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RESULTS OF MICRO-MORPHOLOGICAL STUDIES IN SEDIMENTS, STUCCOS AND SOILS AT TRINIDAD, PETÉN

Ellen Spensley

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Micromorphology is the study of intact soils and sediments collected in blocks and preserved in polyester resins. Once the blocks have been hardened they are cut and set in glass straws, and reduced to a thickness of 30 mm. The analysis is conducted with a petrographic microscope using both flat and polarized light. The archaeological sites are mostly located within matrixes of sediments and soils, and therefore, connected with them.

Thus, it is normal that the soils of archaeological sites may be subjected to analysis, in thin sections, and that techniques associated with petrography may be used to respond archaeological questions including the formation of dumpsters, ancient agricultural techniques, and paleoclimatic reconstructions.

It is in the way how a sample is collected and handled that a link with micromorphology is established. Through the collection and intact preservation of depositional sequences, the nature of sedimentary components, as well as the artifacts and biological remnants, may be examined in regard to their spatial and temporal context (Mathews 1995:46).

In addition to soil studies, micro-morphology has been also used to investigate anthropogenic constructions such as adobes, walls, ceramics and stuccos (Courty *et al.* 1989; Goldberg 1983). Again, the ability to identify the components and their interrelationships, together with the formative processes and those that take place after the deposit was made, may be invaluable. Why certain materials were chosen, where did they originate, how the final products were created and in what way such products were used, are some of the questions that could be answered through micromorphological analysis.

During the 2003 season in the archaeological site of La Trinidad de Nosotros, San José, Petén, stucco samples were collected in a number of excavations to be compared with the materials and techniques used in the construction and maintenance of a variety of structures. La Trinidad de Nosotros is located at the banks of Lake Petén Itzá, 2.6 km southeast of Motul de San José (Figure 1), in one of the best natural harbors in the north shores of the lake. This natural port was extensively modified by the ancient Maya. The main traits in this area are Platform EE, the inner wall of the port, Structure EE-1, a possible dock and an “isle” or breakwater (Moriarty *et al.* 2003).

The nuclear zone of La Trinidad is located on top of a hill with a view to Lake Petén Itzá, and consists of public architecture with a pyramid 12 m high, a Ballgame and several high ranking residential groups (Figure 2). Two residential structures were partially excavated: C-1, an elite residence, and G-1, a sub-elite residence (Moriarty 2003).

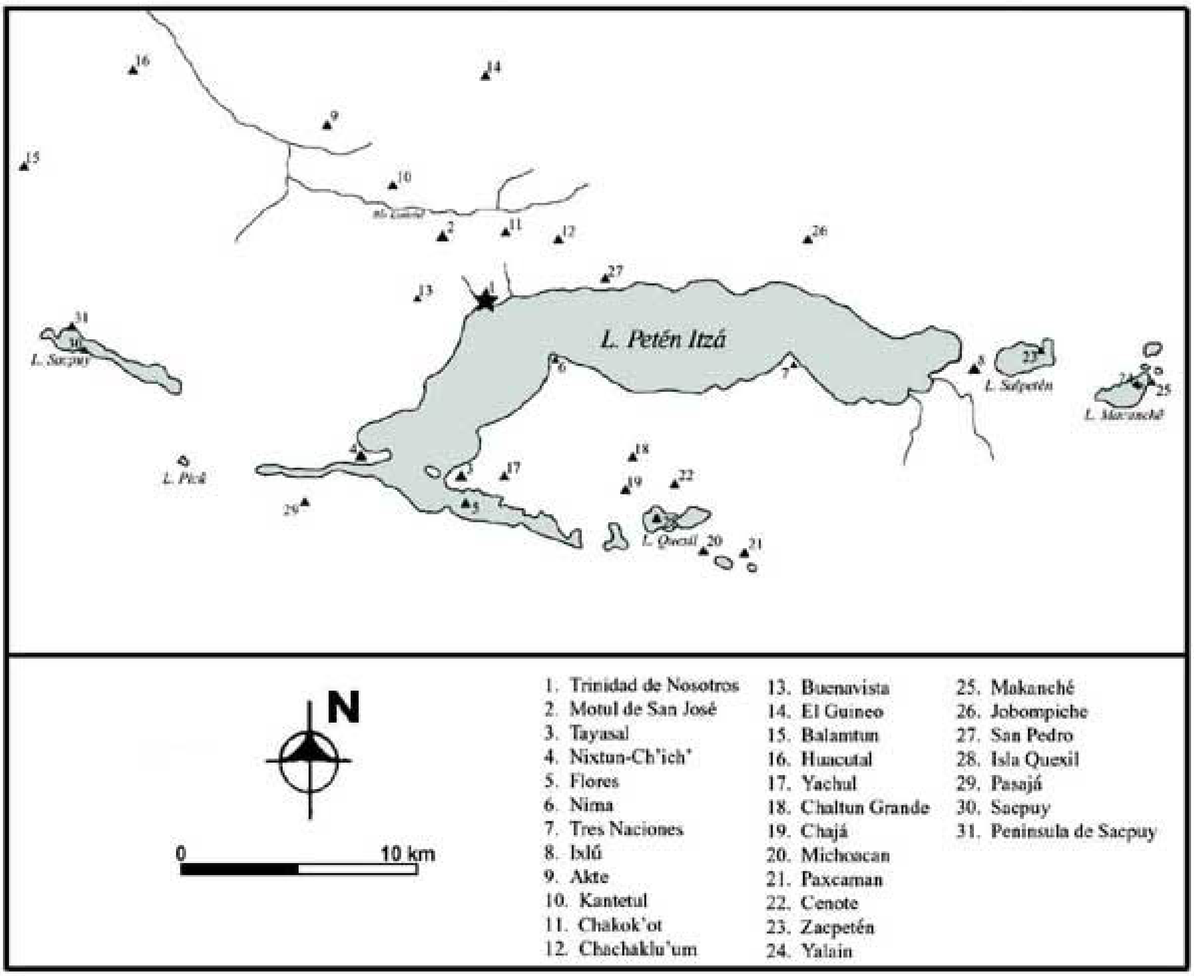


Figure 1. Archaeological sites near Lake Petén Itzá.

Figure 2. Ground plan of La Trinidad de Nosotros.

SAMPLING STRATEGY AND METHODS

The main objectives of this study were:

- To investigate the functional variations of the stuccos used in the different locations around the site (including floors, walls and benches of the elite and sub-elite residences, the floors of ritual structures such as Ballgame patios, and the floors associated with port features, like the platforms.

- To quantitatively examine the qualities of the stuccos used in elite and sub-elite residences.

Samples from garbage pits were also collected in an effort to more accurately categorize those activities that may have been the result of the formation of such deposits.

In the micro-morphology laboratory at Boston University, each sample was dried in a convector at 60º C, at least for one week. Once dried, the samples were impregnated with a mixture of polyester resin, methyl-ethyl-ketone peroxide, and placed in a fume-hood. In most cases, the resin hardened and achieved a consistency similar to gel, after one and a half week. At this point, samples were returned to the convector for additional 24 hours. Upon completion of the hardening of each sample, they were cut, crated and sent to Spectrum Petrographs, in Winston, to be sliced in thin sections.

Each one of the thin sections was examined with a microfilm projector and a petrographic microscope. The attributes selected for analysis under the flat and/or polarized light included the matrix composition and the added aggregates to prevent cracking, as well as the morphological relationships between these two components, their different layers, and the treatment of their surface. Each thin section was described after the corresponding standard terminology (Bullock *et al.* 1985).

RESULTS

All the stucco samples from La Trinidad were composed of locally available materials. Chronologically, the area around La Trinidad is characterized by deposits of tertiary carbonates, which include limestone, dolomites and plaster, as well as reddish clays (Vison 1962). Lime rock was used as the matrix material in almost all floor samples, and chips of this kind of stone were used as aggregates to prevent that stuccos contracted or cracked when dried. Dolomite and sascab were also used in some floors as an aggregate material.

Although all the floors from La Trinidad were built with these locally available materials, there was a significant variation in the preparation techniques and the quality of its components among the stuccos used in the varied structures and different areas of the site, as well as in the port area. In the latter, samples were taken from two floors inside a platform wherefrom the entire bay may be seen; one floor was located over the “island”, and there was a possible floor inside a low mound, which may have functioned as a dock.

The aggregates used in the stucco floors within the site core consisted of moderately thermic lime stones or fragments of dolomite, as well as simple calcareous grains of sascab and dirt. In general, these floors were poorly built, with porous spaces that ranged from 5% to 30%. In contrast, the stuccos within the port area included a very large amount of fragments of thermic limestone and were extremely dense, with porous spaces that ranged between 0% and 2%. These floors were also covered with several very thin layers, a unique pattern in La Trinidad (Figure 3).

Piso del nucléo del sitio (Estructura G-1)

7.5 cm x 5.0 cm

Piso del puerto (La “Isla”)

5.5 cm x 2.0 cm

Figure 3. Details of two stucco floors.

The presence of highly thermic material in the port floors together with the presence of thin facing layers suggests that different processes were used in the preparation and application of stuccos. However, it is not fully clear whether such trends were of a temporal or functional nature. One possible reason for the differences observed in the preparation processes may have been that the thermic limestone exposed to high temperatures helped to protect the floors from erosion, while the careful construction of facing layers may have accomplished a similar function.

In an area nearby the lake, where the floors were probably frequently humid and highly transited, some special preparation technique might have been necessary. Obviously, stucco floors were discovered in traits nearby the lake shores, where preservation seems unlikely.

While some variations in the composition and structure of stucco at La Trinidad may probably be attributed to functional requirements, the work and/or final use of the product in regard to social stratification is likely highly significant.

The excavation of two residences (C-1 and G-1), sampled through micromorphological procedures, provided indications that these groups differed, rank-wise, with architecture and artifacts included; besides, the analysis referred to, revealed variables not visible to the naked eye, such as paint remains and extremely refined facing techniques. In addition, the micro-morphological analysis suggested that a different amount of work was invested in the creation and application of the stuccos used to build and maintain each building.

The relative work was of a reverted character in regard to the stucco production, and has been correlated to different factors:

- The degree through which aggregate materials were separated.

- The degree through which charcoal was removed from the finished stucco (Hansen 2000:63).

- The amount of time involved in rehumidifying the burnt causeway and creating a malleable paste (Barger 1995:394; Morris 1931:239).

Further to the physical preparation of the calcareous paste, the way in which it was applied may as well have been indicative of inverted relative labor. The careful application of stucco in thin layers has been identified as a reflection of the time that the preparation took, the degree of skills involved, and the wealth of those who commissioned its construction (Hansen 2000:202; Litmann 1959; Roys 1934:97.

Ethnographic evidence from Yucatan suggests that the creation of a thick stucco layer is part of the consume process achieved through tamping the floor surface with wooden mallets, for hours (Morris 1931:240). In contrast, the floors of Structure G-1 seem to have accumulated as simple layers with no surface compression. However, the stucco wall removed from Structure G-1 has clearly revealed a construction pattern of sascab alternated with real stucco layers (Figure 4).

Piso de la Estructura C-1, construcción capeada

5.0 cm x 2.0 cm

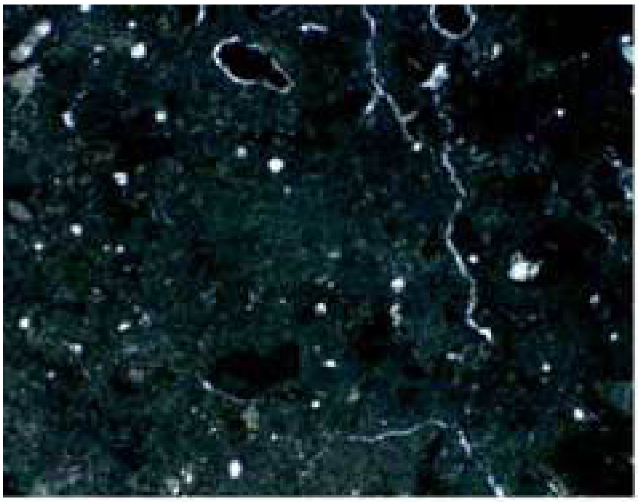
Piso de la Estructura G-1, construcción simple

7.0 cm x 5.0 cm

Figure 4. Details of two stucco floors.

The amount of aggregates added to the stucco has also been identified as an expression of wealth: thick aggregates to the calcareous stucco may have been used to stretch the material (Abrams 1996; Goren and Goldberg 1991; Hansen 2000; Littman 1962). While some aggregates were necessary to prevent an excessive cracking or shrinking, elite members presumably may have not needed to preserve the whitewash.

In comparing the inner floors, the inhabitants of Structure C-1 used slight and low percentages of aggregates (Figure 5). Furthermore, a large number of lime rock fragments were observed on the floors of C-1, while those of G-1 incorporated a larger amount of sascab. The processing of relatively hard stones in fragments of a uniform size compared with an already pulverized material, suggests, again, that a greater labor was involved in the preparation of stuccos with this type of inclusion.



Piso de la Estructura
C-1, sin agregados

foto 10 mm

Piso de la Estructura
G-1, con agregados
mas grandes:

1= caliza

2= sascab

3= concha

foto 10 mm

Figure 5. Details of two stucco floors.

Finally, micromorphology revealed possible paint residues on the three last inner floors of Structure C-1, and corroborated as well the presence of red pigment on the stucco wall of the building. While the floors of G-1 presented no evidence of pigments, the stuccos taken from the bench inside this building revealed that its surface had been painted, not once but several times, with red paint. The inhabitants of Structure C-1 seem to have been more generous with the use of stucco in the construction and decoration of the building, through several occupational phases, while the residents of G-1 turned to different resources for the construction of floors, and seem to have rather preferred elements such as stucco for walls and benches.

Interestingly, the buildings in Group C are distributed after the Plaza 2 Pattern used both in Tikal and in the epicenter of Motul de San José. The structure of Group G shows a less formal layout, and have more features in common with the groups located in the peripheral areas of Motul. Although paint samples were not taken at Motul, a study conducted in Tikal by Eric Hansen (2000) showed that stuccos were manufactured with a technique of several layers. The inhabitants of Structure C-1, besides having distributed their buildings after the patterns established for the regional capital, may have added the technological styles with a fine resolution in the construction of floors, with carefully superimposed layers. If the stucco technology unfolded after the political borders (a theory that will only be corroborated with a more extensive sampling at Motul and other sites in the area), it is possible that the study of stuccowork techniques helps to understand the inter-site relationships.

One final application of micromorphology involves the analysis of activity areas. In Europe or Irak, stucco and dirt floors have been studied through micromorphology to identify microartifacts or specific cracking patterns that could be of help to define activities carried out on these surfaces. At La Trinidad, no inserted microartifacts were found on floor surfaces, perhaps because stuccos were hard and/or were extensively cleaned. Several floors in Structure C-1 revealed a pattern of thin cracks parallel to the surface, though it could be easily attributed to the collapse of the large amount of fallen wall stones. Therefore, the possibility of identifying activity areas was poor.

Nevertheless, one sample from the Ballgame patio showed indications of a certain pattern of use, which could be preserved thanks to the stucco on the floor. Here, we were able to infer that certain activities had taken place; moreover, such behaviors were linked to the morphological characteristics observed. Three spatially nearby floors were revealed thanks to the test pits opened at the ballcourt, the second of which was sampled through micromorphology. The upper surface of this floor built with top quality lime stucco was perforated and undulated, presumably a result of intensive pounding. A thin but dense layer was applied to an uneven surface (Figure 6).

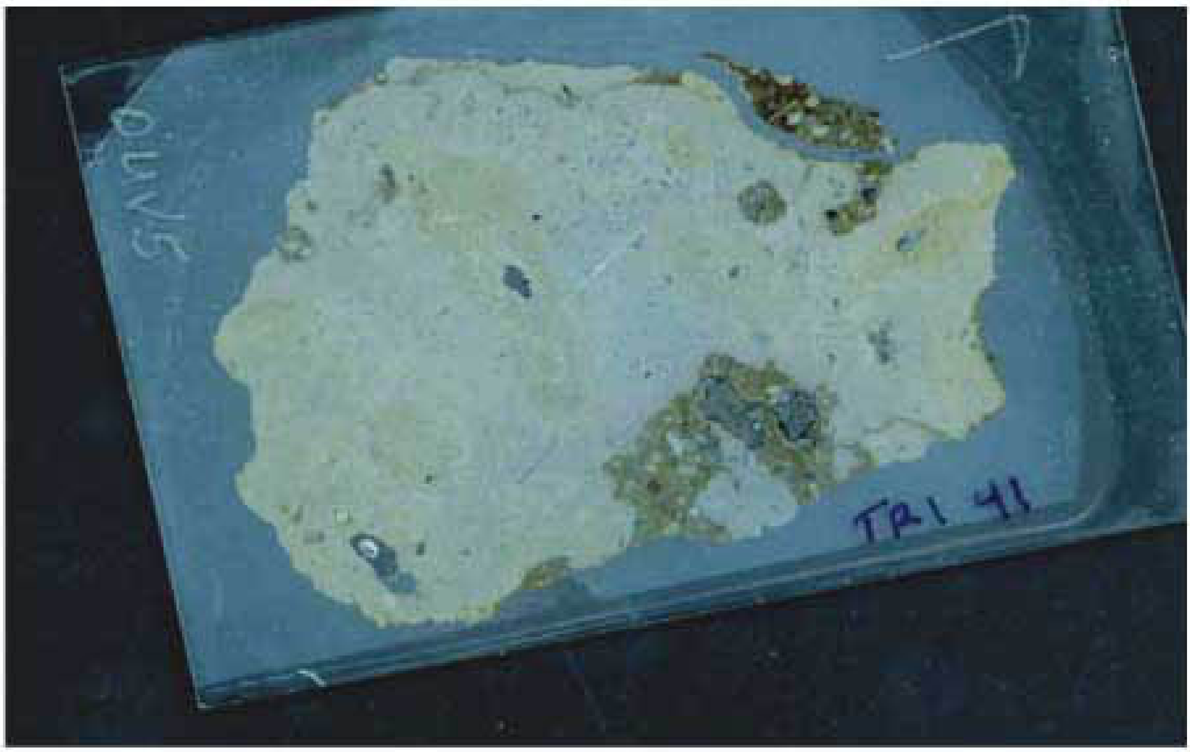
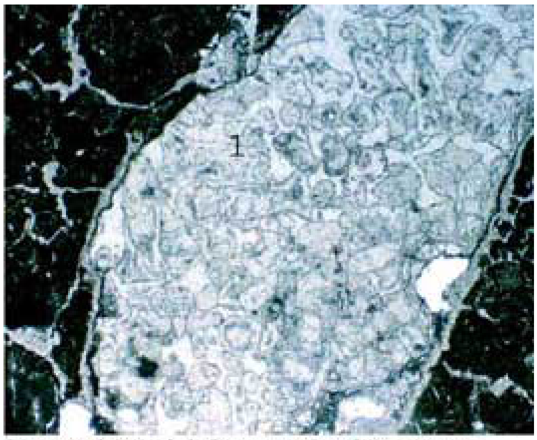


Figure 6. Details of a stucco floor.

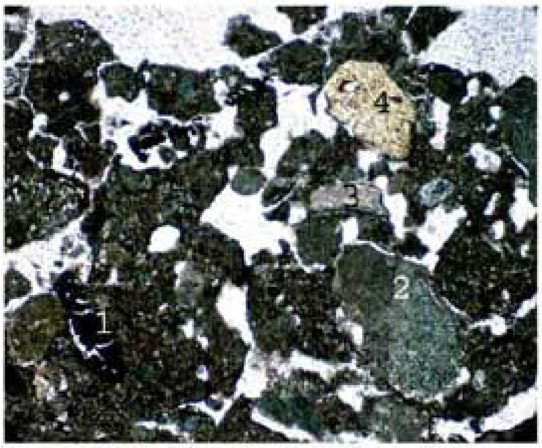
A different way of investigating the activity areas is through the analysis of garbage pits. With the purpose of observing what kind of information may be obtained through microscopic analysis, one Middle Preclassic garbage pit and two transitional ones of the Late Mamom and Early Chicanel phases were sampled during 2003 in La Trinidad. Two samples were associated with Structure G-1 and one with Structure C-1. These three deposits were remarkably similar. All of them exhibited a microstructure of sub-angular to granular blocks, with materials of a fine matrix present as aggregates around the brown calcareous clay. The real variation between these deposits depended on the composition of dirt-free inclusions.

The inclusions in the deposits under Structure C-1 consisted primarily of charcoal with minor amounts of stucco, shall fragments, quartz sand and one fragment of burnt ceramic of an unidentified type. The deposits under Structure G-1 mainly contained stucco chunks with significant amounts of quartz sand and flint flakes, and shell and carbon in lesser quantities. The inclusions in the garbage pit under Plaza G consisted mainly of stucco, sascab and charcoal, with a lesser amount of shell and one sherd of red slip and calcareous temper probably of the Mamom phase (Figure 7).

Basurero debajo de la Plaza G, foto 10.0 mm.
1= carbon, 2= estuco, 3= ceramica



Basurero debajo de la Estructura G-1, foto 10.0 mm.
1= lasca de pedernal



Basurero debajo de la Estructura C-1, foto 5.0 mm.
1= carbon, 2= estuco, 3= concha, 4= estuco altamente termico

Figure 7. Details of garbage pit sections.

While these variations could suggest different activities or formation processes, it is important to remember that often, garbage pits are not homogeneous with respect to the distribution of its components, and therefore, these samples may suggest artificial differences in composition. Nevertheless, Group G stands as candidate for a possible production center of lithic artifacts, based on the high density of instruments of different stages of production recovered in the excavation (Halperín and Hernández 2003). This observation has been confirmed at a microscale by the presence of many micro-flakes of flint, in contrast with the deposit under C-1, which was apparently of a more domestic character.

CONCLUSIONS

Micromorphology, as tested at La Trinidad de Nosotros in 2003, has proved to be an extremely informative technique. The microscopic study of stuccos across the site has revealed a rich variation in this material. Even though stuccos may seem to be very similar during the excavations, differences in composition and application suggested that several factors may have intervened during the manufacturing process.

At times, these factors may be correlated with functional needs, as was the case with the port floors that contained highly thermic materials; at times, socioeconomic status may have been more important. The floors in Structure C-1 and G-1 have illustrated that more expensive materials were used in the production of C-1, and that besides, more time and skilled labor were involved. Although the study of floors did not ultimately reveal a large amount of information on activity areas, the preliminary samples from the garbage pits suggest that micromorphology may be a useful technique to more clearly define the composition of dumpsters and their formation processes.

One of the most interesting results obtained with this study is the insight that Group G, in addition to following the Tikal plaza patterns, possibly also used the same stucco styles of this great center. If the stuccowork techniques unfolded after the political borders, their identification by specific regions or sites will be made possible. The study of the stuccos at Motul and surrounding areas may provide information on regional and interregional policies.

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Figure 1 Archaeological sites near Lake Petén Itzá

Figure 2 Ground plan of La Trinidad de Nosotros

Figure 3 Details of two stucco floors

Figure 4 Details of two stucco floors

Figure 5 Details of two stucco floors

Figure 6 Details of a stucco floor

Figure 7 Details of garbage pit sections