I. ANALYSIS OF HUMAN COPROLITES FROM A DRY NEVADA CAVE

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Preface

This paper, together with the following two by Richard Cowan and Richard Ambro, are interim reports on a joint research project carried out during the academic year 1965-66. These three papers are preliminary in nature, and we anticipate that the analytical work will be completed during the 1966-67 period. The report on fish remains in coprolites from Lovelock Cave by W. I. Follett (see Paper VI in this volume) is the first of what we anticipate will be a long series of specialists' findings.

We are grateful to Professor S. S. Elberg, Dean of the Graduate Division of the University of California, Berkeley, for awarding a generous grant from Opportunity Funds to support this project. The Institute of Social Sciences, through its Director, Professor Herbert Blumer, provided grant funds which were in part devoted to this research.

We wish also to acknowledge our indebtedness to the following persons who have aided us by providing expert identifications, advice, funds, and other assistance: Professor Homer Aschmann, University of California, Riverside; Professor C. Rainer Berger, University of California, Los Angeles; Dr. Don Brothwell, British Museum; Professor Eric Callen, Macdonald College, McGill University; Professor J. G. D. Clark, Cambridge University; Professor Sherburne F. Cook, University of California, Berkeley; Dr. Frederick Dunn, Hooper Foundation, University of California Medical School, San Francisco; Dr. W. I. Follett, California Academy of Sciences, San Francisco; Mrs. Ethel Hesterlee, Lovelock, Nevada; Dr. Willard F. Libby, University of California, Los Angeles; Dr. Alexander C. Martin, Los Gatos, California; Professor Henry Rapoport, University of California, Berkeley; and Mr. Norman L. Roust, Hexcel Corporation, Berkeley.

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In the summer of 1965, a large number of human feces or coprolites, weighing on the average 15 grams, were collected from two locations in a dry prehistoric occupation cave near Lovelock, Nevada.[1] One series of coprolites came from the interior of the cave and is referred to here as the interior

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[1] See p. 14 for end notes.

lot; the other series came from a rock crevice latrine in the ancient entrance to the cave and is referred to as the entrance lot.

Lovelock Cave is situated about two miles from the shore of former Humboldt Lake, a brackish sink without an outlet, formed at the terminus of the Humboldt River. For most of the year the prehistoric people resided in a large village (site NV-Ch-15)[2] on the lake margin at the point where the river entered the lake, and it is assumed that the cave was occupied seasonally in periods of extreme cold weather, at times of high water in the lake in the spring when the village area was flooded, or as a temporary refuge when the local group was threatened by hostile neighbors. The cave is situated so far from water that it is improbable that it was lived in regularly on a day-by-day, month-by-month basis. This conclusion agrees with the opinion of Loud and Harrington (1929:119) that occupation of Lovelock Cave was not continuous.

The cave deposits contain burials and all of the palpable desiccated refuse of dietary and technological activities resulting from habitation. The span of man's use of the cave covers about the last 4000 years.[3] Samples of the entrance and interior coprolites have been radiocarbon dated through the kindness of Drs. W. F. Libby and C. Rainer Berger, Institute of Geophysics and Planetary Physics at the University of California at Los Angeles. All of the coprolites are prehistoric and have been preserved under conditions of complete desiccation. We judge them to be human primarily because of their form, but more certainly by their contents which comprise dietary elements which can, in their combination, be attributed only to man. These specimens can provide, through identification of the materials preserved in them, direct evidence of the prehistoric diet. Since each fecal pellet contains evidence of what some prehistoric man ate at one meal, these unexciting lumps provide us with a type of information which is all too rare in prehistory; that is, detailed evidence of cultural practices by individuals. Also, because of their near-perfect state of preservation, and since they are the product of the infinitely complicated process of metabolism, the coprolites can be said to provide a unique opportunity for studying prehistoric man. What we have done thus far with fifty fecal pellets is nothing more than to make the crudest and simplest examination of dietary elements, and we are quite aware that a great deal more than this can be learned from them.

Analysis of prehistoric human fecal matter is not a new kind of research (cf. Heizer 1960:108-109; Jennings 1957:216-217, 303-304; Jones 1936:150; Harrington 1933:26, 82; Webb and Baby 1957:45; Young 1910:324). Zoologists and botanists have long known that identifiable plant remains occur in desiccated non-human fecal material (Kelker 1937; Harrington 1933:194; Eames 1930; Martin, Sabels and Shutler 1961; Laudermilk and

Munz 1935, 1938; Seton 1925), but archaeologists have only very recently come to appreciate such evidence. In 1960, E. O. Callen and T. Cameron of McGill University published the first detailed analysis of the contents of a substantial lot of prehistoric human coprolites (Callen and Cameron 1960). These were specimens recovered by Junius Bird from a dry Peruvian coastal refuse midden named Huaca Prieta, which was occupied from about 3000 to 500 B.C. Coprolites from seventeen stratigraphic levels were examined, animal and plant food were identified, and eggs of one species of tapeworm of the genus Diphyllobothrium were recovered. Since 1960 Callen has analyzed and reported on two more large lots of prehistoric coprolites secured by R. S. MacNeish from dry archaeological sites in the states of Tamaulipas and Puebla in Mexico (Callen 1963, 1965). A recent analysis of prehistoric Kentucky cave coprolites is by Watson and Yarnell (1966:844-845).

We have adopted the main features of Callen's method of analysis as outlined by him (1963, 1965). The dry, hard fecal pellet is first measured and weighed, and then described. The specimen is cut open and two samples, each weighing two or three grams, are extracted and placed in labeled containers. These samples are saved for future examination to determine pollen content and for chemical tests of some of the fifty or so constituents known to occur in human fecal material (Consolazio et al. 1963:table 13-9, pp. 451-452; Wollaeger and Comfort 1947; Altman and Dittmer 1964:table 53-II). Neither pollen nor chemical analysis of our materials has been carried out so far.[4] We assume from the existing knowledge of the composition of human feces, as well as from recent demonstrations by P. S. Martin and F. W. Sharrock (1964), that human coprolites contain quantities of identifiable pollen grains, and that further investigations will produce useful information.

The specimen is now placed in a glass jar with a screw lid, which contains a cup or so of 0.5 per cent aqueous solution of trisodium phosphate. Soaking for a week or more tends to soften the mass and to reconstitute, by hydration, seeds and plant materials to their original size. The week-long immersion is then followed by a benzine flotation which brings chitonous material, hairs, and some vegetal matter to the interface. This is drawn off and examined for insect remains, feathers, etc., etc. The sample is then gently screened through a one millimeter mesh sieve while water is poured through to remove fine residues which are allowed to settle before being dried. After drying, these fine residues are passed through two or more screens, one with a 0.495 mm mesh (32 to the inch), the other with a 0.147 mm mesh (100 to the inch).[5] This gives us three grades of finer residues, the finest being the powder which passes through the smallest mesh screen. The two coarser grades are scanned with a microscope under twenty power magnification, the percentage of the most abundant components is estimated, and the weight of each of these is calculated.

The coarser material, which does not pass through the one millimeter screen when the softened coprolite is first poured from the glass jar, is placed in six inch petri dishes and examined under an illuminated magnifier.[6] Seeds, bone, hair, feathers, charcoal, and other materials are picked out with tweezers or a dissecting needle and then dried, weighed, and stored. Except for the chemical compounds and some very fine particles which are in suspension in the softening solution and are thrown away, the method is essentially non-destructive.[7] Slides of unidentified seeds, hair, fiber, and insects are made in a glycerin jelly base.

Dry screening and separation of components of crushed coprolites have been carried out by other workers (e.g. Colyer and Osborne 1965; Watson and Yarnell 1966), but it is our impression that the soaking process which was pioneered by Callen (cf. Benninghoff 1947) tends to reconstitute imbedded matter and makes for easier identification. Wet analysis has the disadvantage of recreating the original odor which is, on occasion, literally overpowering, as well as imposing the necessity of drying the wet materials before they are weighed and stored. At the same time, wet analysis has the advantage of making the materials look fresh and fewer problems of identification are presented.

About ten years ago, Norman Roust, then a student at the University of California, carried out dry analysis of about 150 coprolites from Lovelock and Hidden caves in Churchill County, Nevada. His results are presented here in Paper IV, and anyone interested in comparing wet and dry analytical results of coprolites from one site can easily do so.

Anthropologically, it is of interest to note that the simple aboriginal hunter-gatherer peoples of the peninsula of Lower California developed a technique of extracting components of human coprolites. Johann Baegert, a Jesuit priest in Lower California between 1751 and 1768, described the native use of the <u>pitahaya</u> cactus (<u>Lemairocereus thurberi</u>) which bears a fleshy fruit in late summer and early fall. In this arid land where food was always at a premium, the <u>pitahaya</u> harvest time was the one period during the year when everyone had enough to eat, even though the food was limited to a single item. Baegert (1952:68) wrote:

> [The fruits] contain a great many small seeds, resembling grains of powder, which for reasons unknown to me are not consumed in the stomach, but are passed in an undigested

> state. In order to use these small grains, the Indians collect all [their] excrement during the season of the pitahayas, pick out these seeds from it, roast, grind, and eat them with much joking. This procedure is called by the Spaniards the second harvest.

In searching for a title for our coprolite research project, we selected one which refers to this unusual aboriginal practice, and have coined the label "Second Harvest Investigation Technique."[8]

As to results which we have so far secured, the tabulations which accompany the papers by R. Cowan and R. Ambro in this volume provide the basic information. Seeds, especially those of the bulrush (Scirpus) and cattail (Typha) occur in a majority of samples.[9] Small lake fish of the genus Gila (formerly referred to as Siphateles; the Lahontan chub), which run up to four inches long, were an important source of food. Surprisingly large amounts of fishbone occur in some coprolites, and we believe that small fish were either eaten whole and raw, or were parched with glowing coals in the same way seeds were roasted. It is also possible that these minnows were boiled in baskets with hot stones, but we have no evidence to support this supposition.

The whole seeds which we have found indicate which plants were utilized, but whole, small seeds with tough husks are really a measure of the inefficiency of the grinding process whereby such seeds were ground into flour. The fairly large amounts of whole Scirpus and Typha seeds occasionally present in a coprolite are difficult to explain. Perhaps inadequate or incomplete grinding accounts for these. Such whole seeds, enclosed in their indigestible husks, are wasted as food when eaten in this form.

The fine residue, measuring between 1.0 and 0.5 mm in diameter, contains broken seed hulls, bits of fishbone, feather down, and the like. The very fine residue, less than 0.15 mm in diameter, is a mass of undistinguishable, finely comminuted material which, after having been put through the digestive mill, contains few characteristics to aid in determination of specific elements. Presumably most of this fine residue consists of the indigestible remnants of fish and seeds. Occasionally there will be a sizable splinter of bird bone. There are rare occurrences of Gammarus, a freshwater amphipod, but since this animal is also eaten by fishes, birds, and large water insects, its presence may be due to the swallowing by man of an entire fish or a whole Cybister (the water tiger beetle), which rarely occurs in coprolites minus the head.

Bird eggs apparently were not much eaten, or if they were, it was most frequently during nesting periods when the cave was not occupied. Larger birds were eaten after their primary and secondary feathers were plucked out, and baby birds were apparently eaten whole and raw. Bird craw gravel appears in some samples. Birds, it would appear, were eaten after only minimal preparation.

Insects seem rarely to have been deliberately eaten, and most of the forms we have found can be explained as being present through having been casually or accidentally ingested. Some insect remains are those of coprophagous species and are here ignored since they were not an article of diet.

Bits of wood charcoal usually occur with seeds and fish bones, and this attests to the practice of parching seeds and minnows with live coals before they were ground and eaten. A list of items eaten very rarely could be given, but these are not important beyond hinting that anything edible and available was regarded as food.

The absence of splinters of heavy mammal bone may indicate that deer, mountain sheep, and antelope—which are known to have lived here and to have been hunted in prehistoric times—were not available in the seasons when the cave was occupied. It is usually assumed that in the process of butchering and dismembering a large animal carcass, large bones were broken and separated with heavy stone cleavers, and that some of the bone splinters and chips resulting from this breakage would be eaten. This assumption is not provable from our data, and may be incorrect. Cleaner and more efficient means of removing meat from bones may have been employed by the Lovelock Cave people, and in this case bone fragments would not be present in the coprolites. Actually, as regards the method of eating large animals, we are quite ignorant. Animal hairs, not as yet identified, and chemical determinations for protein may throw some light on this question.

It would seem probable that the coprolites from the cave interior represent winter accumulations, when the people were eating mainly dried Scirpus seeds and dried fish, and that the entrance lot was accumulated in the late summer or fall of the year when fish, Typha seeds, and ducklings were available.[10]

In Papers II and III in this volume, Cowan and Ambro discuss some of the cultural-ecological implications of the results of coprolite analysis. Cowan shows that the commonly assumed situation of the arid Great Basin landscape, thinly populated with hungry foragers, does not fit the Humboldt Sink area or its human occupants. W. Taylor's (1964) interesting idea of "tethered nomadism" may be applicable to survival conditions and human reaction in certain parts of the Great Basin, and Steward's (1938) report of what could be called "free-ranging nomadism" may apply to other parts of the Great Basin, but the reconstruction which we have drawn of settled and economically self-sufficient lake shore dwellers at Humboldt Lake (and presumably also at Carson Sink and Walker and Pyramid lakes) provides us with a "limno-sedentary" category of ecologic adjustment[11] that provided a much more assured and abundant way of life than one usually thinks of when referring to the Great Basin Indians. If we take the aboriginal population of the Humboldt Lake band of Northern Paiute (Küpadökadö) as 900, the number reported by Leonard (1904:161)[12] in 1833, and reduce the territory of this group as mapped by Stewart (1939) by eliminating the doubtful southern half lying in Carson Sink south of the Humboldt Range, we find a territory comprising about 2100 square miles. This indicates a population density of 0.43 persons per square mile (or one person per 2.3 square miles), which is, all things considered, a density approximating that of large parts of aboriginal California and far greater than Steward (1938:46-49) finds for all except a few small, specially favored areas of the Great Basin.

Kroeber (1957) has reassessed the intergroup Q_2 correlation coefficients for eleven Northern Paiute bands from whom Omer Stewart had secured Culture Element Distribution lists in 1936. The indicated degrees of inter-band cultural similarity show that five northern bands are more similar to each other than to seven southern bands which internally resemble each other (see map 1). Kroeber wrote that he was aware of "no specific ecological, historical, or linguistic reason for the boundary [between the five northern and seven southern bands of Northern Paiute], but its existence seems undeniable." This conclusion is supported by a similar one reached earlier by Park (1940:map), who reported that the southern bands "regarded themselves as an entirely distinct group" and had "an incipient feeling of nationality."

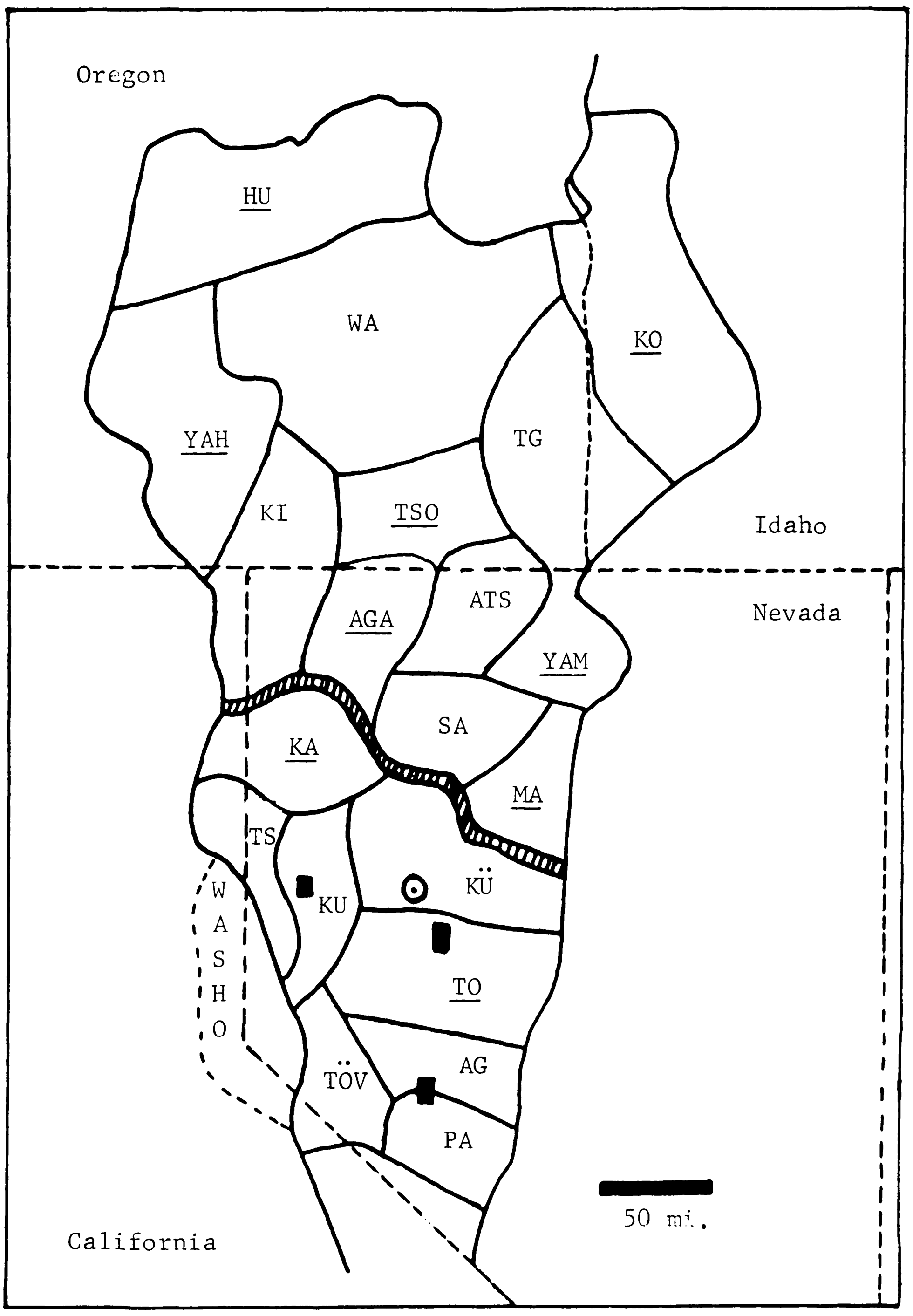
Humboldt Lake lies in the territory of the Küpadökadö band. The Kuyuidökadö immediately to the west centered on Pyramid and Winnemucca lakes, while to the south lay the Toedökadö of Carson Sink, and their southern neighbors were the Agaidökadö and Pakwidökadö of Walker Lake. The southern bands, therefore, were lake people, and we may have here the ecological factor which Kroeber failed to note and which may account, in part at least, for the internal cultural cohesion noted. The Washo occupy a north-south stretch abutting upon the western border of three of the Paviotso bands under discussion. It is possible that the Washo may have acted as a "filter" for Californian cultural traits such as basketry and shell beads (Baumhoff and Heizer 1958; Bennyhoff and Heizer 1958), which were passed on to the west central Nevada lake-centered Paviotso bands. More could be suggested along this line following leads taken from Kroeber's

Map 1. Location of Northern Paiute bands from which culture element distribution lists were secured. Underlined group symbols are bands from which element lists were not secured. (After Kroeber 1957, and Stewart 1939.)

Nearly all of the names listed below are suffixed with dökadö, meaning "eaters." Heavy hachured line is cultural boundary determined by Kroeber between northern and southern bands. Location of Humboldt Lake is shown in KÜ territory by ⦿ ; other lakes by symbol ■ .

Northern group: HU, Hunipui; WA, Wada; KO, Koa'agai; TG, Tagö; YAH, Yahuskin; TSO, Tsösö'ödö; KI, Kidü; ATS, Atsaküdökwa; YAM, Yamosöpö; SA, Sawawaktödö; MA, Makuha; AGA, Agaipanina.

Southern group: KA, Kamö; KÜ, Küpa; KU, Kuyui; TS Tasiget; TO, Toe; AG, Agai; TÖV, Tövusi; PA, Pakwi.



Map 1

article, but the limitations of space and non-immediate relevance of such speculation in this paper preclude this.

Dr. Frederick Dunn of the Hooper Foundation, University of California Medical Center in San Francisco, has examined about fifty of the Lovelock Cave coprolites in search of parasites. Repeated attempts to culture enteric bacteria and yeasts have produced no results, and no human parasites were discovered.[13] Larval nematodes of the genus Rhabditis which are present demonstrate that helminths can survive in recognizable form in desiccated coprolites, and the total absence of true parasitic types such as hookworms, whipworms, roundworms, etc., in the Nevada specimens is taken as indicating a parasitic-free human population.[14] Recent parasitological studies of coprolites from Wetherill Mesa, Colorado, by Samuels (1965) produced evidence of pinworms in the form of eggs and larvae. The reader interested in records of parasites in human and animal fecal material may consult Grzywinski (1959-1960, 1962), Pike (n.d.), Pike and Riddle (1966), E. Taylor (1955), and Witenberg (1961). The broader background of patterns of parasitism in primates is treated by Dunn (1966). P. H. A. Sneath (1962) reported on extensive experiments to determine the longevity of microorganisms, and among his experimental materials were human coprolites dating about four hundred years old from dry caves in the Tehuacán Valley of Mexico. No coliform bacilli or fecal streptococci could be cultured from the Mexican specimens, a result which parallels that of the similar investigation by F. Dunn, and D. Tubbs and C. Berger of the two lots of Nevada materials which are respectively determined as 145 and 1200 years old.

Analyses of stomach and intestine contents of some of the desiccated human remains from Lovelock Cave might yield interesting information on diet as well as providing a means of directly checking on the apparent absence of parasites. Such examinations have been made of desiccated human remains from Egypt (Ruffer 1921:85, 289) and Kentucky (Wakefield and Dellinger 1936). Pike (n.d.) and Pike and Riddle (1966) cite a number of published papers reporting on such findings in Egyptian mummies and European bog-bodies (Moorleichen).

Some conditions of daily life under which the prehistoric occupants of Lovelock Cave existed are suggested by the coprolites. Some of the fecal pellets are three inches in diameter, although this size is exceptional. Many are so solid and packed with fiber and seeds that they can only have been voided with great effort. Generally the coprolites are well formed fecal specimens and are interpreted as evidencing fairly normal intestinal operation considering the coarseness of the diet. Ethnobotanical data secured from the recent Northern Paiute Indians in the area include a number of remedies for constipation, so we can conclude that the diet at times encouraged this condition. One amorphous mass of fecal material contained Charcot-Leyden crystals which are commonly noted in modern diarrheal or dysenteric fecal specimens, particularly in association with intestinal amoebiasis resulting from infection of Entamoeba histolytica.

Sanitary practices of the cave occupants were minimal. Judging from the quantity of coprolites mixed through the occupation refuse, the people simply relieved themselves at will. In an effort to check on the apparent practice of defecating at the spot and on the instant when the impulse came, I have reviewed the ethnographic Great Basin records and find only one account which is relevant—that recorded by Captain J. H. Simpson (1876:56) at a Gosiute camp in western Utah in 1859. He wrote:

> The offal around [the house] and in a few feet of it was so offensive as to cause my stomach to retch, and cause a hasty retreat. Mr. Bean told me the truth when he spoke of the immense pile of faeces voided by these Indians, about their habitations, caused no doubt by the vegetable unnutritious character of the food.

For western North American Indian groups there is very little information published about disposal of human wastes. Koppert (1930:21-22) has a bit to say about the Clayoquot of Vancouver Island, and White (1932:30) reports on defecation practices at Acoma. Judging from these accounts, there was practically no planned disposal of wastes (with latrines) in western North America.

Lovelock Cave, a nearly enclosed chamber, cannot have been a very pleasant place to live in if we are to judge by the quantity of fecal remains present and the odors these release after they have been rehydrated preparatory to being analyzed. The only justification for such habits that I can think of is that the cave may have been lived in during periods of extreme low temperature in the winter when conditions would have been very uncomfortable in the main village about two miles to the north. With sub-zero temperatures (the lowest thermometer record locally is 30 degrees below zero), the people may have been unwilling to leave the cave unless it was absolutely necessary, and if it was their decision that it was not required to go outside the cave to defecate, that may be the reason we have available the rich archaeological harvest of coprolites. In view of what can be inferred without direct testimony on disposal of human wastes by prehistoric village groups in California, Mexico and the American Southwest through determination of concentration in archaeological site soils of nitrogen, phosphorus, and calcium resulting from the deposition of human wastes in the immediate living area, Lovelock Cave is not exceptional in being at the same time a living area and latrine. S. F. Cook and I have

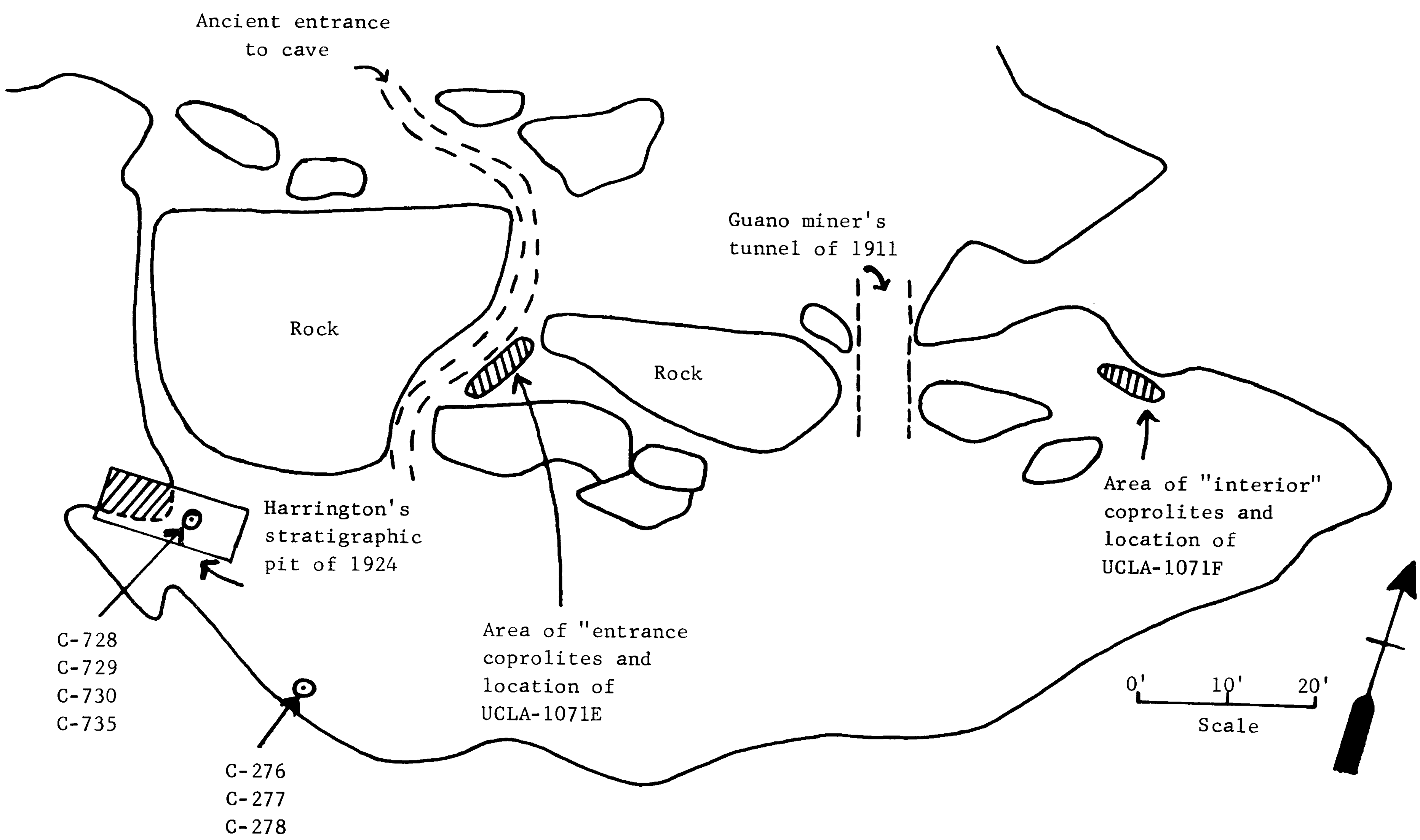


Fig. 1. Plan of Lovelock Cave (from Loud and Harrington 1929, pl. 2) showing location of radiocarbon dated samples and 1965 coprolite collecting areas. This illustration after Heizer 1956, fig. 2.

recently made a study of these elements in the refuse deposits of a number of prehistoric California village sites, and conclude that the high concentrations are consistent with data drawn from other sources which indicate that one hundred occupants could contribute to the soil of the living area 1852 pounds of nitrogen, 273 pounds of phosphorus, and 121 pounds of calcium per year (Cook and Heizer 1962, 1965). Similar data on the significance of human excretory products in the chemistry of archaeological camp and village soils have been provided by Eddy and Dregne (1964) in a study of four sites in the Navajo Reservoir area in New Mexico.

Ethnographers who have investigated the Indian cultures of the Great Basin, as mentioned earlier, report nothing about sanitary practices. Perhaps they were reluctant to discuss such earthy details, but more probably they believed such data to be unimportant. On the topic of diet, the ethnographic accounts have more to say, but the information is usually given in the form of lists of plants and animals eaten. Only rarely are we told at what time of year an item was secured or whether it was collected in quantities greater than needed for immediate consumption; practically never is there information on the kinds of food eaten in combination, that is, menus. The result of this failure of ethnographers to sense that records of such prosaic features of native life would be of value is that we know virtually nothing about the daily routine of existence. It may be that this refusal to rate as significant information which was linked with organic or physiological functioning was due to an overly narrow view of what ethnography was supposed to be. Ethnography, inter alia, was regarded as the study of social organization, but the age and sex distribution of the human group which practiced the social system was considered irrelevant and was not recorded. The economic aspect of culture could be covered by determining what plants and animals were eaten and by describing the catching devices employed to secure them, but how many animals were killed or how many pounds of meat or bushels of seeds were collected were apparently regarded as facts of natural history or botany that would be out of context in the cultural record. In the first two decades of the present century American anthropologists took a strong stand against environmental determinism. Wissler (1912) wrote: "We may, therefore, set it down as probable that the stimuli of the environment and the reactions thereto are so fundamentally alike for all human beings that they operate on a different level from the activities that produce culture." One can read into this statement some element of the disinterest in anything connected with culture except that which is generated from the mind. Ethnographers, it would seem, were almost completely oblivious of the fact that man himself was involved in culture, and they reported the culture facts as though these existed beyond and outside the human participants. This impersonal view was, in effect, taking Kroeber's concept of the superorganic too literally, and it is to be deplored that the unique opportunity which was available to students of American Indians in that brief period between first contact with Caucasians and the extinction of reliable informants was devoted to the collection of data which are so one-sided. Some of this lost information can be recovered by such techniques as coprolite analysis, and in this attempt the archaeologist is doing his proper job of trying to learn how men lived in the past.

Notes

1. The Nevada research, carried out in the summer of 1965, was supported by subvention funds provided to the Department of Anthropology by the Graduate Division, and by the Archaeological Research Facility of the Department of Anthropology, Berkeley.

2. A report on the archaeology of this site, written in 1965-66 by R. Ambro, W. Clewlow, R. Cowan, B. Moyer, J. O'Connell, and J. Toney, is in the manuscript files of the Archaeological Research Facility.

3. See discussion of the chronology of Lovelock Cave by Grosscup (1960:56 ff.); Heizer (1956); and Cressman (1956).

4. Professor Henry Rapoport, Department of Chemistry, has kindly made analyses of some fine residues (less than 0.147 mm in diameter) from the interior coprolite lot. The results are:

Carbon (C)	36.90%	Phosphorus (P)	2.60%
Hydrogen (H)	5.20%	Calcium (Ca)	4.50%
Nitrogen (N)	3.70%	Iron (Fe)	0.31%
Sulfur (S)	2.20%	Magnesium (Mg)	0.38%
Chlorine (Cl)	0.61%	Silica (SiO_2)	5.80%
Potassium (K)	0.21%		

Dr. Rapoport observes, "Of interest is the last item, silica (sand). This might be an artifact, picked up in the collecting. If so, all the percentages should be divided by 0.94 to obtain the correct values." Since the exterior of all the coprolites was carefully cleaned to remove adherent material which might have become affixed when the fecal matter was fresh, it is unlikely that the silica is an "artifact." We have regularly observed well-rounded quartz sand grains in the dissection process, and believe that the source of the silica may have been from fish stomachs, mud adhering to tule rhizomes, bird craws, or the stone dust resulting from grinding seeds on metates or in mortars.

5. The screens used by us are manufactured by W. S. Tyler Standard Screen Co., Cleveland, Ohio.

6. The illuminated magnifiers employed by us are distributed by Abbeon Inc., 179 - 31A Jamaica Ave., Jamaica, N.Y. 11432. We used their table model with a 5 inch 5.5 diopter lens with a GE 22 watt circline bulb.

7. The collection of coprolites is in the University of California Lowie Museum of Anthropology, Berkeley. All of the separated components of the fifty coprolites analyzed by us, as well as the collection of several thousand slides, are also on deposit in the Lowie Museum.

8. H. Aschmann (1959:77, 80-81) cites a number of other accounts of the second harvest among Baja California tribes. These are all pretty much the same as Baegert's description, but Clavigero's version implies that the toasting and grinding to flour of the seeds extracted from the fecal material was done shortly after, or perhaps even during, the pitahaya harvest period, and that the flour was stored to be eaten during the winter when other food was scarce. Consag's account of the second harvest informs us that the people all defecated in a special place paved with flat stones or dry grass.

9. Typha seeds and roots (rhizomes) were probably a more important element of the diet of western North American Indians than generally supposed. The roots will yield about four thousand pounds of flour per acre, and the food value is not inferior to wheat, corn, rice, or potatoes (Classen 1919).

10. Seasonal occupation of Lovelock Cave is a difficult question to answer with available data. The dietary elements thus far identified in the coprolites are all storable items and could therefore have been eaten throughout the year. Even though Humboldt Lake and River froze during the coldest winters, fishing through holes in the ice was practiced (Loud and Harrington 1929:156) and fresh fish were thus potentially obtainable throughout the year.

11. Beals and Hester (1956:414-415) recognize a "Lake Ecologic Type" in California which is close to the one suggested for the lakes of western Nevada. Recognition of the specialized Great Basin lake ecologic type from the archaeological record was earlier made by Loud and Harrington (1929), Heizer and Krieger (1956:4, 6), and Jennings and Norbeck (1955).

12. Annie Lowry, a Northern Paiute of the Lovelock area who served as informant for R. H. Lowie and O. C. Stewart, was of the opinion that Lovelock Valley originally held a native population of 800 to 900 persons (Scott 1966).

13. A second examination has been done. One entrance and one interior coprolite were studied for viable organisms by Tubbs and Berger (n.d.) at UCLA.

14. These data are reported by Dunn (n.d.) in the larger context of health and disease among hunter-gatherers.

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