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Paleoethnobotanical Evidence

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THE ANALYSIS OF plant materials from water flotation processing allows for the study of human plant use activities that may not be readily apparent from screened excavation materials. The primary purpose of flotation is to recover charred plant remains, however other critical classes of material are also recovered such as bone and lithic debitage. This section will outline our basic methodology, some preliminary results along with a brief disucssion of these results, and our goals for future work of paleoethnobotany at Chiripa.

METHODS

In the Field

Water flotation is implemented at Chiripa as an integral part of the excavation research design. The standard excavation practice includes the collection of at least one soil sample from every excavated locus, except for the plowzone contexts. These soil samples are processed by water flotation to recover charred organic plant remains, sub-centimeter-sized artifacts, and to provide information on the materials not recovered by the traditional screening process. Our standard field procedure requires the excavators to sample each locus by collecting one 10-liter point-provenienced "bulk" flotation sample. A "bulk" soil sample is a single 10-liter block of soil, with a recorded x, y, z provenience (Popper and Hastorf 1988). From certain contexts, such as use-surfaces or middens, another 10-liter "scatter," or average soil sample is collected. A "scatter" sample is a collection of soil from throughout the locus, creating an average view of what was deposited within the locus (Popper and Hastorf 1988).

Additionally, across occupation surfaces, many bulk soil samples are taken, usually one sample every 1 by 1 m area but at times we increase the number to one sample every 50 cms. These different sampling strategies, tallied separately but taken together, will provide a broad view of the artifact distribution from all locations and in-depth information about specific locations.

The mechanized water flotation system used at Chiripa is a modified SMAP setup (Watson 1976), with several processing steps added to the basic technique to increase the speed and amount of charred plant material recovered from each flotation sample. Shaking and bouncing the inner flotation bucket in the water, like in an unmechanized system, is performed to speed up the flow of silts through the bottom inner screen, and a siphoning procedure is done near the end of the flotation process to recover carbon in the flotation water that does not rise to the surface (Gumerman and Umeoto 1981). Christine Hastorf built the machine used at Chiripa in 1989 for the Wila Jawira project. We gratefully acknowledge Alan Kolata for granting permission to use this machine.

In the Laboratory

Once the sample is clean and dry, a crew of Chiripa workers sorts the heavy fractions in the on-site laboratory to extract cultural and ecological artifacts. Each heavy fraction is moved through a series of brass geological sieves with mesh sizes of 4 mm, 2 mm, and .5 mm, with the remaining smaller fraction caught in a lower pan. All fractions are sorted for bones, fish scales, charred plant material, ceramics, lithics, metals, and all other artifacts. There is some selectivity in the artifact removal process due to what is useful in analysis. Ceramics are removed only from the 4 mm fraction. Burned soils, adobe pieces, lithics, and bones are removed from the 4 and the 2 mm sieves. Plant remains are collected from all screen sizes of each heavy fraction. These plant remains, along with the plant remains from the light fractions, are analyzed at the University of California-Berkeley Archaeobotany Laboratory with the generous help of undergraduate and graduate students.

Previous Research at Chiripa

The current project is not the first paleoethnobotanical work completed at Chiripa. In 1934 excavations by Bennett (1936) and later excavations by Kidder (1956), report noticeable quinoa and potato fragments found in the bins of the structures on the mound. In Kidder's case, some of the botanical remains were radiocarbon dated by the University of Pennsylvania. In 1974 and 1975, David Browman (1986) floated soil samples from his excavations on the mound and presented some observations. First, the following taxa are represented: *Chenopodium*, Grass seeds, *Malvastrum* species, *Amaranthus,* Cactaceae, *Scirpus, Juncus, Carex, Lepidophyllum, Plantago, Polygonum, Vicia,* and *Sisyrinchium.* These same taxa are also represented in the TAP project flotation samples with the addition of many more species (see table 11).

Browman also found tuber and other starchy root plants, but these have not been identified to species. We also have extracted storage root tissues that are in the process of being identified. Browman observed that the *Chenopodium* seeds increased in diameter through time, but the mean sample size was not as large as modern domesticated varieties. Dung was also found in Browman's flotation samples, along with many taxa of wild or weedy seeds. This observation makes the direct link between the plant taxa in the flotation samples and human activities more complex because we must remember that the inclusion of any seed may be from human or animal dung, and other natural or unintentional processes (Miller and Smart 1983).

Browman's publication on the plants from the site notes that agricultural production is evident by the taxa representation. Further, he concludes that the diet reflected by the plants would be sufficient in protein and other nutrients when added to the faunal resources. These results and interpretations are not in question. Nonetheless, further excavation and analysis of plant remains from identifiable contexts such as domestic, ritual, and midden deposits should not only expand the taxa list that Browman documented for the site but provide new interpretations and questions to be addressed about past plant use.

Results

From the 1992 season 522 flotation samples were collected and processed and from the 1996 season 390 flotation samples were collected and processed.

TABLE 11 List of species recovered from Chiripa flotation samples. Taxa with stars before them are taxa not listed in previous investigations.

Taxa	
Amaranthaceae	Floral head - unknown species
Amaranthus sp.	Stem
Asteraceae	* "Kiana" unknown leaf
* unknown sp.	Lump
Boraginaceae	Tuber
* unknown sp.	Dung
Cactaceae	Wood
Cereus sp.	
unknown sp.	Defined unknown seed types
Chenopodiaceae	* unk 224
Chenopodium sp.	* unk 264
Brassicaceae	* unk 265
* unknown sp.	* unk 270
* *Rubus* sp.	* unk 280
Lepidium sp.	* unk 308
Cyperaceae	* unk 317
Scirpus sp.	* unk 318
Euphorbiaceae	
* unknown sp.	
Fabaceae	
* Wild Type	
Rubiaceae	
* *Galium* sp.	
* *Relbunium* sp.	
Labiateae	
* unknown sp.	
Malvaceae	
Malvastrum sp.	
Oxalideae	
* *Oxalis* sp.	
Plantagenaceae	
Plantago sp.	
Poaceae	
grass stalk	
* *Dactyloctenium agyptium*	
* *Stipa* sp. ichu	
* *Zea mays* kernel	
* *Zea mays* cupule	
unknown spp.	
Potamogetonaceae	
* *Potamogeton* sp.	
Solanaceae	
* unknown sp.	
* *Nicotiana* sp.	
Verbenaceae	
* *Verbena* sp.	

Montículo: House 5

Six samples from House 5 were analyzed. Radiocarbon dates run on *Chenopodium* seeds from House 5 loci give a calibrated age range of 400 to 200 B.C.

To simplify the interpretation process three plant categories are presented for this house: seeds (food and non-food types), tubers (unidentified as of 1998), and fuels (wood and dung). These basic types are functionally much different, and the inclusion of each species on a pie diagram would introduce a clear view of the data. The pie charts in figure 32 show the relative proportions of these three plant types based on total adjusted observations, with the observed counts noted in the lower left of the figure. The individual pie slices represent the three basic types of charred remains, seeds, tubers, and fuel, summarizing the sorted materials. Seeds from both domestic and wild plants, tubers (whole tubers and tissue fragments that derive from starchy storage plant parts), and fuels/construction material (wood, dung, grass stalks) were all found in these bin samples.

With 20 identified plant taxa, the majority of the plant material found in this area's flotation samples are seeds. *Chenopodium* seeds make up the bulk of the counted items. One of the ongoing problems with the Chiripa flotation materials is the high number of grass seed taxa that are as yet unidentifiable to genera or species. We also have similar problems of species identification with the Cyperaceae seed varieties in the samples. Further, this seed type can include members of not only the Cyperaceae, but also the Juncaceae and the Polygonaceae.

In the project completed by Lennstrom and Hastorf (1989), different signatures of plant deposition were found in Inka storage structures (*qollqa*) versus habitation structures. Their paper demonstrates some taxa overlap between storage areas and habitation zones, however the number of weedy species in storage areas was much lower than in houses, creating a different signature for each of these two contexts. If we assume that many taxa might reflect more activities and fewer taxa reflect fewer activities in the assemblages, we can propose some provocative interpretations of the samples from House 5. The starred taxa in table 12 are characteristic of storage areas but were found in both the bins and floor sample of House 5. Interestingly enough, the taxa diversity is much greater in the bins than on the central floor. This initially suggests that the floors do not reflect domestic material. For example, the flotation sample from Locus 1432 on the house floor (see figure 32 for location) illustrates signature of a more non-domestic or selective activity type. Here we see low diversity and few weedy taxa. This sample has a large number of *Chenopodium* seeds but relatively few other taxa compared to most of our Chiripa samples. If we allow ourselves to extend the general pattern of storage versus habitation to the Formative times, we could argue that the plant taxa frequencies from the floor of this upper house structure are more characteristic of storage or other non domestic activities rather than general domestic activities.

If we focus on the *Chenopodium* seeds themselves, we see that the ratio of large diameter seeds, those greater than 1.18 mm, is higher in the House 5 samples than in the rest of the samples from the site. This higher ratio of larger seeded *Chenopodium* and the presence of other food taxa, like tuber fragments, supports Mohr Chavez's hypothesis that the Upper House structures probably included storage activities (1988). The floor flotation sample we have analyzed suggests to us that these floors did not receive typical domestic material.

Our soil samples from the bin area are ambiguous, however, because they are not the actual residues from the bin floors but what was filled into them after the house was burned and abandoned. The bin flotation samples, e.g., Locus 1431, have many more taxa than the floor sample did, suggesting a more domestic type deposit. We believe that these samples actually come from fill above the floor, reflecting other contexts.

Montículo 1A Area

This excavation of the mound, presented by Matt Bandy in chapter 9, dates roughly to 700-400 B.C., and is a complex layering of floors and fill, with features occurring on the floors that were excavated separately. In table 13 the floors, features on the floors, and the fill levels show a much different picture of activities than the

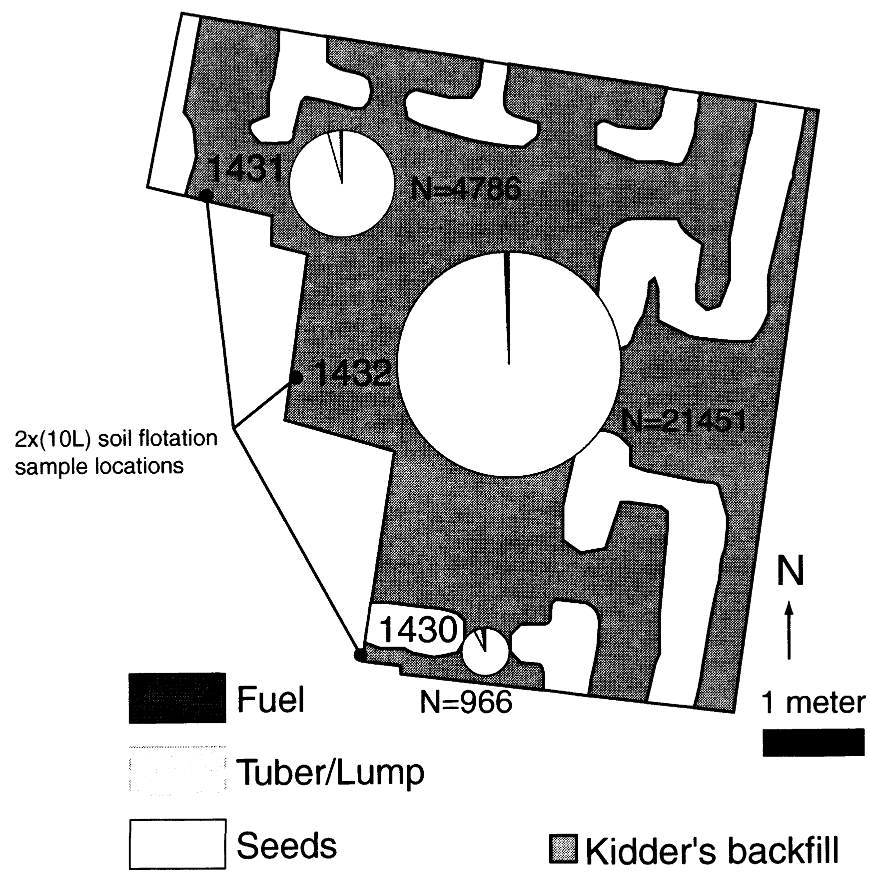

FIGURE 32 Pie diagrams of functional plant groups from House 5 on Montículo.

activities of House 5 just presented. These structures are earlier than the upper house level although they still date to Late Chiripa (see chapter 11). More taxa are represented in these house floors (26 taxa) than in House 5. The density of these remains, however, is low. Two points should be stressed about these floor data. First, the burning events that occurred on the floor have preserved a large number of grass genera with no dung found. The only identifiable dung found in the structure is from the plaster floors, and this is in small quantity (19 pieces all smaller than 2.00 mm found in one flotation sample only). Second, the taxa recovered from the floors versus from the fill between floors are similar. The density of analyzed material in these two contexts differs, with 6 observations per liter from the floors versus 13 observations per liter from the fill. With only 6 pieces of carbon per liter of soil, I would characterize these floors as sparsely covered with plants when compared to the fill between the floors. All of these mound structures seem to have sparse plant remains.

LLUSCO

Materials from the Llusco excavation area are given in table 14. The Llusco area, in comparison to the Montículo structures, is a semisubterranean structure reported on by José Luis Paz in chapter 7. This outdoor enclosure floor seems to have been kept just as clean of materials as the Montículo floors on the interior of the lower house levels. When we compare the plant evidence from the floor versus from the fill at Llusco, we find that again, the Llusco floor samples have a much lower taxa count (Floor 19 versus Fill 41). Further, the plant densities from the floor are roughly half that of the fill (Floor 14 counts/liter versus Fill 38 counts/liter). This suggests that midden was used as fill and that this

TABLE 12 Species and counts of carbon recovered from House 5 flotation samples.

Taxa	Bin Locus 1430	Bin Locus 1431	Floor Locus 1432	Taxa Total
Cactaceae *Cereus* sp.		3		3
**Chenopodiaceae Chenopodium*	785	4506	21358	26649
Cyperaceae	1			1
Cyperaceae *Scirpus* sp.	1	3		4
dung	1			1
Fabaceae wild	3			3
floral head	3			3
Galium sp.	2			2
grass stalk			3	3
Lepidium sp.	1			1
lump	48	138		186
*Malvaceae	5	39		44
*Poaceae	13	15	16	44
*Poaceae *Stipa* sp. ichu	5	6		11
Relbunium sp.	2			2
*tuber	7	55	54	116
twig	1	1		2
unidentified seeds	70	3		73
unknown	1			1
Verbenaceae *Verbena*	2			2
wood	15	17	20	52

* Starred species are characteristic of storage areas from Lennstrom and Hastorf (1989).

fill was always more dense with burned refuse than what was left on floors.

SANTIAGO

The data from the Santiago B16 surface, reported on in chapter 8, is presented in table 15. The B16 surface is a difficult area to analyze due to the fact that the surfaces are extremely diffuse and hard to identify. Bio-turbation seems to have been more active here as well. The area has similar plant taxa representation as the other areas, however the density of the remains was much higher than in the other areas discussed (101 items/liter). The density is even higher than the midden fills from elsewhere on the site. This suggests that domestic activity involving intense burning events and leaving representations of diverse species occurred here. However, from our preliminary analysis of the plant remains, we have yet to detect a clear pattern of spatial use across B16.

DISCUSSION

The results given so far are by taxa presence and counts per liter for the sectors we consider to be floors or surfaces from the excavated areas. Using the density of seeds as an indicator of general use of these different surfaces, we see that the B16 surface has 80 seeds per liter while the

TABLE 13 Species and counts of carbon recovered from from excavation area Monticulo 1A flotation samples. Column heading titles are as follows: plaster floors (PF), fill between floors (FF), burning events on floors (BF).

Taxa	PF	FF	BF	Taxa Total
Asteraceae			2	2
Cactaceae *Cereus* sp.		1	1	2
Chenopodium sp.	298	950	1536	2784
Cruciferae			8	8
Cyperaceae	5	9	7	21
Cyperaceae *Scirpus* sp.			12	12
dung	19		0	19
Fabaceae Wild Type	4	7	11	22
Galium sp.		2	1	3
Dactyloctenium agyptium			1	1
lump	70	30	128	228
Malvaceae	28	185	703	916
Poaceae	33	76	1025	1134
Poaceae *Stipa* sp. ichu	7	22	160	189
Zea mays cupule			1	1
Relbunium sp.		1	1	2
Solanaceae	1		27	28
Solanaceae *Nicotiana* sp.		1	0	1
tuber		9	36	45
twig	1		8	9
unidentified seeds	47	32	167	246
unk 319		1	0	1
unknown			1	1
unknown 265			32	32
Verbenaceae *Verbena*	1	1	3	5
wood	79	438	39	556
Total Count	593	1765	3910	6268

other areas, Llusco and Montículo have 13 and 4 seeds per liter. This supports the interpretation that the Llusco and Montículo areas were more likely to have been special use or irregular-use spaces. These results suggest that these two structures were kept remarkably clean of debris or that they were not used in the same ways or as often as the B16 area. We have seen this pattern in the excavations where both surfaces have looked remarkably clean of burned remains. Visual observations often do not reflect the true nature of charred macrobotanical remains in the soils, but in this case, the archaeobotanical materials support the visual excavation information.

The materials found in the Montículo and Llusco floors appear to be of no special origin or composition but seem to be of the same taxa and crude proportions as other areas of the site. The debris on the Montículo and Llusco floors are then likely to have been incorporated in the use of the structures not overtly from ritual use but from being in contact with human feet and other materials that can track and move small pieces of soil and debris from one area of the site to the other. The taxa found in the three areas are similar, with at least 20 plant types from B16, 16 from Llusco, and 9 taxa from Montículo (tables 13, 14, and 15).

What is notable from these data is that the exposed Llusco structure floor is almost as clean as the covered Montículo Lower House floors (Mont. 1). This finding enhances our interpretation that the Llusco structure is a ceremonial area and activities associated with daily living activities were not going on here.

TABLE 14 Species and counts recovered from excavation area Llusco. Column headings show counts of plant remains from the Late Chiripa plaster floor versus fill.

Taxa	Llusco Plaster Floor	Llusco Fills
Amaranthaceae *Amaranthus* sp.	2	6
Asteraceae		8
Boraginaceae		5
Cactaceae *Cereus* sp.	1661	31
Chenopodiaceae *Chenopodium* sp.	3	11649
Brassicaceae	22	12
Cyperaceae		193
Cyperaceae *Scirpus* sp.	19	1
dung	33	122
Fabaceae wild	3	290
Galium sp.		44
"Kiana"		1
Labiateae		1
Lepidium sp.		1
lump	251	4431
Malvaceae	261	2811
Oxalideae *Oxalis* sp.		4
Plantagenaceae *Plantago* sp.		2
Poaceae	251	1531
Poaceae *Stipa* sp. ichu	39	303
Poaceae *Zea mays* kernel	1	1
Potamageton sp.		2
Relbunium sp.	5	134
Rubus sp.		1
Solanaceae	4	17
Solanaceae *Nicotiana* sp.	8	35
tuber		39
twig		49
unk 264		1
unk 270		4
unk 308		1
unk 317		1
unk 318		1
unidentified seeds	302	2854
unk 224		1
unk 280		4
unk 317		1
unknown 265		1
unknown unidentified seeds	6	33
Verbenaceae *Verbena* sp.	6	126
wood	68	479
Grand Total	2945	25231

TABLE 15 Species and counts recovered from excavation area Santiago B16 surface.

Taxa	Total
Cactaceae *Cereus* sp.	14
Chenopodiaceae *Chenopodium* sp.	5897
Brassicaceae	2
Cyperaceae	67
dung	71
Euphorbiaceae	1
Fabaceae wild	72
Galium sp.	17
Lepidium sp.	4
lump	1769
Malvaceae	1670
Poaceae	377
Poaceae *Stipa* sp. ichu	102
Potamageton sp.	2
Relbunium sp.	182
Solanaceae	32
Solanaceae *Nicotiana* sp.	2
stem	4
tuber	2
twig	6
unk 317	1
unidentified Seeds	1078
unknown 265	25
Verbenaceae *Verbena* sp.	12
wood	634
Grand Total	12043

SUMMARY

Flotation materials from these three excavation areas show three general patterns. The Montículo House 5 floor and bins have different taxa composition and densities. The Llusco enclosure and Montículo 1A floor excavation areas are low in charred plant remains, almost to the point of being charred plant free, which would strengthen the interpretation of these areas as being of special use as opposed to domestic structures. The materials from the B16 surface area have a similar pattern to previously reported patterns of domestic activities in other sites.

These results are preliminary and will be modified and expanded with further excavation, analysis, and interpretation. Taxa identification and the analysis of tubers, unknown seeds, and wood will be conducted and reported on in the future. The analysis of the materials from Chiripa provides a unique opportunity to study the plant use of an early settled community; these results should prove valuable to all altiplano prehistoric research.