ARCHAEOPARASITOLOGY REPORT –

JOINT COURTS ARCHAEOLOGICAL PROJECT, TUCSON

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ABSTRACT

Archaeoparasitological analysis of 110 inhumations from the Joint Courts Site, Tuscon, Arizona was completed. Comparative analysis of macrofossils and microfossils from control and sacrum samples was conducted to determine which inhumations had sufficient preservation to allow for reliable parasitological results. Insufficient preservation was encountered in 35 inhumations. However, 61 inhumations exhibited taphonomic conditions that would allow for parasite egg preservation. The other 14 inhumations had moderate preservation that would probably result in egg preservation. None of the samples revealed parasite eggs. Therefore, I conclude that none of the 75 inhumations exhibiting acceptable taphonomic conditions represent parasitized individuals. This absence of parasitism is corroborated by the analysis of latrines. Seven latrines were represented by 20 samples. Three of these latrine features were represented by at least one sediment sample with good to excellent preservation. No parasite eggs were found in the latrine samples. Therefore, the Tucson communities represented by the inhumations and latrines were free of intestinal parasite infection. This absence of infection is unique in the archaeoparasitology of historic communities and begs explanation.

ANALYSIS GOALS AND SUMMARY

The purpose of the contracted work on the Joint Courts inhumations and latrines was for an archaeoparasitological survey. This has been accomplished for the first all samples. These were excavated from seven latrines and 110 inhumations. The preservation potential varied greatly between the samples. Thus, there is a question as to whether a paucity of parasite eggs was due to a very low level of parasitism or due to post-depositional conditions that promoted decomposition.

In the process of laboratory analysis of the samples, other types of remains were observed. These types of remains include insects, pollen, starch, and macrofossils. I am undertaking the analysis of these remains to assess the preservation potential of the samples. The pollen analysis is underway for selected samples specified in Table 1. All insect pupae cases and eggs are currently being identified by forensic entomologists. The macrofossil analysis, general microfossil analysis, and starch analysis are completed (Tables 2-4 respectively).

The continued pollen analysis of selected latrine and inhumation samples will elucidate some dietary practices in the coming weeks.

INTRODUCTION – INHUMATION AND LATRINE POTENTIALS AND LIMITATIONS

The excavation and analysis of inhumation sediments for evidence of diet and disease has a long history in archaeology. Witenberg (1961) reported parasite eggs from sediments excavated from Palestinian sites. Since that time, refinements in methodology have been accomplished (Reinhard et al. 1986) but focused analysis of inhumations is still rarely included in excavation research designs. Most recently, Fugassa et al. (2008) reveals that even tiny amounts of sediment brushed from sacra results in the recovery of parasite eggs.

Dietary analysis of inhumation sediments is more commonly accomplished (Reinhard and Bryant, 2007). To my knowledge, the earliest analysis of inhumation sediments was done at Shanidar Cave by Ralph Solecki (see review by Sommer, 1999). This analysis focused on palynology. More recent, holistic analysis focuses on recovery of all types of dietary evidence including seeds, fibers, pollen, starch, and other remains (Berg 2001; Reinhard and Bryant, 2007; Reinhard et al. 2006; Reinhard et al. 1992).

Any grave is composed of microenvironments, some overlapping and others discrete. Each microenvironment has a different preservation potential. Recent research into microfossils from dentition shows that dental calculus is its own microenvironment (Boyadjian et al. 2007; Henry and Piperno 2008; Reinhard et al. 2001; Wesolowski et al. 2007). Indeed, this is such an easy area to sample and analyze, that dental calculus study is the most rapidly growing area of recent dietary research in inhumations. For dental calculus, the microenvironment forms during life during the development of plaque and then calculus. Plaque is an ephemeral film composed of food fragments, cellular debris,

minerals and bacteria. Plaque mineralizes into dental calculus. The calculus microenvironment represents microfossil accumulation and preservation. The microfossils, including starch and phytoliths, are encapsulated in dental calculus matrix and survive in inhumation environments. Such remains can survive in harsh preservation environments. For example, Brazilian sambaquis (shell mound monuments) are notoriously poor environments for plant microfossil preservation. However, plant microfossils are consistently found in sambaqui cemeteries through recovery and analysis of dental calculus.

The abdominal region is another inhumation environment that has long recognized potential for diet and disease data preservation. This microenvironment is less discrete than dental calculus because intestinal contents disperse into surrounding sediment matrices as the body decomposes. Published method papers emphasize the importance of the sediment within the pelvic girdle and especially the sediment in contact with the sacrum (Reinhard et al., 1992; Berg, 2001; Reinhard and Bryant, 2007). In rare instances, coprolites have been found within the pelvic cavity (Shafer et al., 1989; Reinhard et al., 2003). The sacrum has been likened to a "bowl" that inhibits the dispersion of colon contents into surrounding sediment (Reinhard et al. 1992). Visible fecal remains are not usually obvious during excavation. However, processing sediment from the pelvic cavity or from the anterior surface of the sacrum reveals the presence of seeds, starch grains, phytoliths, pollen, and other types of residues of dietary and medicinal importance (Reinhard et al. 1992; Berg 2001).

When graves are excavated, field procedures should be conducted with consideration of laboratory analyses. As stated by Reinhard and Bryant (2009) "Failures

during the recovery phase, or the use of improper sampling strategies, will compromise the ability to provide valid interpretations. In addition, inhumation sampling must include control samples from the inhumation fill and surrounding contexts." These researchers go on to emphasize the importance of control samples. All interpretations of disease and diet data from the pelvic cavity are dependent on reference to remains recovered from control samples. Only when differences are found between the control samples and pelvic samples can details of diet and disease be inferred. With regard to parasitic disease, parasite eggs can be recovered and analyzed to identify the worm species that parasitized the intestinal tracts of humans.

Analysis of latrines for parasite remains provides epidemiological information about historic populations. Herrmann and Schulz in 1986 first defined these epidemiological considerations of latrine analysis. They pointed out that a latrine rarely represents the complete cross section of an entire community. More commonly, and in my experience, a latrine represents a subset of a community. This can range from a family household (Reinhard 2000), to the clientele of a restaurant or store (Reinhard et al. 2008), the guests hotel (Yamin et al. 2004), to workers at a boarding house (Reinhard 1996), to soldiers in a military facility (Higgins et al. 1995), to practitioners using a specific religious building (Reinhard et al. 2008). Once the subset represented by the latrine is identified, comparisons with other similar subsets is possible. For example, household diet and disease can be compared across socioeconomic strata (Fisher et al. 2007). Therefore, it is important to know who used a latrine. The household level is the most commonly studied population subset in historic archaeoparasitology.

Relative to parasitology, microfossil analysis of latrine dietary remains is less commonly called for. Usually, zooarchaeological and macrobotanical analysis is employed in the analysis of latrines. However, analysis of starch and pollen provides evidence of starch sources and floral sources of food. Spices such as cloves, vegetables such as broccoli, and condiments such as honey become evident in pollen analysis. Tuber starches such as potato, and grain starches such as maize are evidenced in starch analysis. Pollen can be used to identify the strata within latrine features that are derived from nightsoil since pollen of dietary sources are especially abundant in nightsoils. When macrofloral and microfloral analysis are completed for latrines, an especially detailed picture of floral diet emerges (Yamin et al., 2002, 2004).

Analysis of inhumations and latrines from the same site offers greater details of diet and disease. Analysis of the latrines provides an unbiased list of the parasite species and food microfossils that might be recovered from inhumations. Inhumation data can be a biased source of information. Inhumations should represent a specific subset of the inhabitants of a site; a subset that would include a higher number of people who were ailing. Therefore, the numbers of infections could be elevated and more medicinal plant taxa might be present in the inhumation sediments. A cautionary study comes from Shafer et al. (1989) who report on the analysis of sediments from a Mimbres inhumation. The sediments contained corn ground to smaller fragments than ever noted in previous studies. The pollen analysis revealed a dominance of medicinal plants. Therefore, this individual could not be considered to represent the normal diet for Mimbres people.

One goal of modern parasitological study is to measure the incidence and prevalence of infection. Prevalence refers to the number of people infected out of a

known population at a specified time. Incidence is the measured risk of infection in a defined population over a specific time. In archaeoparasitology and the analysis of inhumations, we can not approach measuring these modern epidemiological terms. However, a inhumation population can provide us with good epidemiological date regard the proportion of deaths associated with parasite infection (Martinson et al., 2003). Parasitologists have observed repeatedly that most parasites of a given species are found in just a few individuals of the host parasite species. Thus, parasite infections are clumped which means that the majority of parasite infections are concentrated in a small subset of hosts. Generally speaking, ten percent of a host population will have 70 to 90 percent of the infections. This can be quantified in inhumation populations (Reinhard and Buikstra 2003). Therefore, in ideal preservation, inhumations can provide useful parasitological data that can be modeled in a more general way than the unachievable goals of incidence and prevalence used by epidemiologists.

Sacrum and latrine sediments are environments that promote good to ideal preservation. Therefore, such sediments contain an abundance of parasite eggs, pollen grains, and starch granules. The exine (outer shell) of pollen grains preserves in perfect form through the human digestive tract. Coprolite samples typically contain thousands to millions of pollen grains per gram. Inhumation sediment and latrine deposits typically have fewer pollen grains due to mixture with surrounding inhumation fill. However, the typical latrine sample or sacral sample contains tens of thousands of pollen grains.

Parasitic worms, collectively known as helminths, are remarkably fecund. The most common helminth of humans is *Ascaris lumbricoides*. A typical female lays 200,000 eggs per day from a uterus that contains as many as 5,000,000 eggs. The second

most common human helminth, *Trichuris trichiura*, lays 20,000 eggs per day per female. Hookworms lay thousands of eggs per day. The amazingly high production of resistance eggs results in high concentrations of eggs from latrines and inhumations. The concentration of eggs is so high in inhumations that eggs have been recovered from sacra even after cleaning and curation in museums (Fugassa et al. 2007). Sediments from latrines used by infected people typically have thousands of eggs per milliliter. Therefore, the recovery of microfossils has great potential in historic archaeology.

Starch has not been quantified from latrines or inhumation sediments yet. I have analyzed Chiribaya mummies from Peru and found an abundance of starch. Analysis of Chilean coprolites (Vinton et al., in press) shows that thousands to millions of starch granules are present per gram. However, my analysis of 10 latrines for starch granules reveals that starch is relatively rare in latrine sediments relative to coprolites and mummy intestinal contents. Considering the excellent preservation and yield of parasites eggs and pollen grains in most latrine sediments, it is surprising that starch is relatively rare. This may be due to the aerobic environment of latrines that promotes fungal decomposition of organic remains.

The summary of recovery potential of microfossils above relates to ecological zones that are conducive to good preservation. However, some environments do not promote the preservation of microfossils.

To explore the potential of inhumations and latrine for recovery of diet and disease date, sediment samples from the Joint Courts Site in Tucson were examined. Two samples were submitted from each inhumation: a control sample and a sacrum

sample. From the latrines, multiple samples were submitted from different strata. This was an ideal sampling strategy.

LABORATORY MATERIALS AND METHODS

The contracted work specified only parasitological analysis for the inhumations and most of the latrines. However, to evaluate the preservation potential of the sediments, I proceeded with macrofossil recovery for all samples and microfossil analysis for a subset of samples that showed the best preservation potential.

Preliminary Steps

All sediment samples from inhumations were checked for evidence of human bone. This was a necessary and time-consuming exercise. Each sample was screened through a 2.0 mm mesh and the separated remains on top of the screens were examined for trabecular bone or cortical bone.

Archaeoparasitological methods were developed by Reinhard et al. (1988) based on multidisciplinary analysis of sediments from Providence, Rhode Island (Reinhard et al. 1986). Later, Warnock and Reinhard (1992) formalized a method for simultaneous recovery of seeds, parasite eggs and pollen grains from the same samples. Later research by other archaeoparasitologists (Bain 2001; Mitchel et al. 2008) confirm the utility of the methods described below for latrine sediments. In general, I use the methods of Warnock and Reinhard (1992) with some refinements. I have found that eliminating the sonication procedure of Warnock and Reinhard (1992), and reducing the amount of sediment processed improves the processing results.

Carbonates are dissolved with hydrochloric acid, and silicates are dissolved with hydrofluoric acid. These acids do not damage parasite eggs or larvae. Starch grains are not damaged either. Therefore, parasitological analysis and starch analysis are done after the hydrofluoric acid treatment. The next stage, acetolysis, destroys cellulose, starch, and

parasite larvae and some parasite eggs. However, pollen preserves through acetolysis which facilitates pollen analysis.

To calculate the concentrations of microfossils in samples of sediment, I add known number of *Lycopodium* spores into the samples (Reinhard et al. 2006). Three *Lycopodium* spore tablets are place in each of five 350 ml beakers. For this analysis, *Lycopodium* spore batch 212761 was used. Previous analysis shows that approximately 12,500 spores are present in each tablet. The tablets are dissolved in ten drops of hydrochloric acid.

Preliminary Processing

While the tablets dissolved, 30 milliliters of fine sediment are removed from each sample bag. When the *Lycopodium* spore tablets are completely dissolved, the 30 ml sediment samples from each archaeological sample are added to the respective beakers and labeled with that sample's assigned laboratory number. Preliminary observations are made. Then 5 drops of 40% hydrochloric acid are added to test whether or not the samples needed to be treated with this acid. If a reaction results, then the sample is treated with HCl until the reaction stops. More distilled water is added when the reaction between the acid and the carbonates in the sediment stopped.

Once dissolved in acid, the samples are transferred to 300-milliliter beakers and treated with the swirl technique. The contents of the beakers are swirled until all particles are in suspension. The beakers are placed on a flat surface for 30 seconds. After 30 seconds, the fluid from the beakers is poured through 250-micrometer mesh screens into 600 ml beakers labeled with the appropriate lab numbers. This was repeated thrice. The

benefit of the swirl technique is that heavy, non-organic particles are removed from the sample and macrofossils such as seeds are recovered on the screen.

Macrofossil Analysis

The macrofossils on the screens are examined for indicators of nightsoils for latrines and dietary seeds for inhumations. I have found from the analysis of over two hundred latrines from historic sites that the presence of *Rubus* seeds is a prime indicator of night soils (Reinhard 1994). This has been supported by other researchers as reviewed by Bain (2001). Dietary seeds can also be recovered from inhumations (Berg et al. 2001). The screened macroscopic remains are dried and transferred to Petri plates marked with 1 cm grids. The seeds and other macroremains are distributed over the grids and are counted.

Parasitological Analysis

Then the screened fluids in the 600 ml beakers are concentrated by centrifugation in 50 ml centrifuge tubes. The sediments are washed three times in distilled water. Then the sediments are transferred into labeled 500-milliliter polypropylene beakers. Fifty milliliters of 48% hydrofluoric acid are added to each beaker and the sediments are thoroughly mixed in the acid. The samples are left in the hydrofluoric acid for 24 hours and are stirred occasionally during this period. Then the sediments are concentrated by centrifugation in 50-milliliter centrifuge tubes. The sediments in the tubes are then washed many times in distilled water until the supernatant is clear.

For archaeoparasitological analysis, drops of the sediments are transferred to glass microscope slides with Pasteur pipettes. The sediment drops are mixed with glycerin and covered with glass cover slips. A minimum of 6 preparations is examined and at least 25

Lycopodium spores are counted for each sediment sample. Parasite eggs and added *Lycopodium* spores are counted. The concentrations of eggs are determined by the ratio of eggs to the known number *Lycopodium* spores added to the samples. Identification of the genera of the parasite eggs is done by morphological analysis. In the case of trichurid eggs, the dimensions of the eggs are measured and compared to those of trichurid species from a variety of hosts including humans, domestic animals, and rodents that commonly infest habitations.

During archaeoparasitological analysis, the presence of starch and pollen is noted. Also, general observations regarding the nature and content of the remains are made.

Starch Analysis

The sediments are then examined for starch grains using 250 and 400 magnification with polarized light. The grains are identified by comparison to my collection of known starch grains from tubers and seeds. Three starch slides are counted for each sample. The starch of cultivated plants can be identified based on longstanding nutritional and botanical references (Wivinis and Maywald 1967). For lab samples 1-100, 12 slides from each sample were examined for starch. This was time intensive and not really productive. For samples 101-246, 3 slides from each sample were examined for starch.

Pollen Analysis

After archaeoparasitological and starch analyses are completed, the samples are processed for pollen. During the archaeoparasitological analysis, I noticed degraded pollen grains. I adjusted the pollen recovery procedure accordingly. The tubes are centrifuged and the water is poured out. Glacial acidic acid is added to the tubes. The

tubes are stirred until all particles are in suspension. Then the tubes are centrifuged and the acidic acid is poured into a waste disposal container. Then, acetolysis solution (8 parts acetic anhydride to 1 part sulfuric acid) is added to each of the tubes. The tubes are stirred and placed in water baths at 99 degrees Celsius for 3 minutes. The tubes are transferred to cool water baths, 20 degrees Celsius for 3 minutes. I have found that this method results in better recovery of degraded pollen than longer treatments in hot solution. The tubes are centrifuged and the acetolysis solution is poured into a waste disposal container. The sediments are then washed with glacial acidic acid and subsequently with distilled water until the supernatant is clear in each tube. Then microscope slides are prepared and examined at 400 power of magnification. Pollen types are identified based on published keys, my reference collection, and past experience. An attempt is made to achieve a 200 grain count for every sample.

Pollen grains are classified as “pristine”, “good”, “degraded”, or “unidentifiable”. Pristine grains are those that are perfectly preserved. Good grains are intact in shape, ornamentation, and aperturation but show some slight deformation. Degraded grains are exhibited one or a combination of eroded surface structure, folding, rupture of the wall, or fragmentation. Degraded grains are still identifiable to a taxon. Unidentifiable grains are so eroded, folded, torn, and/or fragmented that they could not be identified.

Quantification

Concentrations of parasites, pollen grains, and starch grains are calculated with the following formula:

Microfossil concentration = ((f/m) x e)/ v

f = microfossils counted, m = marker *Lycopodium* spores counted, e = *Lycopodium* spores added, and v = volume of sediment.

RESULTS

General Observations

The preliminary classification of the inhumation sediments shows that the sacrum samples have a higher organic content than the controls. The samples are classified as organic-rich, decomposed organic-rich, silty, sandy, or ashy (Figure 1). Organic-rich refers to the preservation of fiber and other plant tissues in recognizable form. Decomposed organic-rich samples contain an abundance of plant organic residue but the general form is decomposed. Silty and sandy classifications refer to the size of incompletely dissolved silicious particles. Silty samples are dominated by fine particulate matter, less than one micrometer is size. Sandy samples are dominated by larger particles of sand that did not dissolve in acid. Ashy samples are dominated by microscopic charcoal fragments. Thirty-four of 110 (31%) sacral samples were organic-rich and 42 (38%) were decomposed organic. Twenty sacral samples were silty (18%), 11 (10%) were sandy, and three (3%) were ashy. Of 110 control samples, ten (9%) were organic-rich, 25 (23%) were decomposed organic, 42 (38%) were silty, 27 (25%) were sandy, and 6 (5%) were ashy. Therefore, for most inhumations, there was a strong contrast between the organic content between control and sacrum samples. This shows that the field sampling methods were generally successful in recovering organic remains from within the pelvic girdle.

The preservation potential of the samples analyzed so far is presented in Table 5. Seventy-five inhumations have good preservation potential and the paucity of parasites in

these inhumations represents remarkably low infection levels. The remaining 35 inhumations represent moderate to poor preservation and the paucity of eggs could easily be due to edaphic conditions that resulted in decomposition of eggs.

The latrine samples were variable. The three samples from latrine feature 650 were very sandy with few organics. The samples from latrine feature 734 were dominated by ash with sand and silt. One sample, lab 60, from latrine feature 3040 was organic-rich. The other four samples from this feature were ashy or sandy. The samples from latrine features 3042 and 10099 were ashy with some sand. The preservation of the samples from latrine feature 16500 was generally good except for lab sample 69 which was dominated by ash. The samples from latrine feature 22355 were all excellent with regard to microscopic organic content.

Parasitology

No parasite eggs were found in any latrine sediments, even those that contained abundant evidence of night-soil origin. Therefore, the evidence shows that intestinal worms were rarely, if ever, a problem for the subset of historic Tucsonians represented by the latrine samples. The presence of insects and small mammal bone in some control samples suggests that organisms entered the inhumations. These could introduced parasite eggs into the inhumations.

The numbers of eggs found in the inhumations were low and the eggs were not in perfect preservation. With such data, care must be taken not to over-interpret the finds. Sample 11, inhumation 7552-9623, contained one object that was consistent with a decorticated egg of *Ascaris lumbricoides* (Figure 2). Eggs of this species have an oval chitin shell surrounded by a protein coat. An egg is said to be decorticated when the

protein coat is lost. This egg is of the same size and morphology as *A. lumbricoides*. However, normally thousands of eggs are present in archaeological deposits. I could find only one egg even after extensive examination of many additional microscope preparations. Therefore, I am unconvinced that this single egg represents a true infection.

Two trematode fluke eggs were found in sample 19, inhumation 7935-18847. The egg morphology is suggested of a *Paragonimus* species of lung fluke, or an *Echinostoma* species of intestinal fluke or *Dicrocoelium* species of liver fluke. Eggs range are 42x27 micrometers; too small for *Echinostoma* or *Paragonimus*. However, they are well within the size range of *Dicrocoelium dentriticum*, the eggs of which range 36-45 micrometers by 22 to 30 micrometers. Sheep, cattle, goats, and pigs are the normal definitive hosts form *D. dentriticum*. Definitive hosts are animals in which the parasite carries out sexual reproduction. For, *D. dentriticum*, there are two intermediate hosts. The first is a land snail, *Cionella lubrica*. The snails eat the eggs of *D. dentriticum* which hatch in the snail. A stage of asexual reproduction occurs in the snail and then *D. dentriticum* larvae, called cercaria, are passed from the snail to the environment in slime balls. Ants eat the slime balls and the cercaria encyst in ants in a form called metacercaria. The metacercaria alter the ants's behavior such that the ants migrate to the tips of grass stems and affix themselves to the stems with their mandibles. The definitive hosts eat the ants with grass. The flukes migrate to the liver where the adults form.

Humans can become infected by eating ants. This is very rare. More often, humans who eat infected liver pass the *D. dentriticum* eggs in their feces. I believe that the *D. dentriticum* most likely represents a false infection due to the consumption of

infected liver. However, the individual in inhumation 7935-18847 could also have suffered a true infection.

Sample 175, inhumation 7853-16850, contained one trematode egg, 31μm x 24 μm in longest and shortest dimension. This egg is not consistent with flukes that infect humans. This egg of a fluke that parasitized a non-human animal could have entered this sacral sample from the colon contents of the inhumation or from inhumation fill.

Sample 186, inhumation 10138-23296, contained a distorted trichurid egg, 31μm x 22μm in longest and shortest dimension. These measurements are much too small for the whipworm that infects humans, *Trichuris trichiura*. This is a contaminant from burial fill.

Macrofossils

Macroscopic remains were very poorly preserved. The control samples were critical for determining what were the common background remains. The most common background remains were wood fragments. The focus of the analysis was on identifying any non-wood plant tissue exclusive to the sacrum samples. Excluding wood as the origin of sacrum plant tissue became relatively easy. However, identifying the non-wood sacrum plant fiber was usually impossible, other than to note fiber that was consistent in form with what typically is found in coprolites, latrines, mummy intestinal tract contents or other fecal sources in archaeological sites.

Macrofossils of dietary origin, or probable dietary origin were found in 38 sacrum samples. These were dominated by plant fibers. However, seeds and plant epidermis were noted in a few (Tables 2 and 5). The following inhumations have macrofossil evidence of dietary residue: 3277-6933, 3283-7080, 5213-8856, 709-13422, 7529-8941,

7608-14911, 7666-14557, 7683-14609, 7690-14652, 7713-14826, 7719-16736, 7786-13337, 7814-14608, 7831-14974, 7833-18562, 7835-16920, 7843-16989, 7856-10454, 7858-18560, 7862-18599, 7883-18830, 7884-17429, 7903-21756, 7917-18925, 7918-18955, 7935-18847, 7945-18923, 7955-18965, 7978-19540, 10081-10206, 10103-11970, 10321-30790, 12495-13246, and 13541-21826. The provenience information for several samples was not recorded in the specimen list sent to me. Four sacrum samples from this group have dietary residue. These samples are represented by field specimen numbers 15921, 25759, 26409 and 30652.

Seeds of dietary origin were found in some latrine samples. Latrine feature/levels 3040/2 and 16500/11 contained *Rubus* seeds and unknown seeds. The sample from 7935-18847 contained fiber.

Starch

A search for starch was completed for 12 microscopic slides for samples 1-150, and three slides for samples 151-246. As noted in Materials and Methods, the examination of 12 slides was excessively time consuming.

Starch was observed in all types of samples: latrines, control, and sacral (Tables 3 and 4). A diversity of types was found (Figure 3). Maize was the most common. However, potato and wheat were found as well as manioc (*Manihot esculenta*). When manioc was found in inhumation contexts, it was found in the control samples. Another common name for manioc is tapioca. Starch of this type has more than just dietary uses. Manioc starch was used in laundry and also glue. Therefore, I suspect that the limited finds of manioc in the inhumation samples came from starched clothing or glue.

In inhumations, eleven sacral samples were positive for maize starch and seven control samples were positive for maize starch. However, the concentrations of starch were so low in inhumations that I hesitate to interpret the evidence as dietary in origin. I believe that the most parsimonious interpretation of the maize starch is that starch from sources surrounding the cemetery entered the inhumation pits when they were originally excavated. Potato starch also appears in control samples and sacral samples. Therefore, potato starch also appears to be an ambient introduction into the inhumation sediments.

Starch in latrines spiked in those samples that were positive for macroscopic seeds and fiber. Only maize, wheat and manioc occur in the latrines. Maize is most common. The fact that some maize starch granules are altered by heat suggests that the maize starch in samples from 3040/2, 16500/7, and 16500/11 had a dietary origin.

Microfossil Fiber Residue

The majority of inhumations exhibited microscopic evidence of plant fibers or partly decomposed plant tissue in the sacral samples but not the control samples (Tables 3 and 5, Figure 4). These microscopic remains are too tiny for specific identification except for sample 89, inhumation 18098, which contained curved microscopic fibers similar, in my experience, to mesquite.

Pollen

The pollen analysis of 40 samples is on-going. Preliminary observations show that some inhumations contain a diversity of pollen (Table 6, Figure 5). Cheno-am pollen is very common and was found in 31 inhumation samples, both control and sacrum. This pollen type is clearly a background type that entered the sediments from some ambient source. Large clumps of cheno-am pollen were found in samples 19, 20, 41, 81 and 93

and may indicate dietary use of pigweed or goosefoot. Two inhumations contain a wider variety of pollen types and further work may recover pollen from even more inhumations.

Latrine samples, in general, have excellent pollen preservation. However, the preservation of pollen in the Joint Courts latrine samples was characterized by partially decomposed grains (Table 6). The counts are dominated by degraded tricolpate, degraded tricolporate, and pollen fragments classified as unidentifiable. Some types that are common to latrines throughout the US include Brassicaceae (consistent with broccoli), *Fagopyrum* (buckwheat), stephanoporate Lamiaceae (consistent with mint), *Trifolium* (clover-type pollen), Poaceae – large (possible from cultivated grains), Rosaceae – Fragaria (consistent with strawberry), and Zea mays (maize). I am continuing to count pollen from more latrine and inhumation samples.

DISCUSSION

The sample size of sediment samples submitted for archaeoparasitological analysis was large enough to identify parasite infections. Sediments from seventy-five inhumations showed sufficient preservation of organics for parasite eggs recovery. No definite infections with common human intestinal worms were found. One burial contained a possible ascarid parasite egg, one burial contained possible eggs of an infective fluke, and two burials contained eggs of parasites non-infective to humans. I conclude that the Tucson population sample represented by these inhumations was remarkable free of intestinal parasite infection.

The absence of parasites is verified by the latrine sediment analysis. No human intestinal parasite eggs were found. I have analyzed sediments from over 100 latrines from a variety of urban and rural settings. These sites have been from California, Alaska,

Rhode Island, New York, New Jersey, Delaware, Virginia, South Carolina, Tennessee, Minnesota, Iowa, and Nebraska. I have consistently found parasite eggs in latrine samples from town sites. Only farms in rural settings can be parasite free. It is surprising then that Tucson latrine samples are free of intestinal parasite eggs. One would expect that emigrants would bring their parasite infections to Tucson and leave some trace of those infections in latrines even if the parasites did not cycle in Tucson itself.

Immigrant populations transfer parasites from one locality to another. For example, 19th century latrines excavated in San Bernardino contained eggs of Chinese liver flukes that arrived with Chinese immigrants (Reinhard et al. 2008). I have found whipworm eggs transferred to Alaska with gold miners (Cooper 1998). These parasites could not complete their life cycles naturally in these places, but the arrival of infected immigrants resulted in the deposition of eggs in the local archaeological record. I would anticipate that immigrants arriving in Tucson dispersed infective eggs into Tucson, but an infection cycle was not established to perpetuate infection in the town.

Thus, there appears to have been barriers to the establishment of intestinal parasite transmission in Tucson. Foremost would have been effective sanitation systems. A simple latrine system is effective if the system is used by the population. I believe that parasite infection at 19th century Five Points, New York was due to the fact that although effective latrines were built and used by some households, not all individuals used them (Reinhard 2000). Latrine systems do not work where environmental conditions result in the flooding of latrines or mixture of latrine effluent with drinking water sources. The analysis of the Albany, New York latrine system showed that the drains from the latrines passed eggs into the environment (Fisher et al. 2007). Latrine systems also fail if

nightsoil from the latrines is used to fertilize yard gardens as was shown to be the case in Revolutionary War period Newport, Rhode Island (Reinhard et al. 1987). Failure will also result from simple systems that do not adequately separate feces from surrounding sediments. In an unpublished report, I found that the early colonies of Philadelphia, Pennsylvania used barrel latrines. These were not deep enough to prevent contamination of the environment with eggs and also spaces apparently opened between the staves and parasite eggs leaked into the surrounding soils as shown by control samples. The absence of eggs in the Tucson latrines shows that the sanitation system was adequate to separate feces from the environment.

The environment of Tucson may have not been completely favorable for the transmission of parasites. Whipworm eggs embryonate best in warm, moist, shaded soils. *Ascaris* roundworms are only partially resistant to desiccation. Therefore, Tucson's environment make have limited the infectivity of eggs that may have escaped the latrine sanitation system. Thus, sanitation and environment are the two aspects of Tucson in the late 19th century that limited infection.

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Table 1: Provenience Information and laboratory goals per sample. Inhumations include lab numbers 1-48 and 75 onward. For inhumations, odd numbers are pelvic samples, even numbers are controls. Abbreviations: Fea.= feature number; mls.= number of milliliters sampled; Macro = macroscopic search accomplished; Starch = starch analysis completed; (12 slides were scanned for starch for numbers 1-150 and 3 slides for 151-246). Parasite = parasite analysis completed; Pollen = palynological analysis completed. The notation "not found" refers to bag numbers that were not listed in the packing list. For lab number 97, the bag number is inconsistent with the provenience number in the packing list.

Lab #	Field #	Fea.	mls.	Macro	Starch	Parasite	Pollen
1	11721	7617-11613	30	X	X	X	
2	11722	7617-11613	30	X	X	X	
3	18601	7862-18599	30	X	X	X	X
4	18602	7862-18599	30	X	X	X	X
5	12859	7797-13206	30	X	X	X	
6	12860	7797-13206	30	X	X	X	
7	12613	7609-11802	30	X	X	X	
8	12614	7609-11802	30	X	X	X	
9	16411	7945-18923	30	X	X	X	X
10	16410	7945-18923	30	X	X	X	X
11	11241	7552-9623	30	X	X	X	
12	11242	7552-9623	30	X	X	X	

13	18469	7944-19513	30	X	X	X	
14	18470	7944-19513	30	X	X	X	
15	19637	7978-19540	30	X	X	X	X
16	19638	7978-19540	30	X	X	X	X
17	19346	7918-18955	30	X	X	X	
18	19345	7918-18955	30	X	X	X	
19	19143	7935-18847	30	X	X	X	X
20	19141	7935-18847	30	X	X	X	X
21	14941	7690-14652	30	X	X	X	
22	14942	7690-14652	30	X	X	X	
23	16049	7831-14974	30	X	X	X	
24	16048	7831-14974	30	X	X	X	
25	18899	7936-18857	30	X	X	X	
26	18900	7936-18857	30	X	X	X	
27	15564	7683-14609	15	X	X	X	
28	15565	7683-14609	20	X	X	X	
29	16771	7719-16736	30	X	X	X	
30	16772	7719-16736	30	X	X	X	
31	15921	not found	30	X	X	X	X
32	15922	not found	30	X	X	X	X
33	15465	7803-16869	30	X	X	X	
34	15466	7803-16869	30	X	X	X	
35	12526	7584-11612	30	X	X	X	

36	12527	7584-11612	30	X	X	X	
37	17052	7839-16821	30	X	X	X	X
38	17051	7839-16821	30	X	X	X	X
39	18704	not found	30	X	X	X	
40	18705	not found	30	X	X	X	
41	8371	5196-8659	30	X	X	X	
42	8372	5196-8659	30	X	X	X	
43	9421	7529-8941	30	X	X	X	X
44	9422	7529-8941	30	X	X	X	X
45	15750	7678-14960	30	X	X	X	X
46	16084	7678-14960	30	X	X	X	X
47	30035	10312-30013	30	X	X	X	X
48	30036	10312-30013	30	X	X	X	X
49	10628	650, L1	30	X	X	X	X
50	10640	650, L2	30	X	X	X	X
51	10641	650, L3	30	X	X	X	X
52	4666	734	30	X	X	X	
53	4667	734	30	X	X	X	
54	4668	734	30	X	X	X	
55	4669	734	30	X	X	X	
56	4671	734	30	X	X	X	
57	10706	3040	30	X	X	X	
58	10716	3040, L6	30	X	X	X	

59	10718	3040, L7	30	X	X	X	
60	27081	3040, L2	30	X	X	X	
61	27082	3040, L3	30	X	X	X	
62	27097	3042, L2	30	X	X	X	
63	27098	3042, L3	30	X	X	X	
64	27099	3042, L4	30	X	X	X	
65	27033	10099, L6	30	X	X	X	
66	27183	16500, L7	30	X	X	X	X
67	27184	16500, L8	30	X	X	X	X
68	27185	16500, L9	30	X	X	X	X
69	27186	16500, L10	30	X	X	X	X
70	27187	16500, L11	30	X	X	X	X
71	10982	22355, L3	30	X	X	X	X
72	10983	22355, L4	30	X	X	X	X
73	10984	22355, L5	30	X	X	X	X
74	10891	22355, L2	30	X	X	X	X
75	11550	7557-9729	30	X	X	X	
76	11551	7557-9729	30	X	X	X	
77	12914	7787-13390	12	X	X	X	
78	12915	7787-13390	30	X	X	X	
79	13341	not found	30	X	X	X	
80	13342	not found	30	X	X	X	
81	13895	7798-14681	30	X	X	X	

82	13896	7798-14681	30	X	X	X	
83	17101	7685-16835	30	X	X	X	
84	17102	7685-16835	30	X	X	X	
85	17341	7858-18560	30	X	X	X	
86	17342	7858-18560	30	X	X	X	
87	18248	689-17416	30	X	X	X	
88	17473	689-17416	30	X	X	X	
89	18098	7843-16989	30	X	X	X	
90	18099	7843-16989	20	X	X	X	
91	18877	7883-18830	30	X	X	X	
92	18876	7883-18830	30	X	X	X	
93	19033	7928-18679	7	X	X	X	
94	19034	7928-18679	17	X	X	X	
95	19461	7955-18965	18	X	X	X	
96	19460	7955-18965	15	X	X	X	
97	24624?	13541-21826?	15	X	X	X	
98	24625	13541-21826	30	X	X	X	
99	30099	not found	30	X	X	X	
100	30098	not found	30	X	X	X	
101	5676	951-7017	30	X	X	X	
102	5675	951-7017	30	X	X	X	
103	6354	7568-9519	30	X	X	X	
104	6355	7568-9519	30	X	X	X	

105	6926	3358-6872	30	X	X	X	
106	6927	3358-6872	30	X	X	X	
107	7169	3277-6933	30	X	X	X	
108	7170	3277-6933	30	X	X	X	
109	7238	3311-6882	30	X	X	X	
110	7239	3311-6882	30	X	X	X	
111	7295	5167-7112	30	X	X	X	
112	7296	5167-7112	30	X	X	X	
113	8446	5214-8753	30	X	X	X	
114	8447	5214-8753	30	X	X	X	
115	8524	3246-6899	30	X	X	X	
116	8525	3246-6899	30	X	X	X	
117	8632	3280-7383	30	X	X	X	
118	8633	3280-7383	30	X	X	X	
119	8761	699-8696	30	X	X	X	
120	8762	699-8696	30	X	X	X	
121	8882	690-8877	30	X	X	X	
122	8883	690-8877	30	X	X	X	
123	9141	7524-5500	20	X	X	X	
124	9142	7524-5500	30	X	X	X	
125	9381	7504-9548	30	X	X	X	
126	9382	7504-9548	30	X	X	X	
127	9468	7587-9602	30	X	X	X	

128	9469	7587-9602	30	X	X	X	
129	9779	7526-8962	30	X	X	X	
130	9780	7526-8962	30	X	X	X	
131	10374	7709-16750	30	X	X	X	
132	10375	7709-16750	30	X	X	X	
133	11494	7600-11511	30	X	X	X	
134	11495	7600-11511	30	X	X	X	
135	12328	7610-11752	12	X	X	X	
136	12329	7610-11752	15	X	X	X	
137	14370	727-14540	30	X	X	X	
138	14371	727-14540	30	X	X	X	
139	14385	7666-14557	7	X	X	X	
140	14386	7666-14557	20	X	X	X	
141	14499	7786-13337	30	X	X	X	
142	14500	7786-13337	30	X	X	X	
143	14658	7814-14608	30	X	X	X	
144	14659	7814-14608	30	X	X	X	
145	14969	7608-14911	30	X	X	X	
146	14970	7608-14911	30	X	X	X	
147	16465	7917-18925	30	X	X	X	
148	16464	7917-18925	30	X	X	X	
149	30652	not found	30	X	X	X	
150	30653	not found	30	X	X	X	

151	7240	3283-7080	30	X	X	X	
152	7241	3283-7080	30	X	X	X	
153	8041	3274-7121	30	X	X	X	
154	8042	3274-7121	30	X	X	X	
155	8652	672-7458	30	X	X	X	
156	8653	672-7458	30	X	X	X	
157	8718	5195-8702	17	X	X	X	
158	8719	5195-8702	30	X	X	X	
159	8945	5213-8856	30	X	X	X	
160	8946	5213-8856	30	X	X	X	
161	8968	665-8604	30	X	X	X	
162	8969	665-8604	30	X	X	X	
163	9048	700-8903	30	X	X	X	
164	9049	700-8903	30	X	X	X	
165	11106	7531-8921	30	X	X	X	
166	11107	7531-8921	30	X	X	X	
167	13002	10103-11970	30	X	X	X	
168	13003	10103-11970	30	X	X	X	
169	14373	10081-10206	30	X	X	X	
170	14374	10081-10206	30	X	X	X	
171	14495	7775-14613	10	X	X	X	
172	14496	7775-14613	25	X	X	X	
173	15195	7713-14826	30	X	X	X	

174	15197	7713-14826	30	X	X	X	
175	17118	7853-16850	30	X	X	X	
176	17117	7853-16850	30	X	X	X	
177	17252	7835-16920	20	X	X	X	
178	17253	7835-16920	30	X	X	X	
179	17256	10435-16987	30	X	X	X	
180	17255	10435-16987	30	X	X	X	
181	19072	7927-18721	4	X	X	X	
182	19073	7927-18721	30	X	X	X	
183	23145	7903-21756	30	X	X	X	
184	23144	7903-21756	30	X	X	X	
185	23596	10138-23296	30	X	X	X	
186	23597	10138-23296	30	X	X	X	
187	23914	13517-25045	30	X	X	X	
188	23915	13517-25045	30	X	X	X	
189	24297	13541-21826	13	X	X	X	
190	24296	13541-21826	30	X	X	X	
191	25432	7998-25349	30	X	X	X	
192	25433	7998-25349	30	X	X	X	
193	25712	13566-25073	30	X	X	X	
194	25713	13566-25073	30	X	X	X	
195	25591	7997-21939	30	X	X	X	
196	25590	7997-21939	30	X	X	X	

197	26543	8000-21971	30	X	X	X	
198	26544	8000-21971	30	X	X	X	
199	28631	10306-28629	30	X	X	X	
200	28632	10306-28629	30	X	X	X	
201	11292	7554-9664	30	X	X	X	
202	11293	7554-9664	30	X	X	X	
203	12176	7753-11815	5	X	X	X	
204	12177	7753-11815	30	X	X	X	
205	12879	12495-13246	30	X	X	X	
206	12880	12495-13246	30	X	X	X	
207	14189	709-13422	25	X	X	X	
208	14190	709-13422	30	X	X	X	
209	17181	7856-10454	10	X	X	X	
210	17182	7856-10454	30	X	X	X	
211	18133	7833-18562	30	X	X	X	
212	18132	7833-18562	30	X	X	X	
213	19022	7884-17429	30	X	X	X	
214	19023	7884-17429	30	X	X	X	
215	19293	7954-18889	17	X	X	X	
216	19294	7954-18889	22	X	X	X	
217	20135	7899-19574	30	X	X	X	
218	20136	7899-19574	30	X	X	X	
219	20713	7979-19564	3	X	X	X	

220	20714	7979-19564	30	X	X	X	
221	24247	13512-21830	15	X	X	X	
222	24248	13512-21830	30	X	X	X	
223	24547	13521-21835	30	X	X	X	
224	24548	13521-21835	30	X	X	X	
225	24872	13576-25118	30	X	X	X	
226	24873	13576-25118	28	X	X	X	
227	25615	10150-22814	9	X	X	X	
228	25614	10150-22814	30	X	X	X	
229	25759	not found	30	X	X	X	
230	25758	not found	30	X	X	X	
231	25871	not found	30	X	X	X	
232	25872	not found	30	X	X	X	
233	25973	not found	30	X	X	X	
234	25974	not found	30	X	X	X	
235	26189	not found	30	X	X	X	
236	26190	not found	30	X	X	X	
237	26229	not found	30	X	X	X	
238	26300	not found	30	X	X	X	
239	26409	not found	30	X	X	X	
240	26408	not found	30	X	X	X	
241	26841	13594-26825	30	X	X	X	
242	26867	13594-26825	30	X	X	X	

243	30528	not found	30	X	X	X	
244	30529	not found	30	X	X	X	
245	30879	10321-30790	30	X	X	X	
246	30880	10321-30790	30	X	X	X	

Table 2: Macroscopic observations

Lab #	Field #	Observations
1	11721	no organic remains
2	11722	wood fragments and charcoal
3	18601	17 small seeds, probably mustard family
4	18602	2 insect mandibles
5	12859	no organic remains
6	12860	no organic remains
7	12613	no organic remains
8	12614	no organic remains
9	16411	35 ceroid cactus seeds
10	16410	no organic remains
11	11241	no organic remains
12	11242	no organic remains
13	18469	wood fragments
14	18470	wood fragments
15	19637	corn and black seed coat fragments
16	19638	1 fragment of charcoal
17	19346	1 pupa case, 1 monocot stem fragment
18	19345	ant head, wood fragments
19	19143	one badly decomposed plant tissue fragment
20	19141	no organic remains

21	14941	4 fragments of spongy plant fiber, similar to prickly pear
22	14942	no organic remains
23	16049	5 fiber fragments from stem or leaf
24	16048	wood fragments
25	18899	root fragments and 1 woven cloth fragment
26	18900	wood, charcoal, small mammal bone fragment
27	15564	decomposed insect egg or seed fragment, wood fragments
28	15565	wood fragments, charcoal, fly pupa case
29	16771	charcoal
30	16772	wood fragment
31	15921	fiber, decomposed insect egg or seed fragment
32	15922	rootlets
33	15465	wood fragments
34	15466	no organic remains
35	12526	no organic remains
36	12527	wood fragments
37	17052	wood fragments, rootlets
38	17051	rootlet and fungal spore capsules
39	18704	no organic remains
40	18705	ant fragment and ash
41	8371	no organic remains
42	8372	no organic remains
43	9421	monocot stem fragments and wood fragments

44	9422	wood fragments
45	15750	wood fragments
46	16084	monocot stem fragment
47	30035	ash
48	30036	ash, wood fragments
49	10628	charcoal
50	10640	charcoal
51	10641	no organic remains
52	4666	no organic remains
53	4667	charcoal
54	4668	charcoal
55	4669	charcoal
56	4671	white paste-like substance
57	10706	white paste-like substance
58	10716	charcoal
59	10718	white paste-like substance
60	27081	charcoal, 16 *Rubus* seeds, 13 unknown seeds
61	27082	white paste-like substance
62	27097	white paste-like substance
63	27098	charcoal, plant fiber, wood fragments
64	27099	charcoal, 1 grape seed
65	27033	charcoal
66	27183	charcoal, 4 *Rubus* seeds, 26 unknown seeds

67	27184	charcoal
68	27185	no organic remains
69	27186	charcoal, plant fiber, wood fragments
70	27187	
71	10982	no organic remains
72	10983	no organic remains
73	10984	no organic remains
74	10891	no organic remains
75	11550	no organic remains
76	11551	no organic remains
77	12914	wood fragments
78	12915	wood fragments
79	13341	wood fragments
80	13342	no organic remains
81	13895	charcoal
82	13896	no organic remains
83	17101	wood fragments
84	17102	wood fragments, plant fiber, decomposed plant epidermis, possible hair
85	17341	18 plant fibers
86	17342	322 insect eggs or pupa cases
87	18248	no organic remains
88	17473	no organic remains
89	18098	mass of plant fibers similar to those in fruit pulp

90	18099	no organic remains
91	18877	prickly pear epidermis?
92	18876	insect egg
93	19033	no organic remains
94	19034	no organic remains
95	19461	tiny fragments of unidentifiable plant tissue
96	19460	insect mandible
97	24624	seed testa, poorly preserved seed fragments
98	24625	insect egg
99	30099	no organic remains
100	30098	wood fragments
101	5676	wood fragments and charcoal
102	5675	wood fragments
103	6354	rootlets
104	6355	rootlets
105	6926	no organic remains
106	6927	no organic remains
107	7169	charcoal and dietary fiber
108	7170	wood fragments and charcoal
109	7238	charcoal
110	7239	charcoal
111	7295	wood fragments
112	7296	rootlets and wood fragments

113	8446	no organic remains
114	8447	no organic remains
115	8524	wood fragments
116	8525	wood fragments
117	8632	charcoal
118	8633	charcoal
119	8761	no organic remains
120	8762	tiny plant fibers
121	8882	charcoal
122	8883	charcoal
123	9141	no organic remains
124	9142	rootlets
125	9381	wood fragments
126	9382	wood fragments
127	9468	rootlets
128	9469	charcoal
129	9779	no organic remains
130	9780	no organic remains
131	10374	charcoal
132	10375	charcoal
133	11494	no organic remains
134	11495	no organic remains
135	12328	no organic remains

136	12329	no organic remains
137	14370	no organic remains
138	14371	no organic remains
139	14385	charcoal and dietary plant fiber
140	14386	charcoal
141	14499	charcoal, seeds, dietary fiber
142	14500	no organic remains
143	14658	charcoal
144	14659	charcoal
145	14969	seed and seed fragment
146	14970	wood fragments and seeds
147	16465	wood fragments
148	16464	wood fragments
149	30652	wood fragments
150	30653	charcoal
151	7240	wood fragments, fiber, course/curly hair strands, charred plant remains
152	7241	no organic remains
153	8041	wood fragments and course/curly hair strand
154	8042	light brown hair strand
155	8652	charcoal and wood fragments
156	8653	no organic remains
157	8718	no organic remains
158	8719	no organic remains

159	8945	dietary fibers
160	8946	no organic remains
161	8968	wood fragments
162	8969	no organic remains
163	9048	no organic remains
164	9049	no organic remains
165	11106	no organic remains
166	11107	no organic remains
167	13002	wood fragments and dietary fiber
168	13003	wood fragments
169	14373	dietary fiber
170	14374	no organic remains
171	14495	wood fragment
172	14496	wood fragments
173	15195	dietary fiber and grass epidermis
174	15197	wood fragments, insect fragments, rootlets, fiber from small plants
175	17118	wood fragments
176	17117	no organic remains
177	17252	wood fragments and dietary fiber
178	17253	wood fragments
179	17256	no organic remains
180	17255	wood fragments, insect fragments, grass stem epidermis
181	19072	no organic remains

182	19073	no organic remains
183	23145	wood fragments and herbaceous plant fiber
184	23144	wood fragments
185	23596	wood fragments
186	23597	no organic remains
187	23914	insect mandible
188	23915	no organic remains
189	24297	no organic remains
190	24296	no organic remains
191	25432	no organic remains
192	25433	no organic remains
193	25712	no organic remains
194	25713	no organic remains
195	25591	no organic remains
196	25590	no organic remains
197	26543	mass of charcoal
198	26544	small amount of charcoal
199	28631	wood fragments
200	28632	wood fragments
201	11292	no organic remains
202	11293	charcoal and wood fragments
203	12176	no organic remains
204	12177	charcoal and wood fragments

205	12879	woody stem fragments and grass stem
206	12880	wood fragments
207	14189	wood fragments
208	14190	wood fragments
209	17181	wood fragments and dietary (?) fiber
210	17182	grass stem
211	18133	long stem and plant epidermis
212	18132	long stem
213	19022	granular organic material
214	19023	no organic remains
215	19293	wood fragments
216	19294	decomposed wood
217	20135	wood fragments
218	20136	no organic remains
219	20713	no organic remains
220	20714	no organic remains
221	24247	plant epidermis, tiny cloth fragments
222	24248	no organic remains
223	24547	no organic remains
224	24548	plant fiber
225	24872	no organic remains
226	24873	no organic remains
227	25615	no organic remains

228	25614	plant fiber
229	25759	wood fragments and caryopsis glumes
230	25758	wood fragments
231	25871	no organic remains
232	25872	no organic remains
233	25973	decomposed woody tissue
234	25974	wood fragments
235	26189	no organic remains
236	26190	no organic remains
237	26229	no organic remains
238	26300	wood fragments
239	26409	decomposed plant tissue
240	26408	no organic remains
241	26841	wood fragments
242	26867	wood fragments
243	30528	no organic remains
244	30529	no organic remains
245	30879	decomposed plant fiber
246	30880	no organic remains

Table 3: Microscopic observations. The first notation under sediment type indicates the dominant component and classification category. For example "decomposed organic, sand" means that decomposed organic remains dominated the sample and sand was a minor component. The sample would be classified as "decomposed organic" in the Results section of the report.

Lab #	Field #	Sediment type	Starch, pollen, and other relevant observations
1	11721	decomposed organic	Pollen – cheno-am
2	11722	sand, silt	Pollen – cheno-am
3	18601	organic rich	none
4	18602	sand, silt	none
5	12859	decomposed organic	Starch – maize
6	12860	silt	Starch – unknown
7	12613	organic rich	Starch – maize: Pollen – cheno-am, ragweed-type, pine
8	12614	silt	Pollen – cheno-am
9	16411	organic rich	plant epidermal fragments
10	16410	sand	Starch – maize
11	11241	decomposed organic	Possible parasite egg – *Ascaris*: Starch – unknown
12	11242	sand, silt	Starch – maize: Pollen – pine
13	18469	organic rich	none
14	18470	sand	none

15	19637	silt	Starch – maize
16	19638	sand, silt	Pollen – cheno-am, pine
17	19346	sand, silt	none
18	19345	sand, silt	none
19	19143	organic rich	Parasite egg - Unknown operculate egg 42x27 micrometers: Pollen – cheno-am
20	19141	silt	Pollen – cheno-am, pine
21	14941	ash	Pollen – cheno-am, pine
22	14942	ash	Pollen – cheno-am
23	16049	decomposed organic	Starch – unknown: Pollen – pine
24	16048	silt	none
25	18899	sand	Pollen - cheno-am
26	18900	sand	Starch – manioc, unknown: Pollen – cheno-am
27	15564	decomposed organic	Starch – maize, unknown
28	15565	sand, silt	none
29	16771	sand, silt	none
30	16772	sand, silt	none
31	15921	decomposed organic	none
32	15922	sand	starch – maize
33	15465	decomposed organic, silt	none
34	15466	sand	Pollen - cheno-am, pine
35	12526	decomposed organic, silt	none
36	12527	silt	Starch – maize, potato, manioc

37	17052	decomposed organic	Starch – maize: Pollen - cheno-am
38	17051	decomposed organic, sand	Starch – unknown: Pollen – cheno-am, Fabaceae clump
39	18704	decomposed organic	Starch – potato, large aggregate
40	18705	sand, silt	none
41	8371	organic rich	Starch - maize, unknown: Pollen - cheno-am, low spine Asteraceae
42	8372	organic rich	Starch - manioc, potato, maize, unknown: Pollen - cheno-am, ragweed-type
43	9421	organic rich	Starch – unknown: Pollen – cheno-am, prickly pear, pine
44	9422	decomposed organic	Pollen – cheno-am
45	15750	organic rich	none
46	16084	sand	Starch – maize
47	30035	organic rich	Starch - maize, unknown: Pollen - cheno-am, low spine Asteraceae
48	30036	decomposed organic, sand	Pollen – cheno-am
49	10628	decomposed organic, sand	Starch – maize
50	10640	sand	Starch – maize
51	10641	sand	none
52	4666	sand	none
53	4667	silt, ash	Pollen – cheno-am
54	4668	ash	none

55	4669	ash	Starch – maize
56	4671	sand, silt	none
57	10706	ash	Starch – maize
58	10716	ash	Starch – maize: Pollen – pine
59	10718	sand	none
60	27081	organic rich	Starch – maize
61	27082	silt	none
62	27097	ash	none
63	27098	sand, ash	Pollen – cheno-am
64	27099	sand, ash	none
65	27033	ash	none
66	27183	organic rich	Starch – maize
67	27184	decomposed organic	Starch – maize
68	27185	decomposed organic	Starch – maize: Pollen – cheno-am
69	27186	decomposed organic, ash	none
70	27187	organic rich	Agave epidermis: Starch – maize, wheat, unknown
71	10982	organic rich	Starch – maize: Pollen – prickly pear
72	10983	organic rich	Starch – aggregate of unknown type: Pollen – pine
73	10984	organic rich	Agave epidermis
74	10891	organic rich	Agave epidermis: Pollen – cheno-am
75	11550	decomposed organic	none

76	11551	sand	none
77	12914	organic rich	Starch – unknown type
78	12915	silt	Starch – unknown type: Pollen – pine
79	13341	organic rich	Starch – maize: Pollen – cheno-am, pine
80	13342	silt	none
81	13895	organic rich	Starch – maize, unknown: Pollen – cheno-am, pine, prickly pear, unknown, ragweed-type, thistle-type, sunflower-type, low spine Asteraceae
82	13896	silt	none
83	17101	decomposed organic, silt	Pollen – cheno-am, pine
84	17102	silt, ash	none
85	17341	sand, silt	Pollen – cheno-am: glochidia
86	17342	silt	none
87	18248	ash	none
88	17473	silt, ash	none
89	18098	organic rich	Mesquite pod fibers: Starch – unknown type: Pollen – cheno-am
90	18099	silt	none
91	18877	decomposed organic	Pollen – cheno-am
92	18876	organic rich	Starch – unknown type: Pollen – cheno-am
93	19033	decomposed organic, silt	Pollen – cheno-am
94	19034	silt	none

95	19461	silt	Starch – maize: Pollen – cheno-am: glochidia
96	19460	silt	Starch – maize
97	24624	decomposed organic, silt	Starch – maize: Pollen – cheno-am
98	24625	ash	Starch – unknown type: Pollen – pine
99	30099	organic rich	Pollen – cheno-am
100	30098	organic rich	none
101	5676	organic rich	starch – maize, wheat, unknown
102	5675	decomposed organic	none
103	6354	silt, ash	fungal spores abundant
104	6355	silt, ash	Pollen – cheno-am: fungal spores abundant
105	6926	decomposed organic, silt	Starch – altered maize, maize, wheat, unknown: Pollen – cheno-am, low spine, pine
106	6927	silt, ash	none
107	7169	decomposed organic, silt	Starch – unknown: Pollen – cheno-am, prickly pear
108	7170	decomposed organic	none
109	7238	sand	none
110	7239	decomposed organic, sand	none
111	7295	decomposed organic, sand	none
112	7296	silt	fungal spores abundant
113	8446	silt	none
114	8447	silt	none
115	8524	sand, ash	none

116	8525	silt	none
117	8632	decomposed organic	none
118	8633	silt	none
119	8761	organic rich	none
120	8762	sand	Starch – unknown
121	8882	silt	none
122	8883	silt	Starch – unknown
123	9141	sand	none
124	9142	sand	none
125	9381	organic rich	Pollen – degraded agave
126	9382	decomposed organic	none
127	9468	sand	none
128	9469	sand	none
129	9779	sand	none
130	9780	silt	fungal spores abundant
131	10374	decomposed organic, sand	none
132	10375	sand	none
133	11494	silt	none
134	11495	sand, ash	none
135	12328	decomposed organic	fungal spores abundant
136	12329	decomposed organic	Pollen – cheno-am: fungal spores abundant
137	14370	decomposed organic, sand	none
138	14371	silt	fungal spores abundant

139	14385	decomposed organic	Pollen – cheno-am, low spine
140	14386	decomposed organic	Pollen – cheno-am
141	14499	decomposed organic, silt	none
142	14500	silt	none
143	14658	organic rich	Pollen – mustard family, grass family
144	14659	decomposed organic	none
145	14969	silt	Starch – unknown
146	14970	decomposed organic, sand	Starch – unknown
147	16465	silt	none
148	16464	organic rich	Starch – unknown: Pollen – cheno-am
149	30652	decomposed organic, silt	Starch – maize
150	30653	silt	none
151	7240	organic rich, silt	none
152	7241	ash, sand	none
153	8041	organic rich, silt	Pollen – cheno-am
154	8042	organic rich, silt	none
155	8652	decomposed organic	Pollen – pine
156	8653	silt, sand	none
157	8718	decomposed organic	Starch – Unknown altered: fungal spores abundant
158	8719	sand	fungal spores abundant
159	8945	silt	fungal spores abundant
160	8946	decomposed organic, sand	none

161	8968	silt, sand	none
162	8969	sand	none
163	9048	silt	Starch – maize
164	9049	decomposed organic, silt	none
165	11106	organic rich, sand	Pollen – cheno-am, ironwood
166	11107	silt	none
167	13002	organic rich	Pollen – cheno-am, pine
168	13003	silt, sand	none
169	14373	silt	none
170	14374	organic rich, sand	none
171	14495	organic rich	Pollen – cheno-am
172	14496	organic rich	Starch – unknown: Pollen – cheno-am
173	15195	decomposed organic	mites
174	15197	silt	none
16	17118	organic rich	Parasite - trematode egg, 31μm x 24 μm: mites,
176	17117	ash	Pollen – cheno-am, pine
177	17252	organic rich	Pollen – cheno-am
178	17253	decomposed organic	Pollen – cheno-am
179	17256	silt	none
180	17255	decomposed organic	mites
181	19072	decomposed organic	fungal spores abundant
182	19073	sand, ash	none
183	23145	silt	none

184	23144	decomposed organic	Pollen – cheno-am
185	23596	organic rich	Pollen – cheno-am, prickly pear
186	23597	decomposed organic, ash	Parasite – trichurid egg 22μm x 31μm: Pollen – cheno-am,
187	23914	decomposed organic, sand	Pollen – cheno-am
188	23915	silt, ash	none
189	24297	decomposed organic	none
190	24296	silt, ash	none
191	25432	ash	none
192	25433	decomposed organic	fungal spores abundant
193	25712	decomposed organic	fungal spores abundant
194	25713	ash	fungal spores abundant
195	25591	silt, sand	Pollen – pine, cheno-am
196	25590	sand, ash	none
197	26543	sand, ash	Starch – maize
198	26544	decomposed organic, ash	none
199	28631	silt	none
200	28632	organic rich	none
201	11292	decomposed organic	glochidia,
202	11293	decomposed organic	
203	12176	organic rich	Pollen – pine, prickly pear
204	12177	silt	Pollen – pine
205	12879	organic rich	Pollen – cheno-am and cheno-am aggregates

206	12880	silt	
207	14189	decomposed organic	
208	14190	silt	Pollen – cheno-am
209	17181	organic rich	fungal spores abundant
210	17182	silt	Starch – unknown
211	18133	decomposed organic	Pollen – pine, cheno-am
212	18132	decomposed organic	Pollen – pine, cheno-am
213	19022	decomposed organic	
214	19023	sand, ash	
215	19293	organic rich	Pollen – pine: very fine plant fibers
216	19294	organic rich	Pollen – cheno-am
217	20135	organic rich	non-wood fibers
218	20136	ash	
219	20713	organic rich	Pollen – pine
220	20714	silt, sand, ash	
221	24247	silt	
222	24248	sand, ash	Pollen – pine, cheno-am: fungal spores abundant
223	24547	decomposed organic	Pollen – cheno-am: mites
224	24548	decomposed organic	
225	24872	sand	fungal spores abundant
226	24873	silt	fungal spores abundant
227	25615	decomposed organic	Starch – maize
228	25614	silt, sand	

229	25759	silt	
230	25758	sand	
231	25871	silt	Starch – maize
232	25872	silt	
233	25973	decomposed organic, sand	
234	25974	decomposed organic, silt	Pollen – pine
235	26189	decomposed organic	Pollen – grass
236	26190	silt	
237	26229	silt	
238	26300	silt	
239	26409	decomposed organic	
240	26408	silt, sand	
241	26841	decomposed organic	dietary fibers
242	26867	organic rich	wood fragments abundant
243	30528	organic rich	fungal spores abundant
244	30529	decomposed organic, ash	Pollen – pine, cheno-am
245	30879	organic rich	Pollen – cheno-am
246	30880	decomposed organic, silt	Pollen – cheno-am

Table 4: Starch concentration values in terms of starch granules per milliliter of sediment.

Lab #	Field #	Maize	Wheat	Manioc	Potato	Unknown
5	12859	50				
6	12860					50
7	12613	50				
10	16410	100				
11	11241					trace
12	11242	50				
15	19637	50				
23	16049					1,200
26	18900			300		100
27	15564	66				120
32	15922	150				
36	12527	50		100	50	50
37	17052	100				
38	17051					100
39	18704				50	1,750
41	8371	200				150
42	8372	250		20,900	400	200
43	9421					150
46	16084	100				
47	30035	150			50	50

49	10628	50				
50	10640	50				
55	4669	50				
57	10706	100				
58	10716	100				
60	27081	100				
66	27183	625				
67	27184	180				
68	27185	trace				
70	27187	200	40	180		140
71	10982	50				
72	10983					200
77	12914					trace
78	12915					700
79	13341	trace				
81	13895	trace				trace
89	18098					trace
92	18876					trace
95	19461	1,000				
96	19460	500				
97	24624	1,000				
98	24625					trace

Table 5: Inhumation list rating potential of recovering useful parasitological information from sacral samples. Samples rated "good" are those for which intestinal residue was identifiable in the sacral samples. Parasite eggs, if present at the time of inhumation, would have been recovered in excavation and analysis. Samples rated "moderate" are those for which intestinal residue was identified but the residue was in a decomposed state. Parasite eggs, if present at the time of inhumation, could have decomposed before excavation. Samples rated "poor" did not provide evidence of intestinal residue.

Lab #	Inhumation Number	Analysis Potential	Comment
1-2	7617-11613	poor	Minimal preservation of organic remains in both sacrum and controls samples and only background pollen and wood is evident.
3-4	7862-18599	good	Dietary seeds found in sacrum. Abundant microscopic plant fibers in sacrum. Strong contrast between sacrum and control.
5-6	7797-13206	poor	Sacrum and control samples are generally similar although the microscopic preservation of wood is evident in the sacrum. Starch shared by both.
7-8	7609-11802	good	Abundant microscopic plant fibers in sacrum. Strong contrast between sacrum and control.
9-10	7945-18923	good	Dietary seeds found in sacrum. Abundant

			microscopic plant fibers and plant epidermal fragments in sacrum. Strong contrast between sacrum and control.
11-12	7552-9623	moderate	Possible parasite egg discovered in sacrum. Abundant decomposed microscopic fibers in sacrum. Contrast between sacrum and control.
13-14	7944-19513	good	Abundant microscopic plant fibers in sacrum. Strong contrast between sacrum and control.
15-16	7978-19540	good	Dietary seeds found in sacrum. Microscopic preparations are silty.
17-18	7918-18955	poor	Sacrum and control samples are similar and show no evidence of dietary residue.
19-20	7935-18847	good	Abundant microscopic plant fibers in sacrum. Unusual parasite eggs found in sacrum. Strong contrast between sacrum and control.
21-22	7690-14652	moderate	Probable macroscopic dietary fiber found in sacrum. Both samples contain inert ash which limits information potential
23-24	7831-14974	good	Possible dietary fiber/leaf found in sacrum. Abundant decomposed microscopic fibers in

			sacrum. Strong contrast between sacrum and control.
25-26	7936-18857	poor	Sacrum and control samples are similar and have limited organics.
27-28	7683-14609	moderate	Abundant decomposed microscopic fibers in sacrum. Contrast between sacrum and control.
29-30	7719-16736	poor	Sacrum and control samples are similar and have limited organics.
31-32	not found	moderate	Abundant decomposed microscopic fibers in sacrum. Contrast between sacrum and control.
33-34	7803-16869	poor	Sacrum and control samples are similar and have limited organics.
35-36	7584-11612	poor	Sacrum and control samples are similar and have limited organics. Control sample has elevation of starch content.
37-38	7839-16821	good	Abundant decomposed microscopic fibers in sacrum. Contrast between sacrum and control.
39-40	not found	moderate	Abundant decomposed microscopic fibers in sacrum. Contrast between sacrum and control.

41-42	5196-8659	good	Abundant microscopic plant fibers in sacrum and control sample with starch and pollen.
43-44	7529-8941	good	Probable dietary fiber found in sacrum. Abundant microscopic plant fibers in sacrum with diversity of pollen. Strong contrast between sacrum and control.
45-46	7678-14960	good	Abundant microscopic plant fibers in sacrum. Strong contrast between sacrum and control.
47-48	10312-30013	good	Abundant microscopic plant fibers in sacrum with some pollen. Strong contrast between sacrum and control.
75-76	7557-9729	moderate	Abundant decomposed microscopic fibers in sacrum. Good microscopic organic contrast between sacrum and control.
77-78	7787-13390	good	Abundant microscopic plant fibers in sacrum. Strong contrast between sacrum and control.
79-80	not found	good	Abundant microscopic plant fibers in sacrum with some pollen. Strong contrast between sacrum and control.
81-82	7798-14681	good	Abundant microscopic plant fibers in sacrum with a diversity of pollen. Strong contrast

			between sacrum and control.
83-84	7685-16835	moderate	Many decomposed microscopic fibers in sacrum. Contrast between sacrum and control.
85-86	7858-18560	poor	Sacrum and control samples are similar and have limited organics.
87-88	689-17416	poor	Sacrum and control samples are similar and have no organics.
89-90	7843-16989	good	Probable dietary fiber found in sacrum. Abundant microscopic mesquite-type fibers in sacrum sample. Strong contrast between sacrum and control.
91-92	7883-18830	poor	Control sample has better preservation than sacrum sample. Sacrum sample is dominated by inert silt. Fungal spores and fungal fibers are common in both samples.
93-94	7928-18679	poor	Sacrum and control samples are similar and have limited organics.
95-96	7955-18965	poor	Sacrum and control samples are similar and have limited organics.
97-98	13541-21826	good	Probable dietary seed found in sacrum. Cooked maize starch and pollen found in sacrum. Abundant microscopic plant fibers

			in sacrum. Strong contrast between sacrum and control.
99-100	not found	good	Both control and sacrum samples are rich in microscopic plant fibers.
101-102	951-7017	good	Maize, wheat and unknown starch found in sacrum. Macroscopically, sacrum and control samples are similar. There is a strong contrast between sacrum and control microscopically.
103-104	7568-9519	poor	Very bad preservation environment. Rootlets and fungus dominate both samples.
105-106	3358-6872	good	Abundant microscopic plant fibers in sacrum. A diversity of starch and pollen in sacrum but absent in control. Strong contrast between sacrum and control.
107-108	3277-6933	good	Some starch and pollen in sacrum but absent in control. Abundant microscopic decomposed plant fibers in sacrum and control. Probable dietary fiber found in sacrum but not in control.
109-110	3311-6882	poor	No starch or pollen in samples. Macroscopically, sacrum and control samples are similar. Better microscopic

			preservation in control.
111-112	5167-7112	moderate	Some microscopic decomposed fibers in sacrum. Macroscopically, sacrum and control samples are similar.
113-114	5214-8753	poor	Silty samples with no identifiable remains.
115-116	3246-6899	poor	Silt, sand and ash. No identifiable remains.
117-118	3280-7383	poor	There is some decomposed residue in microscopic sacrum sample, but not sufficient to indicate good preservation conditions for parasite eggs.
119-120	699-8696	good	Abundant microscopic plant fibers in sacrum. Strong contrast between sacrum and control.
121-122	690-8877	poor	Silt and charcoal only.
123-124	7524-5500	poor	Sand and charcoal only.
125-126	7504-9548	good	Abundant microscopic plant fibers in sacrum. Strong contrast between sacrum and control.
127-128	7587-9602	poor	Sand and charcoal dominate samples. Roots disturbed sacrum sample.
129-130	7526-8962	poor	Sand, silt, fungal spores dominate samples.
131-132	7709-16750	poor	Sand and charcoal dominant.
133-134	7600-11511	poor	Silt, sand and ash dominant.

135-136	7610-11752	poor	Abundant fungal spores in both samples. Limited preservation potential
137-138	727-14540	moderate	Microscopic decomposed plant fibers in sacrum. Strong contrast between sacrum and control.
139-140	7666-14557	good	Probable dietary fiber found in sacrum. Abundant microscopic decomposed plant fibers in sacrum. Strong contrast between sacrum and control.
141-142	7786-13337	good	Probable dietary seeds and fiber found in sacrum. Abundant microscopic decomposed plant fibers in sacrum. Strong contrast between sacrum and control.
143-144	7814-14608	good	Strong contrast in microscopic preservation with superior organic content in sacrum and preservation of dietary pollen. Abundant microscopic plant fibers in sacrum. Strong microscopic remains contrast between sacrum and control. Sacrum and control macroscopic remains are similar.
145-146	7608-14911	good	Starch present in both samples with better microscopic fiber preservation on control. Probable dietary seed fragments found in

			sacrum.
147-148	7917-18925	poor	Silt dominates microscopic remains.
149-150	not found	good	Abundant microscopic decomposed plant fibers in sacrum. Strong contrast between sacrum and control. Maize starch is present in sacrum.
151-152	3283-7080	good	Abundant microscopic plant fibers in sacrum. Strong contrast between sacrum and control. Probable macroscopic dietary fiber found in sacrum sample with possible human hair.
153-154	3274-7121	moderate	Sacral and control samples are similar microscopically with abundance of wood fibers. Wood fragments and possible human hair found in samples. No macro organic remains except for a light brown hair found in control.
155-156	672-7458	good	Better microscopic organic content of sacrum. Wood and charcoal in sacrum but no macro remains present in control
157-158	5195-8702	good	Abundance of fungal spores in both samples. Abundant microscopic decomposed plant fibers in sacrum. Strong contrast between

			sacrum and control.
159-160	5213-8856	good	Sacral and control samples are similar microscopically. Probable macroscopic dietary fibers found in sacrum.
161-162	665-8604	poor	Silt and sand dominate samples.
163-164	700-8903	poor	Sacral and control samples are slightly different microscopically with better organic content in control. No macro organic remains in sacrum and control samples.
165-166	7531-8921	good	Abundant microscopic plant fibers in sacrum. Strong contrast between sacrum and control.
167-168	10103-11970	good	Probable macroscopic dietary fiber found in sacrum. Abundant microscopic decomposed plant fibers in sacrum. Strong contrast between sacrum and control.
169-170	10081-10206	good	Probable macroscopic dietary fiber found in sacrum. Sacrum and control samples have acceptable organic content.
171-172	7775-14613	good	Abundant microscopic plant remains in both samples.
173-174	7713-14826	good	Probable dietary macroscopic fiber found in sacrum. Abundant microscopic decomposed

			plant fibers in sacrum. Strong contrast between sacrum and control.
175-176	7853-16850	good	Abundant microscopic plant fibers in sacrum. Strong contrast between sacrum and control.
177-178	7835-16920	good	Probable dietary fiber found in sacrum. Abundant microscopic plant fibers in sacrum. Strong contrast between sacrum and control.
179-180	10435-16987	poor	Better macroscopic and microscopic preservation in control.
181-182	7927-18721	good	No macro organic remains in sacrum and control samples. Microscopic preservation is superior in sacrum sample.
183-184	7903-21756	good	Probable dietary fiber found in sacrum.
185-186	10138-23296	good	Abundant microscopic plant fibers with pollen in sacrum. Strong contrast between sacrum and control.
187-188	13517-25045	good	Abundant microscopic decomposed plant fibers in sacrum. Strong contrast between sacrum and control.
189-190	13541-21826	good	Abundant microscopic decomposed plant fibers in sacrum. Strong contrast between

			sacrum and control.
191-192	7998-25349	poor	No macro organic remains in sacrum and control samples. Microscopic preservation is superior in control sample.
193-194	13566-25073	moderate	Abundant microscopic decomposed plant fibers in sacrum. Strong contrast between sacrum and control. Fungal activity in both samples
195-196	7997-21939	moderate	No macro organic remains in sacrum and control samples. Microscopic preservation is fair in sacrum sample.
197-198	8000-21971	poor	Sacrum is composed of charcoal. Control macro has very little organics other than traces of charcoal. Microscopic preservation is superior in control sample.
199-200	10306-28629	poor	Sacrum and control macro samples are similar. Microscopic preservation is superior in control sample.
201-202	11292-11293	good	Better macroscopic wood preservation in control. Microscopic preservation is superior in sacrum sample.
203-204	12176-12177	moderate	Abundant microscopic plant fibers in sacrum. Strong contrast between sacrum

			and control.
205-206	12879-12880	good	Abundant microscopic plant fibers in sacrum. Strong contrast between sacrum and control. Probable macroscopic dietary fiber found in sacrum.
207-208	14189-14190	poor	Sacrum and control samples are similar macroscopically. Poor microscopic preservation in both samples.
209-210	17181-17182	good	Abundant microscopic plant fibers in sacrum. Strong contrast between sacrum and control. Probable dietary fiber found in sacrum..
211-212	18133-18132	good	Microscopic preservation is superior in sacrum sample. Possible dietary fiber found in sacrum. Microscopic preservation is acceptable in both samples.
213-214	19022-19023	good	Abundant microscopic decomposed plant fibers in sacrum. Strong contrast between sacrum and control. Probable dietary fiber found in sacrum.
215-216	19293-19294	good	Better macroscopic wood preservation in control. Microscopic preservation is superior in sacrum sample with dietary fibers.

217-218	20135-20136	good	Abundant microscopic plant fibers in sacrum. Strong contrast between sacrum and control.
219-220	20713-20714	good	Abundant microscopic plant fibers in sacrum. Strong contrast between sacrum and control.
221-222	24247-24248	good	Macroscopic preservation is superior in sacrum sample. Probable dietary fiber found in sacrum. Microscopic preservation is similar in both samples.
223-224	24547-24548	good	Abundant microscopic decomposed plant fibers in sacrum. Strong contrast between sacrum and control.
225-226	24872-24873	poor	No macro organic remains in sacrum and control samples. Poor microscopic preservation in both samples.
227-228	25615-25614	moderate	Some microscopic decomposed plant fibers in sacrum. Weak contrast between sacrum and control.
229-230	25759-25758	good	Macroscopic preservation is superior in sacrum sample. Probable dietary fiber found in sacrum. Microscopic preservation is similar in both samples.

231-232	25871-25872	poor	Silt dominates samples.
233-234	25973-25974	good	Macroscopic and microscopic preservation is superior in sacrum sample.
235-236	26189-26190	good	Abundant microscopic decomposed plant fibers in sacrum. Strong contrast between sacrum and control.
237-238	26229-26300	poor	Silt dominates samples.
239-240	26409-26408	good	Abundant microscopic decomposed plant fibers in sacrum. Strong contrast between sacrum and control. Probable dietary fiber found in sacrum.
241-242	26841-26867	good	Possible microscopic dietary fiber is present in sacrum sample. Abundant microscopic decomposed plant fibers in sacrum. Strong contrast between sacrum and control.
243-244	30528-30529	good	Abundant microscopic decomposed plant fibers in sacrum. Strong contrast between sacrum and control.
245-246	30879-30880	good	Macroscopic preservation is superior in sacrum sample. Abundant microscopic plant fibers in sacrum. Strong contrast between sacrum and control.

Table 6: Pollen counts from latrine samples.

	70	66	69		
Lycopodium	110	25	100		
Asteraceae – Helianthus			1		
Asteraceae – Artemisia	0	2	1		
Asteraceae – high spine	0	2	1		
Asteraceae - Liguliflorae	0	1			
Asteraceae, Ambrosia-type	0	6	3		
Asteraceae, low spine	2	1	4 (2)		
Brassicaceae	1	2	1		
Cheno-am	36	43	134 (2)		
degraded tricolpate	0	90			
degraded tricolporate			6		
degraded stephanoporate			1		

Ephedra	0	1			
Fabaceae	4	4			
Fabaceae – Prosopis	2				
Fagopyrum	3				
Labiatae, steph	1		1		
Large Fabaceae	6				
Larrea ?	8				
Opuntia	3				
Pinus	0	1			
Pinus bladders	2				
Poaceae – large	6	3	2		
Poaceae – small	3	15	1		
Quercus	7	2	2		
Rhus	1				
Rosaceae – degraded	10	2	1		
Rosaceae – Fragaria type	28				
Sarcobatus	1				

Trifolium	2				
Unidentifiable	62	45	34		
Unknown	5	3			
Zea mays	7				

Table 7: Pollen results from selected cemetery samples.

	3	4	9	10	15	16
Lycopodium	50	50	50	50	50	250
Cheno-Am	2	1		6	4	110 (14)(2) (3)(9)(∞)
Low Spine			1(2)	1(4)	1	2
Pinus						2
Poaceae						1
Unident.	1	2		2		

Table 7, Continued: Pollen results from selected cemetery samples.

	19	20	27	28	31	32
Lycopodium	50	50	50	50	50	50
Asteraceae - High Spine		1				
Asteraceae - Ambrosia		1				
Asteraceae - Low Spine		5 (3)				
Cheno-Am	112 (2) (4)(30)	58 2(2), (6)	1	3	2	3
degraded tricolpate		1				
Pinus	1	3				
Pinus Bladder	1					
Poaceae		1				

	43	44	49			
Lycopodium	50	50	50			
Asteraceae - High Spine						
Asteraceae - Ambrosia	1		1			
Asteraceae - Low Spine	1					
Cheno-Am	29 (2)(∞)		13 (2)			
degraded tricolpate						
Pinus	5					
Pinus Bladder						
Poaceae						
Unidentifiable	7		21			

LIST OF FIGURES

Figure 5: Pollen grains from sample 81. A and B shoe cheno-am pollen aggregates. C and F show low spine Asteraceae grains. D is a prickly pear grain. E shows and aggregate of pollen that is as yet unidentified.