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SEARCHING FOR THE PLUMBATE FACTORIES: GEOPHYSICAL EXPLORATIONS IN THE AREA OF LA BLANCA, SOUTH COASTAL GUATEMALA

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Plumbate wares are the product of a special technology which produced a gray, very hard and shiny surface, fit to be described as the only glazed ware of the New World (Shepard 1948). More than sixty years of scientific investigations devoted to this interesting ware (Coe 1961; Coe and Flannery 1967; Drucker 1948; Dutton 1943; Dutton and Hobbs 1943; Kidder at al. 1946; Lowe and Mason 1965; Neff 1984, 2002, 2003; Neff and Bishop 1988; Shepard 1948; Shook 1965; Thompson 1948), have produced a wealth of information about its history, distribution and nature. To start with, we know of the occurrence of two stylistic varieties: San Juan Plumbate, corresponding to the Late and Terminal Classic periods, limited to southern Guatemala and its neighboring regions, and the more ornamented one Tohil Plumbate, of the Early Postclassic period and found all over southern Mesoamerica, down to Panama to the south, and up to Nayarit to the north.

The petrographic studies by Shepard (1948) and the chemical ones by Neff and colleagues (Neff 1984; Neff and Bishop 1988) have shown that both stylistic varieties, San Juan and Tohil, are different in their paste, so that this finding may suggest the existence of two different sources. One of the sources, according to field reconnaissances conducted by Shook (1965; also Drucker 1948; Lowe and Mason 1965; Shepard 1948), is located in the region of the Pacific Coast between the Coatan and the Tilapa rivers, where large concentrations of Plumbate were observed at La Blanca, Izapa, and other sites. Even though the Plumbate ware of this region corresponds to the plain style, chemical analysis shows that around 40% of the plain fragments correspond to the Tohil paste. Altogether, the evidence we have had at hand for the past 25 years, makes us reach the undeniable conclusion that the region of the Pacific coast is the only source of Plumbate Wares.

A new phase in the history of the scientific interest regarding Plumbate Wares was initiated in 1999, with a reconnaissance of the ceramic resources conducted at the Pacific Coast in both sides of the border. A sample of 207 clays from 132 different locations was collected. Clays were analyzed using neutron activation and laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS). The first test provides analytical data fit to be compared with the chemical paste profiles of the two Plumbate groups, and the second provides data fit to be compared with the data obtained through LA-ICP-MS of the slip of both groups. In effect, two different investigations were simultaneously carried out in regard to the provenience of

Plumbate, one with the purpose of finding the sources of the raw material used for the paste, and the other with the purpose of finding the sources of the raw material used for the surface.

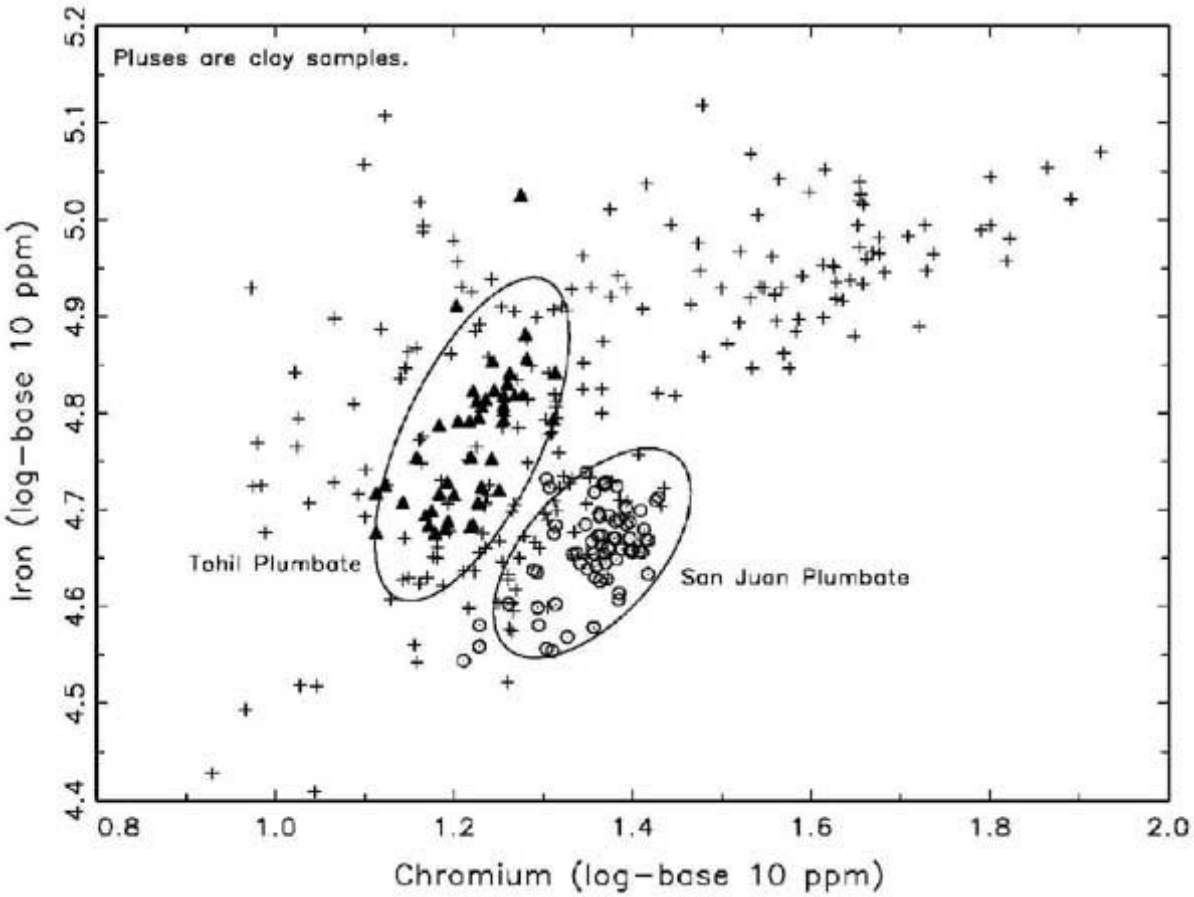

Figure 1. Chromium and iron concentrations determined by AAN in samples of Plumbate sherds surfaces and samples of raw clay from the Pacific Coastal southern Chiapas, Mexico, and the southwestern corner of Guatemala. The ellipses represent the 90% level necessary for membership to each group.

Just like in the previous investigation, the new chemical data suggest that there are two profiles in the Plumbate sample (Figure 1). In this case, the present conclusion may be extended to the material used for the slip (Figure 2). The fact that several samples of raw material fall into the San Juan and Tohil groups in the bi-dimensional charts (Figures 1 and 2), suggests that the samples we have collected are from the same ceramic environment exploited by plumbate potters. However, a better way for establishing a close and specific connection between the ceramic groups and their zones of origin is through statistical comparison between the chemical profile of the clay samples and the chemical profile of the group (Neff 1998, 2000, 2001a; Neff and Bove 1999). The probabilities associated with each one of the clay groups can be used to estimate a probability map where the peaks and tables of a higher probability show a geographic zone where raw materials approximate more closely to the group profile, thus making it possible to identify such zone as the most probable source of the chemical group.

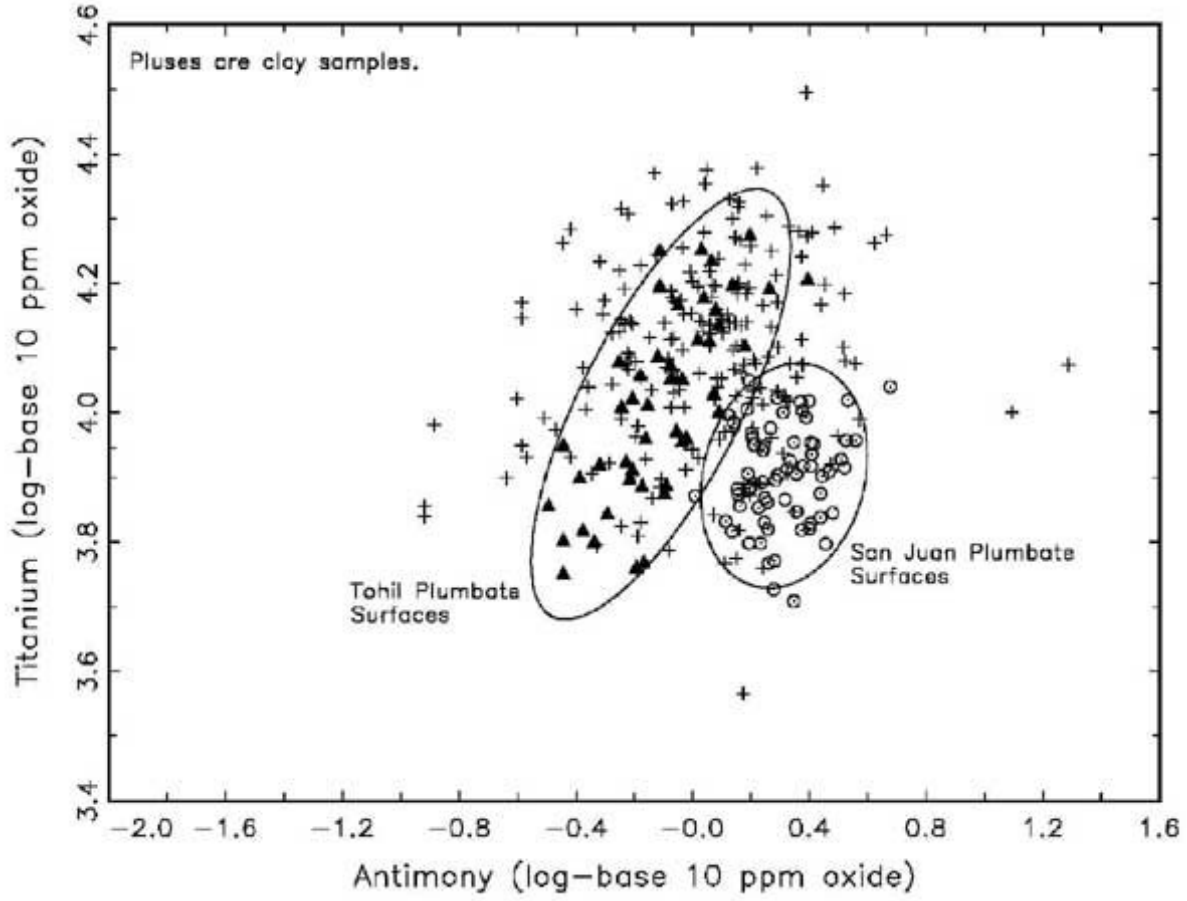

Figure 2. Concentrations of antimony and titanium determined by LA-ICP-MS in samples of surfaces of Plumbate sherds and samples of raw clay originated in the region of the Pacific Coast at the southern end of Guatemala, Mexico, and the southwestern corner of Guatemala. The ellipses represent the 90% level necessary for membership to each group.

Like we have previously reported (Neff 2001b, 2002, 2003), comparisons of raw materials with the different Plumbate groups have identified two regions within the frontier region, like the probable zones where Plumbate wares were manufactured (Figure 3). As to the paste of the San Juan group, the high probability area is located around the mouth of the Río Naranjo (Figure 3). When considering the slipped material of the San Juan group, we find more or less the same pattern: the high probability area is located in the river bed of the Río Naranjo, between the site of La Blanca and the coast. On the other hand, the paste of the Tohil group presents closer links with the clays of the Cahuacan river bed, while the material of the Tohil slip is linked with raw materials from the same river, though more towards the inland.

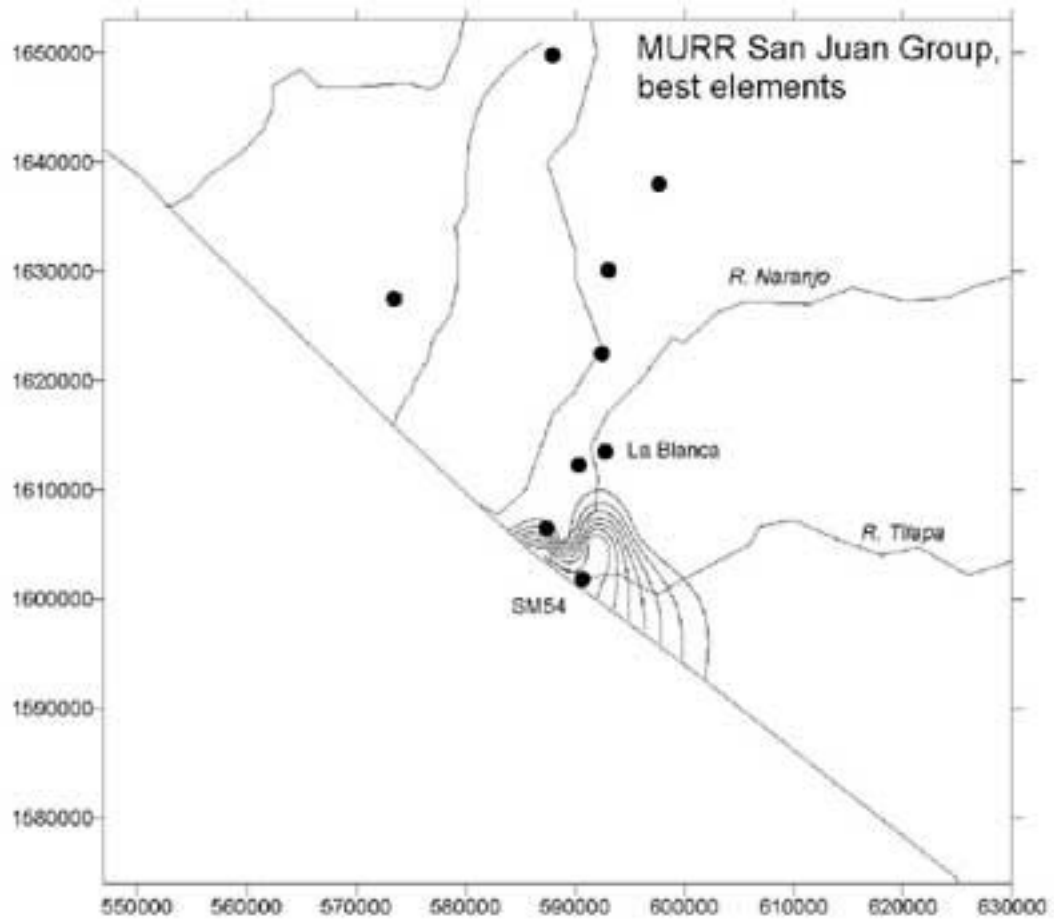

Figure 3. Map showing variation in the probabilities that raw clays were members of the San Juan Plumbate group defined, based on data obtained by neutron activation of the paste. Axis units are UTM coordinates (in meters), and the north is at the top.

In short, according to the most recent study on Plumbate provenance, we have very concrete evidence pointing to the fact that both varieties come from the Pacific Coast region, close to the present border between Guatemala and Mexico. Within this region, we have established specific connections between the ceramic groups and the ceramic resources of two restricted zones: the vessels of the San Juan group apparently originated in the Naranjo river bed, between La Blanca and the coast, and the vessels of the Tohil group originated in the Cahuacan river bed, on the Mexican side of the border.

GEOPHYSIC EXPLORATION IN THE AREA OF LA BLANCA

In what way the unique industry that produced the Plumbate vessels was organized, and how did technology evolve throughout time? To make progress in finding an answer to such questions, we need to investigate the archaeological remains of production-related activities. Unfortunately, even though the zones of origin of Plumbate have been established beyond any doubt, the specific locations of the workshops remain so far unknown. Therefore, the next step in the investigation of

this industry is to search for the archaeological remains of the workshops and other component parts of the infrastructure.

Archaeological observations have offered some hints on where we should start searching. For example, during the construction of the road to Tilapa in 1972, Shook (personal communication) observed the destruction of a trait he interpreted as a hearth for firing Plumbate vessels. On the other hand, the investigations conducted in 1981 documented a very dense concentration of Plumbate sherds in SM54 and other sites of the littoral zone (Neff 1981, 1984; Neff and Bishop 1988), near de maximum probability point for the San Juan Plumbate paste. During the month of July, 2003, we investigated the possibility that these observations could be showing the presence of facilities associated to the production of San Juan Plumbate. These investigations were made in association with Michael Love's La Blanca Project, and his collaboration is much appreciated.

The search of traits associated with the production of Plumbate was accomplished through a survey made with a magnetometer within the areas of high concentrations of Plumbate sherds and/or other evidences of clay firing. A magnetometer is an instrument that detects variations in the magnetic field of the Earth. Localized magnetic traits may increase or decrease the field, creating anomalies in the magnetic measures. The firing of pottery in hearths or kilns is a cultural activity that may create such anomalies. The magnetic variation also results from the variation in the density and nature of the sherds and other archaeological materials under the surface.

In the studies conducted in the area of La Blanca, the instrument consisted of two magnetometric sensors with a vertical separation of 25 cm. The readings of the sensors were simultaneously recorded. Thus, each series of records produced three types of data: those of the upper sensor, the lower sensor, and the gradiometer. Other details regarding instrumentation have been already reported (Neff 2004).

In view of the chemical results and the archaeological observations discussed earlier, the geophysical investigation focused primarily on the area immediately at north of the urban center of La Blanca, at both sides of the road, the construction of which, according to Shook, caused the destruction of a trait associated with the firing of San Juan Plumbate. We worked combining reconnaissance on foot, our previous knowledge of the area, and information from local residents for the identification of locations with dense concentrations of Plumbate sherds or other types of evidence of pyrotechnic activities on the surface. A magnetometric survey was conducted in four places. This paper will present the results obtained from two of them, Operation PL003-1 and Operation PL003-3. An additional survey that will be discussed below was conducted in SM54, the place that showed high concentrations of Plumbate in the littoral zone, south of La Blanca.

OPERATION PL003-1

The first operation, PL003-1 was carried out in a banana plantation where the survey made on foot led to the discovery of high frequencies of plumbate sherds on the

surface and into the drainage cuts. This area is located a few meters east of the place where the furnace reported by Shook was found. The initial survey covered a wide area, and the rows of banana trees were used to keep the alignment straight. The most interesting feature found at the place was an intense anomaly at the center of the west side of the map that displays the gradiometric data, as well as in the map of the upper sensor. To corroborate the possibility that this trait were a pyrotechnic trait, several other detailed studies were initiated on the west side of PL-003-1.

The first detailed survey used one meter intervals and covered the entire rectangular area of 37 x 50 m shown in the plan of the total area. Little magnetic variation was recorded in the area, with the exception of a very large anomaly localized in the north-central portion, which corresponds to the anomaly documented previously. To ascertain the morphology of this trait, an even more minute survey was conducted in a 10 x 10 m area on the place of the anomaly. The lower sensor, just like the gradiometer, points to the presence of a complex, perhaps square-shaped feature, or a feature with rays emanating from a trait at its center.

Due to time restraints to carry out an excavation of Trait 1, small samples of deposits in the subsoil were collected in the trait area with a manual soil-drill. The results confirm the presence of pyrotechnic remains, but do not provide enough details to clarify the nature of the anomaly. For what it seems, there is ash and burnt clay concentrations 40 to 60 cm below the surface in the trait area, but its association with Plumbate sherds cannot be confirmed with the drill samples only. Therefore, the nature of this trait and its possible association with the industry of Plumbate wares will remain unknown, for the moment.

OPERATION PL003-3

An additional interesting survey was Operation PL-003-3, on the west side of the road, approximately 0.5 km north of PL-003-1. The area with this concentration of plumbate sherds was only found during the last but one day of the project, and truth is it was not given proper attention. It was located in a banana plantation which was previously leveled, an activity that apparently damaged the archaeological traits, possibly down to a depth of almost 1 m on the west side. There were large Plumbate sherds together with burnt clay on the surface. The plan of the upper sensor shows an area with very high magnetic readings in the southwest corner of the operation. Blocks of burnt clay, amorphous in shape, were also observed in this area. Other areas with high magnetic records were as well detected.

The plan of the gradiometric records for PL003-3 is relatively flat, and the traits visible in the records of the lower sensor almost fade away. On the other hand, a minute analysis of the data from the southwest corner suggests the possibility of structural alignments in this area. Clearly, area PL003-3 deserves additional attention. Due to the brevity of the investigation conducted so far, it is not possible at this time to offer solid conclusions on the nature of the activities that created the magnetic traits, together with the burnt clay and the concentrations of Plumbate sherds. However, the possibility exists that these signs pointed to the presence of facilities associated with the production of San Juan Plumbate wares.

MAGNETIC SURVEY IN SM54

The other survey was carried out in SM54, the group of small mounds in the littoral zone south of La Blanca. The density of plumbate sherds in this site, as well as in other sites in the vicinities, is consistent with the hypothesis that San Juan Plumbate was a product, at least in part, of the littoral zone (Neff 1984). And, as we discussed above, the raw materials around the mouth of the Río Naranjo are consistent with the chemical composition of San Juan Plumbate. The magnetic survey in SM54 was conducted on the largest mound of the site. The lower sensor identified long term trends consisting of high magnetic readings on the south side of the mound, and relatively weak readings at north. We believe that this pattern reflects the reading of a dense deposit of cultural materials, mainly sherds, located inside the mound. According to this interpretation, three looting pits appear to be surrounded by very high readings due to the density of the sherds deposited in the ring of each pit. Long term trends are eliminated in the gradiometric data. Looting pits can be more clearly seen in this plan, and perhaps additional patterns could appear. Specifically, it is possible that the gradiometric records were showing two superimposed structures, one oblong structure perpendicularly oriented towards the long axis of the study area, and one quadrangular structure oriented diagonally with respect to the other one, and with its center more or less in the place of location of the looting pit, more towards east.

In short, the magnetic survey of SM54 has failed to provide any data consistent with the interpretation according to which these mounds were facilities connected with the production of pottery. Although the mound refill seems to create a long term trend in the magnetic records, and hints of structures are present, no anomaly was recorded with the magnetic intensity expected to be produced by a hearth or by a firing action outdoors.

CONCLUSION

In conclusion, although the geophysical explorations reported here have not produced the discovery of a large factory of San Juan Plumbate, the results are important in the context of the overall effort aimed at understanding the evolution of the Plumbate industry. For example, the notion according to which San Juan Plumbate wares were produced within the littoral zone (Neff 1984; Neff and Bishop 1988) seems less probable in view of the findings at SM54. In contrast, the explorations in the area of La Blanca have yielded several traits of a seemingly pyrotechnical nature, and the possibility exists that at least one of them could be associated with the production of San Juan Plumbate. Now we need to increase the sample from those facilities and to clarify their nature with additional investigations.

For the future, more investigations are planned for the area of La Blanca, to clarify the nature of the already known traits, and to look for others. Field information from the other side of the Mexican border, where Tohil Plumbate was produced, is also needed. Ultimately, these investigations will generate comparative data on the

organization and scale of the activities produced at the two centers of the Plumbate industry. The goal is similar to that which promoted the study of Plumbate 25 years ago: the elaboration of a scientific understanding of the evolution of the most sophisticated ceramic industry of the prehispanic New World.

Finally, and methodology-wise, the explorations in the area of La Blanca corroborate the benefits of using the magnetometer for the quick identification of buried traits across wide areas. Thus, it allows for the investigation of the relationships of space within the communities, without the need to conduct large excavations. Nonetheless, in general, we need to clarify the nature of the traits found through a more detailed magnetometric coverage, with drill tests, and at times, through larger excavations. Having established the usefulness of the instrument, the next step will involve the development of a better methodology for the integration of the magnetic survey with on foot surveys, surface collections, and several types of excavation units.

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Figure 1 Chromium and iron concentrations determined through AAN in surface samples of Plumbate sherds and raw clay from the Pacific Coastal region in the south edge of Chiapas, Mexico, and the southwestern corner of Guatemala. The ellipses represent the 90% level necessary for membership in each group.

Figure 2 Antimony and titanium concentrations as determined by LA-ICP-MS in surface samples of Plumbate sherds and samples of raw clay from the Pacific Coastal region in the south edge of Chiapas, Mexico, and the southwestern corner of Guatemala. The ellipses represent the 90& level necessary for membership in each group.

Figure 3 Map showing variation in the probabilities that raw clays were members of the San Juan Plumbate group defined based on data obtained by neutron activation of the paste. The units of the axis are UTM coordinates (in meters), and the north is at the top.