Soil analyses to identify ancient human activities

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One of the most complex early urban developments in the New World was the city of Teotihuacan, in the Basin of Mexico (first eight centuries AD). Its planned and regular grid, its elaborate drainage and water-supply systems, and its unique living accomodations (the multi-family apartment compounds) characterized this urban center in Classic Mesoamerica.

Apartment compounds generally consist of several rooms at slightly different levels, arranged around open spaces (courtyards, refuse areas, and light wells); these are places for ritual, rain water collection, partial refuse disposal, and the provision of light. The compounds consist of different apartments joined by passages for communication; they have domestic sanctuaries, and the entire compound is enclosed within an exterior wall.

It is believed that these compounds were occupied by corporate groups sharing kinship, residence, and occupation. It has been archaeologically determined that craftsmen dedicated to the manufacture of different products lived in separate compounds (Millon 1973). In mapping activities shared by all households in our compound, we have found additional data supporting this idea.

From 1985 to 1988, as part of an intensive interdisciplinary project, we carefully dissected an apartment compound in the northwestern fringe of ancient Teotihuacan. We knew that the stucco floors were scrupulously swept in the ancient domestic setting, so we would not have abundant macroscopic remains for our analysis. We thus planned a strategy that also took into consideration chemical traces of activities on the plastered floors, as well as microscopic evidence related to these activities.

After the geophysical, geochemical, and archaeological plotting of surface materials, archaeological raw material, debris and artifact distribution were contrasted and complemented by the fine-grained analyses of phytoliths and pollen, botanical and faunal macrofossils, and chemical compounds on floors, as well as micro-artifactual distributions (Manzanilla and Barba 1990; Manzanilla 1993). In this manner, we obtained the anatomy of an apartment compound during the 6th century AD, room by room.

The discrete distributions of artifacts, raw materials and debris were described as potential activity areas exhibiting a specific set of characteristics. These artifactual patterns were then contrasted with the distribution of the biological elements and chemical compounds, to gain an idea of the set of activities for each room.

With respect to chemical analyses and activity area research, Barba (1986) has proven, in ethnographic as well as archaeological examples, that stucco floors trap chemical compounds in their structure derived from repeated specific activities. At our apartment compound, we collected samples to a depth of 5 cm in each m^2 of the stucco floor. The following tests were made with each sample:

a. **Phosphate analysis.** This semiquantitative test was based on the intensity of blues generated in the surface of filter paper which reflects the quantity of phosphate in each sample. Areas where organic refuse was abundant tend to have high phosphate values.

b. **Carbonates.** The quantity of carbonates present in the sample was estimated based on its reaction to hydrochloric acid. A scale from one to five was employed to measure the intensity levels of these reactions. Leaving natural calcium carbonate deposition aside, carbonate concentrations could be derived either from *tortilla* preparation, or from stucco and limestone processing.

c. **pH.** pH levels were determined by routine procedures used for soils in a water solution, and measured with a combined electrode. The presence of fire in the vicinity of a stucco floor increases pH values.

d. **Color.** Soil samples were compared using a Munsell Soil Color Chart. Color could be an indicator of organic material; a change in color also could signify where a fire had been lit.

Specific chemical tests for sodium and iron were used in locations where it was expected that particular activities had been carried out. For example, iron concentrations are derived from *Agave* processing or from the butchering of animals. Organic and inorganic chemical analyses were also undertaken on the bottoms of specific types of ceramic vessels, and provided further information on food preparation and consumption.

For example, three kitchen sectors, recognized by dark red stains on the floor, a reduction of carbonate values, and a considerable increase in pH in the place where the portable stove stood, were differentiated. Ash augmented the pH in the stain zone. This area was surrounded by a semicircular band of phosphates, evidencing a major consumption area. In some cases, a grinding instrument was found near the dark red stain. Access to storage rooms also was nearby. Plant and animal remains provide further support for food processing and consumption. These include the remains of rabbit and hare, the bones of young and adult deer, charred *Agave* spines, together with *Panicum* and charred maize remains, squash phytoliths, and charred prickly pear seeds.

In one of these kitchens, the door gave access to a small service patio (a medium-sized open space to which refuse

was swept and where rainwater was probably collected), with drainage to the north, where we found a band of refuse from the consumption area (e.g. turkey remains). The phosphate value was high near the drain, where all the refuse was concentrated.

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