird bones and feathers from the Lovelock Cave coprolites have not as yet been identified beyond the judgment that they appear to have been those of small passerine and/or wading birds. A bone of a duck and a falcon bone have been identified in the Hidden Cave rat nest coprolites. The rare occurrence of egg shell in the samples suggests that eggs were not an important source of food.

No mammal bones were recovered from the 1965 Lovelock Cave coprolites, but mammal hairs were present in one entrance sample and in five interior specimens. Four of the interior coprolites contained hairs identified as probably those of the coyote, while three more contained hairs provisionally identified as those of the ring-tailed cat (Bassariscus). Roust lists one per cent of the total weight of bone from his Lovelock Cave coprolites as mammalian. These consist of one example each of the bones of pack rat (Neotoma), ground squirrel (Citellus), and rabbit (Sylvilagus). The 32 inch midden coprolites from Hidden Cave contained one identifiable mammalian item (a rodent tooth). The remainder of the mammal bone (10.81 per cent by weight) was unidentifiable. In addition, strands of human hair, undoubtedly due to accidental ingestion or contamination, were recovered from several coprolites in both sets of 1965 samples.

Various miscellaneous items are noted whose weight is insignificant but whose presence is of some interest. A single example of the amphipod Gammarus (brine shrimp) is noted by Roust in a Lovelock Cave coprolite. Insects occur occasionally as intrusive elements—especially those coprophagous in nature. Roust reports four coprolites from Lovelock Cave and seven from the 32 inch midden at Hidden Cave which contained the large water beetle Cybister. One of our interior specimens produced parts of a dragonfly and fragments of a large hovering fly (Diptera syaphid). However, the association of the latter with bird remains suggests that they may have been part of the bird's stomach contents. Small amounts of mussel shell occur in the Hidden Cave 32 inch midden coprolites and in Roust's

Lovelock Cave coprolites. Apparently these items, though present, can only be considered as very minor supplements to the diet.

A large number of animal species are represented by bones in the refuse layers of the caves. Almost all of the animals which can be proved to have been eaten through analysis of the coprolites have been recognized in the cave deposits, the exceptions being the insects, the amphipod, and, particularly, the ring-tailed cat. However, there remain a large number of species apparently known to the prehistoric occupants whose traces either do not occur or have not yet been recognized in the coprolites.

Bird remains were found in abundance in the upper layer of Lovelock Cave. These are not only small birds, but also large forms such as pelican, duck, goose, swan, gull, heron, crow, and owl (Loud and Harrington 1929:32). The types represented in the refuse from Hidden Cave, although not as numerous as those at Lovelock Cave, still demonstrate a considerable size range (Roust and Grooscup n.d.). Of course, eventual identification of the feathers from the 1965 coprolites may indicate the presence of some larger bird types as well.

Fish remains in the occupation refuse of Lovelock Cave include not only examples of the small fish (Gila) observed in the coprolites, but evidence of the much larger cuui (Chamistes cujus) (see Follett, Paper VI).

Mammal remains in the Lovelock Cave living trash include carnivores (wolf, coyote, fox, mink, skunk, and wild cat) as well as rodents (mouse, gopher, beaver, woodchuck, and rabbit) and artiodactyls (deer, antelope and big horn sheep) (Loud and Harrington 1929:32).

Comparison of the refuse components with the coprolite contents points to an interesting contrast. The coprolite data sugggest a strong emphasis on small animals, while the refuse shows a range from quite small to very large fish, birds, and mammals. Loud and Harrington (1929) suggest that perhaps the remains of larger birds and carnivores were intrusive and due to the presence of carnivores such as the coyote and fox, who make it a practice to lair in caves and rock shelters. This may be partially true; however, bones of the large animals were made into artifacts, and instances of feather-covered decoys and objects of fur and leather prove that these animals were certainly utilized. They were no doubt hunted, and, more importantly, were probably eaten as well.

The basic problem in this area is that of why only certain animals are represented in the coprolites. Presumably, one of the reasons for the lack of evidence of larger forms would be the inability or improbability of ingesting recognizable osseous elements. A large animal would be skinned and its flesh cut from the bones, whereas the smaller forms or immature individuals could be, and apparently were, eaten more or less whole. Bone fragments and hairs would be the sole clue to their presence, while only the latter would serve to identify the animal precisely.

A second difficulty lies in ascertaining the importance of the various faunal items of the diet on the basis of undigested elements. With the exception of the small fish, so numerous in the samples, the bones, feathers, and occasional hairs offer little quantitative information as a basis for reconstructing the amount, and thus the importance, of meat in the diet. Seeds, fibrous plant sections, and small fish yield a uniformly representative fund of undigestable residue (bone, fiber, seed husks) which may be employed to judge differences and even to reconstruct the original weight of the components in question. Thus Dr. Follett has been able to ascertain that in one coprolite from Lovelock Cave 51 small fish are represented whose size suggest an original total weight of about 3.7 pounds (Follett, Paper VI). In the case of birds, although we can presume that the entire bird was eaten (judging from coprolite residues of skin, feathers, leg skin, etc.), by no means were all the feathers ingested, and, as very little recognizable bone was recovered, it is difficult to estimate the original number of individuals and thus the weight. This is especially true if the larger or adult bird types were involved. Mammals are even less accurately represented in that an occasional hair or bone splinter only indicates the probability of a mammalian element, but this provides no way to suggest the amount of meat ingested. In addition, the possibility of contamination is also present. Perhaps some means of chemical analysis of the fine residue of the coprolites can be developed which would permit the recognition and quantification of flesh in the diet.

Our findings serve to illustrate the drawbacks, as well as the advantages, of this technique of coprolite analysis. Table 1 presents an attempt to bring together information on prehistoric food materials as evidenced by items in occupation refuse, artifacts, and coprolites.

No information on precise dating is available for Roust's Lovelock Cave coprolites beyond knowing that they were deposited before the final abandonment of the cave. C-14 dates for our interior lot place it at about 750 A.D. (1210 ± 60 B.P., UCLA 1071F), and that of the exterior lot at about 1800 A.D. (145 ± 80 B.P., UCLA 1070E). The 32 inch midden at Hidden Cave, which has a C-14 date of 1094 ± 200 B.C. (Grosscup 1958:19), is equated by Roust with the Early Lovelock phase on the basis of artifact similarities. The Hidden Cave rat nest samples may be contemporaneous with the top of the upper refuse midden, which Roust equates with the Late Lovelock in time (Roust and Grosscup n.d.). Evidence of occasional Indian visitors to Hidden Cave in historic times (Ambro 1966) suggests that part, if not all, of the coprolites could be quite late; that is, could be contemporary with the Lovelock Cave exterior coprolites.

Admittedly, the sample is small in each case and error due to sampling is to be expected. However, some generalizations can be made. The major items and catagories observed in the five lots of coprolites from the two caves are quite similar (see table 2). There are also some readily apparent differences. The relatively high proportion of seed to fiber content by weight at Hidden Cave (15.4 for the 32 inch midden; 32.3:1 for the rat nest sample) suggests that the stem and root sections of Typha and/or similar fibrous plants were less extensively exploited than at Lovelock Cave where the ratio is 4.6:1 for the 1965 interior lot and 4.2:1 for the entrance sample (see table 2). Comparison of the ratio of occurrence also illustrates a greater frequency of seed over fiber use in Hidden Cave, whereas at Lovelock Cave fiber occurs far more frequently. However, the ratio between floral and faunal remains by weight and occurrence appears to be relatively consistent between the two sites. Again, this ought to be considered in the light of error in weight representation of bird and especially mammal flesh. Thus, although the ratio by weight of fish to bird remains is 13.7:1 in the 32 inch midden deposit at Hidden Cave—the largest of all the samples—it cannot be said with confidence that higher fish utilization characterizes the Hidden Cave material, especially in light of a ratio of 1:1.9 for the rat nest coprolites in the same cave.

Judging from the two lots collected at Lovelock Cave in 1965 and those from Hidden Cave, the dietary pattern may be observed to have changed little, if at all, over time. At Lovelock Cave, the exterior sample (dated to about 1800 A.D.) shows no great increase in the proportion by weight or occurrence of seed to fiber from the interior lot which is dated 1100 years earlier. However, when data on individual seed types are examined, Typha seed represents only 20 per cent of the total weight and occurs in only 10 of the 30 coprolites, while Scirpus seed represents almost all of the remaining 80 per cent of seed weight and occurs in 24 of the coprolites, often with Typha seed. In the entrance sample, Typha accounts for 50 per cent of total seed weight and occurs in 14 of 20 coprolites, while Scirpus occurs in 16 specimens. Apparently the later inhabitants of the cave utilized Typha seed far more extensively than did the earlier occupants, although Scirpus seed continued to be eaten in great quantities. Presumably the entrance lot reflects historic Paiute adaptations to the area. The presence or absence of Typha seed in the Hidden Cave coprolites has yet to be determined.

In the Lovelock Cave entrance coprolites the ratio (by weight) of fish to bird remains (feathers, bones) is 1:2; compare this to the interior coprolites where the ratio is 1:4.6. From this it can be concluded that birds were relatively more important as a food item at the time the entrance coprolites were deposited than earlier, as judged by the interior coprolites (see table 2). Again, it is difficult to ascertain the importance of meat in the diet, although it is interesting to note that only one entrance coprolite had mammal remains while five were reported for the interior lot.

The Hidden Cave samples, which may span a period of 2,000 years or more, indicate that the rat nest or later sample appears to have a larger ratio by weight (32.3:1) and occurrence of seed to fiber than those of the earlier 32 inch midden sample (15:1), indicating a possible increase in seed use or a decrease in the already low use of fibrous plants. An interesting increase in bird remains is noted in the later sample, paralleling the increase seen in the entrance sample at Lovelock Cave. The apparent contemporaniety of the entrance lot at Lovelock Cave and the Hidden Cave rat nest (proto-historic to historic times) suggests that a shift in diet pattern was in progress and that this was characterized by an increase in bird and seed exploitation and decrease in use of the complementary or alternative items which had been exploited earlier.

The results serve to illustrate that the inhabitants of Lovelock Cave and Hidden Cave exploited very similar environments in much the same way. Despite minor differences between them and through time, the two sites appear to be manifestations of the same cultural heritage.

The terrain in and around the Humboldt and Carson sinks appears quite harsh and forbidding, and the contents of cave refuse and coprolites indicate that these people were omnivorous. However, closer examination of the data, especially those of the coprolites, suggests a certain degree of abundance and perhaps specialization in the diet.

The aboriginal populations obviously focused their hunting-gathering, catching-collecting activities around the marshy lake and river edges not far distant from the caves. The marshy lake margins provided an abundance of plants whose edible parts formed approximately half of the food materials observed in the coprolites. The same plants harbored various resident and migratory water fowl and their nests, while the lake itself provided fish. All of these were captured and utilized as food.

Collection and use of plants, birds, and small animals found away from the shore area, but still nearby, supplemented the diet. Thus the major sources of sustenance could be secured close at hand. However, the habits of the larger mammals (carnivores, artiodactyls, etc.) are more far ranging, and probably involved not only local hunting but also tracking in the mountains on either side of the sink and beyond. This aspect, as well as a smaller density of population of such animals, might also suggest—considering technical qualifications of representation—that these animals were rarer and less often used as food (Brooks 1956:109). Two items present in the diet, however, suggest even more distant sources. The nearest piñon stands are approximately twenty miles south of Lovelock Cave, in the Stillwater Range, indicating travel to that area when the nuts were in season. Of even more interest is the occurrence of the cui-ui, which Follett states (see Paper VI) has its nearest habitat in the Pyramid Lake-Truckee River area, indicating a minimum trip of over fifty miles to the west to reach the easternmost extension of the Truckee River. Although it is likely that the inhabitants traveled to this area and caught the fish themselves, the possibility of trade cannot be ruled out.

One can view the range of economic exploitation, as reflected in the cave deposits and coprolites, as three concentric circles in terms of area and importance. The first and most important is the area in and immediately around the lake and river, which provided the major part of the food resources and comprised only a few square miles. Beyond this area would extend the range of the larger mammals and other occasional food items that would encourage the prehistoric hunters and gatherers to visit the hills and mountains nearby. The third zone would include the distant sources of piñon and cui-ui.

Naturally, the question of seasonality could modify these statements. The presence of large amounts of seeds and the evidence of fish scales (Follett, Paper VI) suggest cave occupation in the late summer, fall, and probably winter, when shelter from the inclement weather would be sought in caves. Although no seasonal study of faunal remains has been done to date, evidence of eating nestlings suggests an occasional visit in the warmer seasons. The remainder of the year was probably spent in summer village sites, such as NV-Ch-15 on the floor of the Humboldt Sink or elsewhere in the valley, according to the food resources and cycle of movement.

More intensive investigations of coprolites correlated with the examination of cave refuse for the area just treated, and for the Great Basin as a whole, are needed. Not only would such studies clarify and broaden our knowledge of cave or shelter dwellers' diets, but also permit reconstruction of the missing elements in nearby open sites of comparable age and cultural affinities. The results of additional analysis would provide an expanded and refined understanding of prehistoric Great Basin diet and a better comprehension of the relationship of aboriginal peoples to their environment.

TABLE 1

Comparison of Evidence for Elements of Prehistoric Diet at Lovelock Cave, Nevada

	Cave Refuse	Artifacts	Coprolites
		Flora	
Seeds	P	(mullers, parching trays)	A
Stems, roots	? (quids)		A
lacustrine			A
other			P
Parching		? (trays)	P (total frequency in question)
Grinding		R (mullers)	?
		Fauna	
Fish, small	A	P (hooks & nets)	A
large	A	P (hooks)	-
local	A		-
distant	P		-
parching		P (trays)	P (frequency in question)
Mammals, small	A	P	R
large			
carnivores	A	P	P (frequency uncertain)
artiodactyls	P	P	-
Birds, small	P		A
large	A	P	?
aquatic	A	P	?
passerine	P	R	?
Insects	?		R
Amphipods	?		R
Mussel	?		R

P = present

\- = absent

A = abundant

? = questionable or unreported

R = rare

TABLE 2

Coprolite Components*
(weight in grams)

Lot		Seed	Fiber	Floral Total	Faunal Total	Bird Remains	Fish Remains	Mammal Remains
Lovelock Cave	% total wt.	20.80	5.00	25.80	11.50	3.80	7.70	trace
Entrance 1965	ratio (by wt.)	4.2 :	1	2.2 :	1	1 :	2	
Total: 20	occurrence	19	16	18	20	10	15	1
Lovelock Cave	% total wt.	26.80	5.80	32.60	10.00	1.80	8.20	trace
Interior 1965	ratio (by wt.)	4.6 :	1	3.3 :	1	1 :	4.6	
Total: 30	occurrence	27	25	30	30	6	20	5
Lovelock Cave	% total weight	25.98	7.63	33.61	9.36	1.70	5.07	1.00
Mixed (Roust)	ratio (by wt.)	3.5 :	1	3.5 :	1	1 :	3 :	0.6
Total: 51	occurrence	35	20	40	40	21	18	6
Hidden Cave	% total wt.	32.3	0.80	33.10	8.52	5.00	2.75	0.77
Rat nest (Roust)	ratio (by wt.)	32.3 :	1	3.8 :	1	1.9 :	1 :	0.2
Total: 11	occurrence	10	4	11	11	6	6	1
Hidden Cave (32")	% total weight	22.20	1.29	23.49	8.56	0.46	6.20	0.35
Midden (Roust)	ratio (by wt.)	15.4 :	1	2.6 :	1	1 :	13.7 :	0.76
Total: 74	occurrence	34	18	49	57	10	47	8

* In presenting the ratios above, the figures have been rounded out to the first decimal place.

(For a complete breakdown of components by individual specimen, as well as data concerning miscellaneous items and unidentifiable residues, see tables appended to R. Cowan, Paper II herein.)

Bibliography

Ambro, Richard D.
1966 Two Fish Nets from Hidden Cave, Churchill County, Nevada. Univ. Calif. Archaeol. Survey, Report 66:101-135. Berkeley.

Brooks, Richard
1956 Faunal Remains. App. III to Heizer and Krieger, The Archaeology of Humboldt Cave, Humboldt County, Nevada. Univ. Calif. Publs. Amer. Archaeol. and Ethnol. 47:106-112.

Follett, W. I.
1967 Fish Remains from Coprolites and Midden Deposits at Lovelock Cave, Churchill County, Nevada. Univ. Calif. Archaeol. Survey, Report 70, Paper VI. Berkeley.

Grosscup, Gordon L.
1956 The Archaeology of the Carson Sink Area. Univ. Calif. Archaeol. Survey, Report 33:58-64. Berkeley.

Hall, E. Raymond
1946 Mammals of Nevada. Univ. of Calif. Press, Berkeley.

Heizer, R. F. and A. D. Krieger
1956 The Archaeology of Humboldt Cave, Churchill County, Nevada. Univ. Calif. Publs. Amer. Archaeol. and Ethnol. 47:1-190.

Jennings, J. D.
1957 Danger Cave. Univ. Utah Anthrop. Papers, No. 27. (Reprinted <u>in</u> Mem. Soc. Amer. Archaeol. No. 14.)

Loud, L. L. and M. R. Harrington
1929 Lovelock Cave. Univ. Calif. Publs. Amer. Archaeol. and Ethnol. 25:1-183.

Martin, A. C. and W. D. Barkley
1961 Seed Identification Manual. Univ. Calif. Press, Berkeley.

Roust, N. L. and G. L. Grosscup
n.d. Archaeological investigations in the southern Carson Sink. MS in the files of the Univ. Calif. Archaeol. Research Facility, Berkeley.