PRELIMINARY ANALYSIS OF BOTANCIAL REMAINS FROM LUKURMATA, BOLIVIA: A TIWANAKU REGIONAL CENTER

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This paper is a preliminary report on paleoethnobotanical work being done on flotation samples from archaeological excavations at the site of Lukurmata, a Tiwanaku regional center on the south shore of Lake Titicaca in western Bolivia. (map slide) The soil samples were from excavations undertaken by Projecto Wilajawira during the summers of 1986 and 1987. They were processed using a modified SMAP water flotation system last summer, (flot slide) and the light botanical fractions were brought back to Dr. Christine Hastorf's paleoethnobotany laboaratory at the University of Minnesota for sorting and analysis. (lab shot?) As I said, this is a preliminary report : 96 samples from Lukurmata have been sorted, coded and entered on the computer so far.

Lukurmata (site shot) is located on an artificially leveled hilltop on the Taraco Peninsula directly overlooking Lake Titicaca. Earlt investigations by Bennett revealed a (temple shot) central rectangular sunken court or "temple" complex with the customary classic Tiwanaku finely-cut stairway and stonework. Also recovered were fine classic Tiwanaku pottery and fine grave goods such as semi-precious stone pendant, slivers of embossed gold and silver, etc. Little was known about what the extent of domestic occupation of the site was, both in time and space, prior to the Wilajawira investigations.

Aside from being located on the shores of rich laucstrine resources, Lukurmata is also overlooks the broad

(pampa shot) plain of the Pampa Koani, home to over 75 square kilometers of ancient raised and ridged agricultural fields. (old field) Most of these fields date to Tiwanaku 3-5 (AD100 - 1000), with the greatest expanse during Tiw 4, or classic Tiwanaku (AD400-700). It is these agricultural fields which are thought to have supported the expansion of the Tiwanaku empire, and enabled the large urban concentrations of people at sites such as Lukurmata and the capital city of Tiwanaku (Tiw shot) itself ten kilometers to the south. One theory about the fall of the Tiwanaku empire holds that changing lake levels may have altered the salinity of the fields causing a widespread agricultural crisis.

[Projecto Wilajawira is also currently involved in an effort to reclaim these ancient fields for modern use (new field shot), with remarkably good results. Soil salinity is controlled by fresh water canals between the fields, which also grow an algae which is said to make a great fertilizer. The yields from the test fields have exceeded expectations : they may well revolutionize modern altiplano agrigulture. But that, my friends, is another story]

Lukurmata's (site shot) strategic location had led it to be interpreted as a regional administrative center, overseeing the management of these huge field complexes. The sheer size and complexity of these fields have led many to suppose some system of mit'a labor tax; certainly they

represent a large investment of corporate labor which, presumably, would require ongoing management.

What crops were being grown on these raised fields is not entirely certain -- it was hoped that the paleoethnobotanical analyses would help to shed some light on the question. Presumably the agricultural complex at Lukurmata was similar to that which has been attested to in other Middle Horizon altiplano sites, many of which crops are still grown today. (crop slide) The staple crops consist primarily of tubers, such as potatoes, mashua, oca, and ollucu; the grainy chenopods, quinoa and caniwa, and tarwi, a domesticated lupin. These crops do well at higher altitudes and colder climates, and chenopodium in particular is fairly resistant to soluable salts in their soil. Crops from lower, warmer climates which are unable to grow well in the altiplano proper were probably traded in : capsicum (chile pepper), beans, coca, tobacco, and of course, maize. Also possible imported food items include fruits and herbs from the selva of the eastern slopes. In addition to actual cultivated crops, many wild and weedy plants are, and presumably were, utilized by the people of the altiplano. Ichu grass (slide) and other grasses are used for thatching roofs. Herbs of various kinds (herbal hospital slide), both local and imported, are used for a variety of medicinal purposes [during the course of our summer collecting of modern plants for our comparative collection, when asked what a plant was used for, our local informant (slide of

Telesforo) inevitably answered "mate... para dolor."]
Fruits of the cactus are collected for food. And, of course, there are the water plants. Tortora reed (slide) is used for making the famous Lake Titicaca reed boats, and is general a very useful material for weaving and plaiting. The inner part of the stem is sometimes eaten, as are the rhizomes. Tortora, sedges and rushes may have been used for fodder for camelids, as they are for sheep and llama today. At Chiripa, (Chiripa site slide) a nearby site which predates Lukurmata substantially, impressions of tortora reed were found in pieces of burnt daub, suggesting its importance as a building material.

During the two seasons of excavation at Lukurmata, several habitation areas spanning in date from Tiw 3 to colonial were excavated. The samples I will be talking about today came from two different habitation areas (site map slide), with a third, non-habitation area used for contrast. One area, excavated by a team led by Marc Berman in 1986, contained the remains of 12 domestic structures : 3 house floors from Tiw 3, 7 house floors from Tiw 4 and 2 house floors from Tiw4/early Tiw 5. In addition to the floors were a variety of features : internal and external hearths, storage pits, midden deposits, external activity areas, and several intrusive graves. Many of these house floors were in stratigraphic sequence, displaying a prolonged and continous occupation, building and rebuilding of houses. Wall foundations from these houses seems to have

been a double row of field stones in an oblong or rectangular shape. The walls themselves were mudbrick, and the house frequently had one or more abode-lined hearth, as well as storage and ash pits. Unfortunately, the soil sampling strategy was not entirely systematic. Rather than collecting samples from every level of every context, samples were taken when it was deemed there might be interesting botanical remains in them. A common practice, this nonetheless makes p.e.b. analyses much more difficult. This area was returned to during the 1987 excavations, and far more samples taken from a number of different contexts. (All in all, 34 samples have been analyzed from this area).

The second area from which we received several samples was the domestic area excavated by a team led by Bob Coffman in 1987. These excavations also revealed the remains of a number of domestic habitation contexts : wall foundations, floors, ash pits, midden deposits, etc. This is the same area in which Marc Berman and Gray Graffam excavated in 1986 (unfortuneately, we have no samples from that season's effort). During the 1986 season, a different kind of house architecture was uncovered. (slide) Rather than the oblong or rectangular houses with two or more hearths, this house was round in form, with only one hearth. It was located on a constructed terrace, held in by a retaining wall made of the same style of fieldstone-and-clay-mortar construction as the wall foundation. What this difference in architecture means in not yet clear : it doesn't seem to represent a

chronological distance : this house appears to be contemporaneous with the [redacted] the oblong houses. Perhaps its location on the site may have something to do with it : rather than being close to the ceremonial precincts, this house is somewhat removed. We await analyses from the 1987 season to clarify these questions. All in all, 28 botanical samples have been analyzed from this area, half of them from numbered features.

SLIDES OFF

The third area ~~(slide~~) from which we have a few samples for contrast is not a domestic area, but rather an area of tombs and a ceremonial platform excavated by a team led by J. Estevez in 1986 and returned to by Howard Earnest and John Januscek in 1987. This was the most sparesly samoled area, with only 18 samples analyzed.

[slides off]

Given the site's proximity to these lovely, productive raised fields, we expected to find good evidence of the crops that were being grown therein. Oddly enough, our samples were alomst bereft of any domesticates at all. A grand total of 15 samples had any domesticates at all, with the highest concentration being one sample which had all of 7 maize kernels and one cupule. The only domesticated species found were zea mays (corn), capsicum sp. (chile), doestic legumes (bean), and inspecific tuber. Most of the instances of domesticates ~~were~~ was one seed. Chenopodium was found with great frequency. Unfortunately, there are common wild as well as domestic species of chenopodium in that area

today (and presumably prehistorically). We divided our findings of chenopodium into large (>1.18mm) and small (<1.18 mm), but these cannot as yet be interpreted as domesticated and wild, respectively. We found no chenopodium greater than 2mm, which is the size of modern domesticates. Dr. Hastorf's peb lab is beginning this spring a project on chenopodium, in hopes that by studying characteristics such as size, shape and testa thickness, we may be able to work out criteria for identifying domesticated chenopodium archaeologically (and criteria for separating soecies, such as quinoa (Ch. quinoa) and caniwa (Ch pallidicaule). The domesticates occurred in a number of different contexts : ash deposits, midden pits, floors and hearths. They didn't cluster in any one context, but the majority of them (10 out of 15 samples) came from the area excavated by Bob Coffman et al (though all three areas had at least something). THe numbers involved here are much too small to make any kind of reliable generalizations.

The most common seeds recovered were the weedy seeds : chenopodium, small and large poaceae (grasses), wild legumes, malvaceae (mallows). In addition to seeds, frequently recovered were burnt pieces of dung (clear evidence of its popularity as a fuel source), wood, and "lumps" which are undidentifiable fragments of larger botanical remains (not wood) such as tubers, larger seeds, etc. The preservation of the botanical remains was quite good, seed counts were respectably high, so preservation

cannot account for the absence of domesticates. The explanations for the presence of these weedy species are myriad : use as fire starters, presence in fuel dung, use as roofing material, use as matting, being tracked into fire zones by humans and animals, use as food or medicine, etc.

Just as curious as the absence of domesticates is the similarity of samples across cultural contexts, areas of the site, and time. [transparency on] Although the number of samples we have for comparison is small, these pie charts demonstrate their remarkable similarity. (note U263 is one of our common as yet unidentified seeds) Whether from a floor, a pit, a midden, or a tomb; whether from TIW 3, 4 or 5; whether from Berman's "downtown" habitation area, Coffman's "subruban" area, or Estevez' ceremonial platform; these samples contain grasses, ~~cheno-ams~~, other weedy species, and often lumps, wood or dung. The variations between proportions of these items does not appear to be at all sytematic in terms of time period, provenience, or cultural context (I won't bore you with 96 pie charts to show you).* As the title of this talk indicates, this is a preliminary analysis : further investigation could reveal some sort of patterning not immediately obvious, but it hardly seems likely at this point.

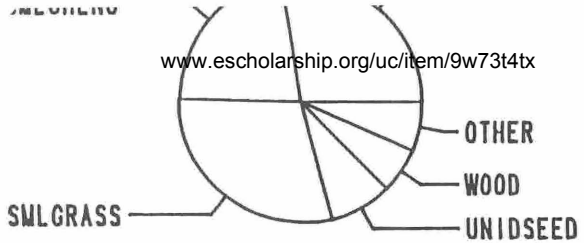
*In fact, these samples resemble more closely those recovered by Bowman at Chi-ipa - a site which predates the raised fields by hundreds of years.

So, instead of conclusions, all I can leave you with is a conundrum : where's the crops? Why, if Lukurmata's raison d'etre is managing vast expanses of agricultural fields, are the products of these fields missing from the archaeological

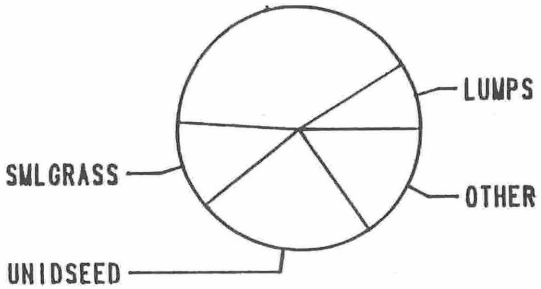
record? [Jokes floating around the lab ranged from the suggestion that actually they were growing flowers on those fields, to the idea that this proves an early form of farm subsidy : the Tiwanacota bureaucracy was paying the farmers of Lukurmata not to grow crops!] And why are the samples so similar across time, space, and context?

Part of the answers to these questions may lie in sampling strategy. Because the sampling was not systematic, we don't have a reliable sample universe out of which to make comparisons. The samples are biased in the sense that they were taken only when it was thought they might be of botanical interest. In fact, as many peb studies have shown, botanical remains are found all over archaeological sites, even in places where burned material is not visible to the naked eye. We are rectifying this part of the problem at the current Wilajawira excavations at the capitol city of Tiwanaku : flotation samples are now being taken from every level of every unit and every feature. (pile of flots shot) This sampling strategy will also be used when Wilajawira returns to Lukurmata (in the form of John Januscek) next year.

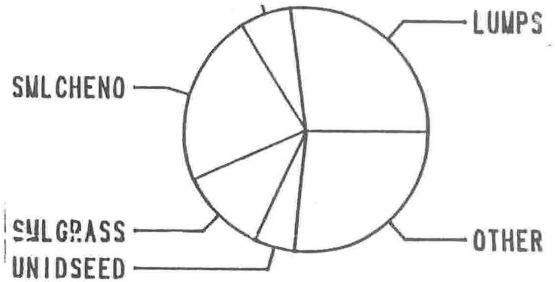
I welcome any questions, ideas, suggestions, or help you might offer.(sunset shot)



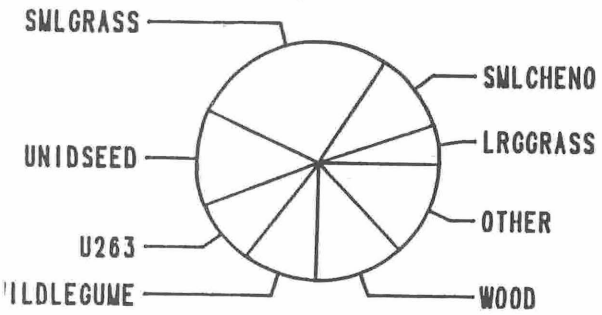
FLOOR TIW 4 BERMAN



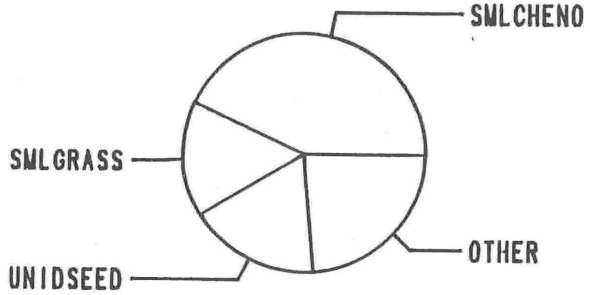
FLOOR TIW 3 BERMAN



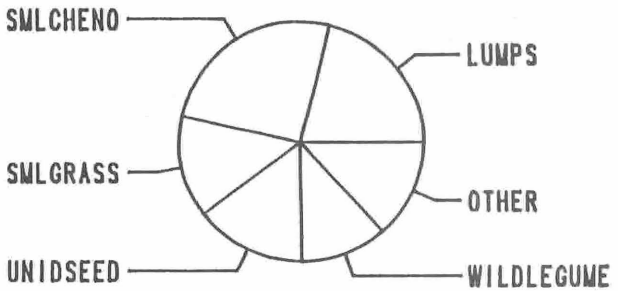
FLOOR COFFMAN



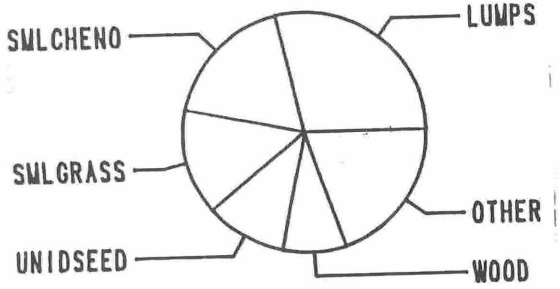
EXTERNAL HEARTH TIW 4 BERMAN



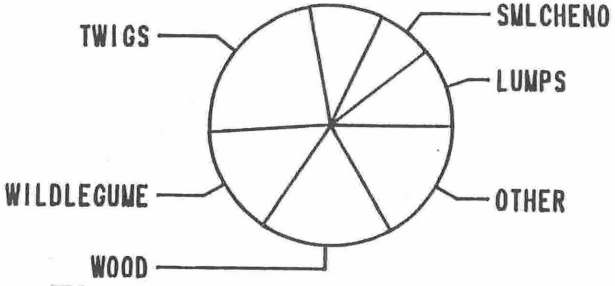
INTERNAL HEARTH TIW 4 BERMAN



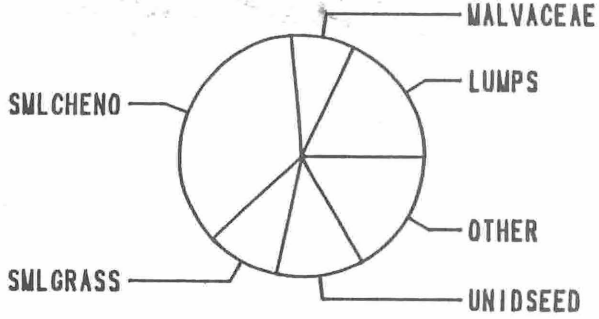
HEARTH COFFMAN



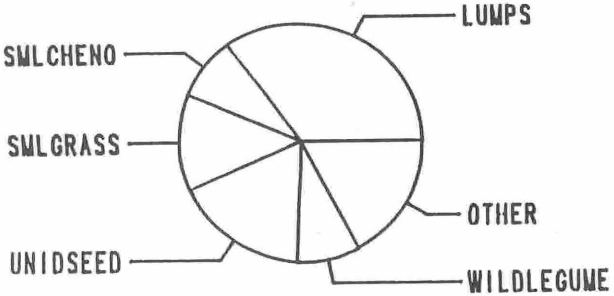
CAPPED, COLLARED CIST TOMB TIW 4 BERMAN



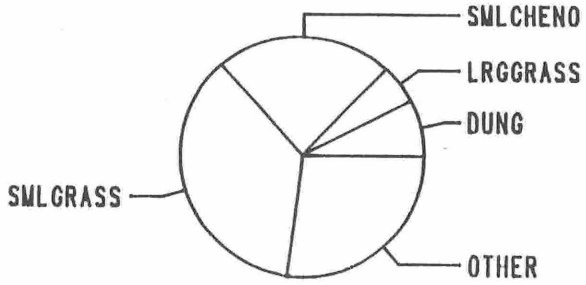
STORAGE PIT FILL BERMAN



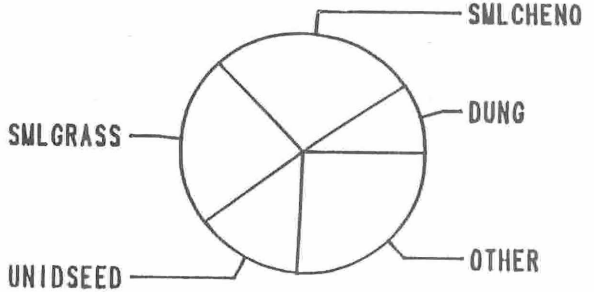
ASH PIT FILL COFFMAN



MIDDEN PIT FILL ESTEVEZ



MIDDEN LAYER IN CONTACT WITH TIW 3 FLOOR BERMAN



MIDDEN PIT FILL COFFMAN