

Archaeological prospection methodology at Teotihuacan (Mexico): study of a neighbourhood in the centre of the city

Alessandra Pecci¹, Luis Barba², Agustín Ortiz², Jorge Blancas², Itzayana Bernal³ and Natalia Moragas⁴

¹ ERAAUB, IAUB, INSA-UB, Departamento de Historia y Arqueología, Universitat de Barcelona, Spain. alepecci@gmail.com, alessandrapecci@ub.edu

² Laboratorio de Prospección Arqueológica, Instituto de Investigaciones Antropológicas, UNAM, Mexico. barba@unam.mx, ortizbutron@gmail.com, jorgeblancasvaz@gmail.com

³ Facultad de Ingeniería, UNAM. México. ibercorts@gmail.com

ERAAUB, IAUB, Departamento de Historia y Arqueología, Universitat de Barcelona, Spain. nataliamoragas@ub.edu

Abstract

Teotihuacan was an important city in Mesoamerica and during the first centuries AD was the most important city in the Center of Mexico. It has been investigated during several years by different projects, but there is still much work to do. The goal of the project is to understand the organization of a neighborhood located in an area in the center of Teotihuacan, between San Juan River, the Pyramid of the Sun and the Street of the Dead, named by Millon “sectors N2E1 and N2E2”, through the combined application of different research techniques. We applied aerial photography with drone, topography, geophysical prospection techniques (magnetic, electric and georadar studies) to identify buried structures and the study of chemical residues on the soil surface and the distribution of archaeological materials in selected areas, to identify human activities. The data obtained until now, suggest preliminary hypotheses about the distribution and depth of buried buildings, that should be part of a neighborhood with its components such as residential areas, workshops, temples, and squares.

I. INTRODUCTION

In 2017 we began a joint international and interdisciplinary project to study a neighborhood in the center of Teotihuacan (Mexico), in academic

collaboration between the UNAM (A. Ortiz, L. Barba) and the University of Barcelona (A. Pecci, N. Moragas) [1]. The studied area is located in the center of Teotihuacan, between the river San Juan, the Pyramid of the Sun and the so called “Street of the Dead” (the main avenue that runs north-south) and it is named “sectors N2E1 and N2E2” after Millon’s map of the city (1973) (each sector is 500x500m). This very central location had not been deeply investigated until now although it is in the core of Teotihuacan, one of the most important urban centers of Mesoamerica during the Classic Period (ca. 0-550 dC).

The goal of the project is to investigate these two sectors, through the combined application of aerial photography with drone, topography, geophysical prospection techniques (georadar, electrical and magnetic studies) to identify buried structures. Finally, the study of chemical residues on the soil surface and the distribution of archaeological materials in selected areas is also carried out, to identify indicators of human activity.

The project originated from the idea that perhaps one of the four main neighborhood/sector centers of the city of Teotihuacan could be located there, as suggested by Agustín Ortiz in his PhD thesis [2]. However, before being able to establish if there is a neighborhood center there, we needed to know the area and the neighborhood itself. The project is therefore aimed at better understanding the organization of this area of Teotihuacan, and in particular, the organization of

buildings in this space, and understand if there are different construction phases. Here we mainly focus on the results obtained with the magnetic gradient survey in the N2E1 sector.

II. METHODOLOGY

The research methodology we apply follows the one already established by the Laboratorio de Prospección Arqueológica of the IIA, UNAM since 1983 [3] (Fig.1).

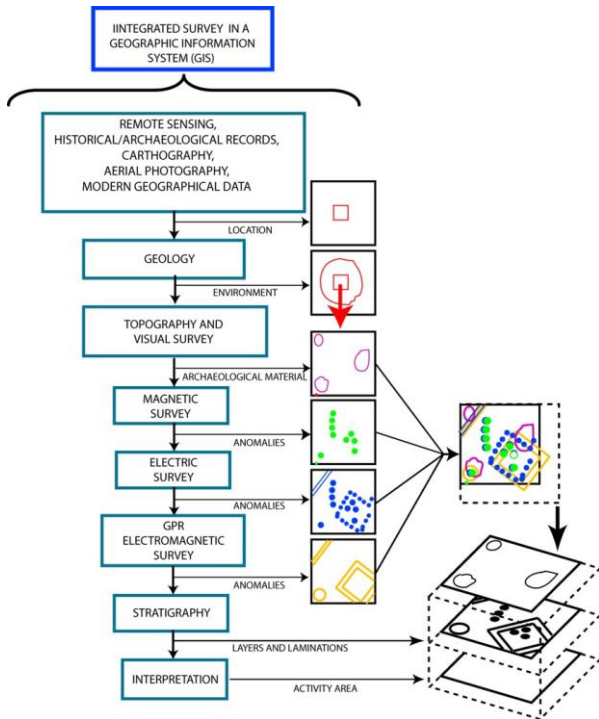


Fig. 1. Methodology carried out in the LPA of the IIA, UNAM, Mexico, also applied in this study (after Barba 1985 and modified by Blancas [9]).

This methodology attempts to study the archaeological context from the general to the particular. Therefore, we employ the remote sensing analyses to study the place of interest from the air to identify its characteristics and extension. It is also important to study the rocks and soils present in the area so we can have an idea of what kind of materials might be found during the study.

The next step is to record the micro-topography of the area to identify alterations, probably produced by some of the ancient buildings buried in the subsoil.

Then a further action of the study of subsoil that integrates three geophysical techniques, magnetic gradient, electric resistivity and georadar, was carried out.

The magnetic gradient study was carried out with a Geoscan FM36, with a distance between readings of 25 cm and one meter between parallel lines, and the georadar study using a SIR System 3000 from GSSI

with 400-MHz antenna with survey wheel, penetrating barely 3 m and S-N lines every 1 m.

The integration of these results provides a better perspective of the natural and cultural anomalies found beneath the surface. Finally, thanks to the results of the above-mentioned techniques it is possible to design a sampling strategy to attempt to identify the human activities carried out in specific areas through the analysis of chemical residues of soil samples and the study of the distribution of archaeological surface materials.

A similar methodology previously applied in other areas of Teotihuacan, such as Oztoyalco (Barba y Manzanilla [4]), Teopanazgo (Ortiz et al. [5]), Tlajinga (Blancas et al. [6]), and Techinantitla (Ruvalcaba et al. [7]) has demonstrated to be successful in the study of these archaeological contexts.

In our case, the methodology included aerial photography using a *drone*, obtained thanks to the collaboration with the Laboratorio de Análisis Espacial y Digital, IIA, UNAM to produce by photogrammetry the Digital Elevation Model DTM of the quadrant.

An extensive magnetic gradient survey and the verification of specific areas with ground penetrating radar and electric resistivity.

Moreover, we recorded surface materials distribution, and in specific areas, we took samples of soil for chemical residue analysis to identify possible activity areas.

In this study we focused on the part of the quadrant that hasn't been excavated yet. Therefore, we decided not to investigate the buildings that directly face the Street of the Dead that can be seen in the lower part of figure 2.



Fig. 2. Digital elevation model of the studied area. View from west.

III. RESULTS

In figure 3 we show the interpretation of the magnetic gradient survey map. Here we observe different features. In particular, we have to take into account that Teotihuacan is located in an area that nowadays is urbanized and that only the center is protected as an archaeological site open to the public. Consequently, we sometimes identify modern materials/features. A striking example is the long blue dotted line visible in figure 3 (number 1), that indicates the presence of a modern 3 inches iron pipe.

In Teotihuacan city the wall's construction technique consisted in building the core of the walls with selected pieces of *tezontle* (local volcanic scoria) with the same size, put together with mud mortar. Therefore, when the walls collapsed, all these stones usually accumulated on the surface and were dispersed. This is the origin of the thousands of dipoles we can see in the magnetic gradient map and provides an idea of the number of walls collapsed in the studied area. Some of them were identified by geophysical techniques but the majority were covered by the bottom noise of dispersed stones. Examples of features that we interpreted as walls are mentioned in the following lines.

To the north (number 2), there is a small pyramid referred by Millon [4] (1973) as a "temple". Close to it we found scattered painted stucco on surface. The archaeological and magnetic data allowed to detect a surrounding plaza, that is delimited by walls indicated by the dotted lines.

In number 3, it is possible to observe aligned magnetic dipoles interpreted as parallel walls, delimiting a terrace. Some walls making corners with another terrace limit can be identified in the area number 4 (Fig.2), while to the south, more walls making corners, can be identified

in number 5, where today there is an open plaza (suggesting a previous occupation).

To the west, a rectangular space, likely a patio, surrounded by walls is indicated by number 6.

In the southeastern edge of the investigated area (number 7, Figure 2), an open patio, also sided by structures that can be observed as a stone concentration. Figure 4 shows the relationship between the area 7 gradient map and the georadar line 51. It is clear that where magnetic dipoles are absent there is no reflexion in radargram. On the contrary, the amplitude of reflexions is higher in places where we can see a major concentration of dipoles. As said above, in Teotihuacan, building materials are volcanic and they are usually visible as dipoles in the gradient map. Therefore, it is likely that we have identified a central courtyard about 20 m wide, surrounded to the east and west by two rooms about 10 m wide, where floors are also visible in the radargram. To the east there is an empty space, before reaching the next structure.

Finally, going back to figure 3, towards the left, where the important Street of the Dead is located, it is also possible to observe the presence of many walls forming corners and rooms (number 8).

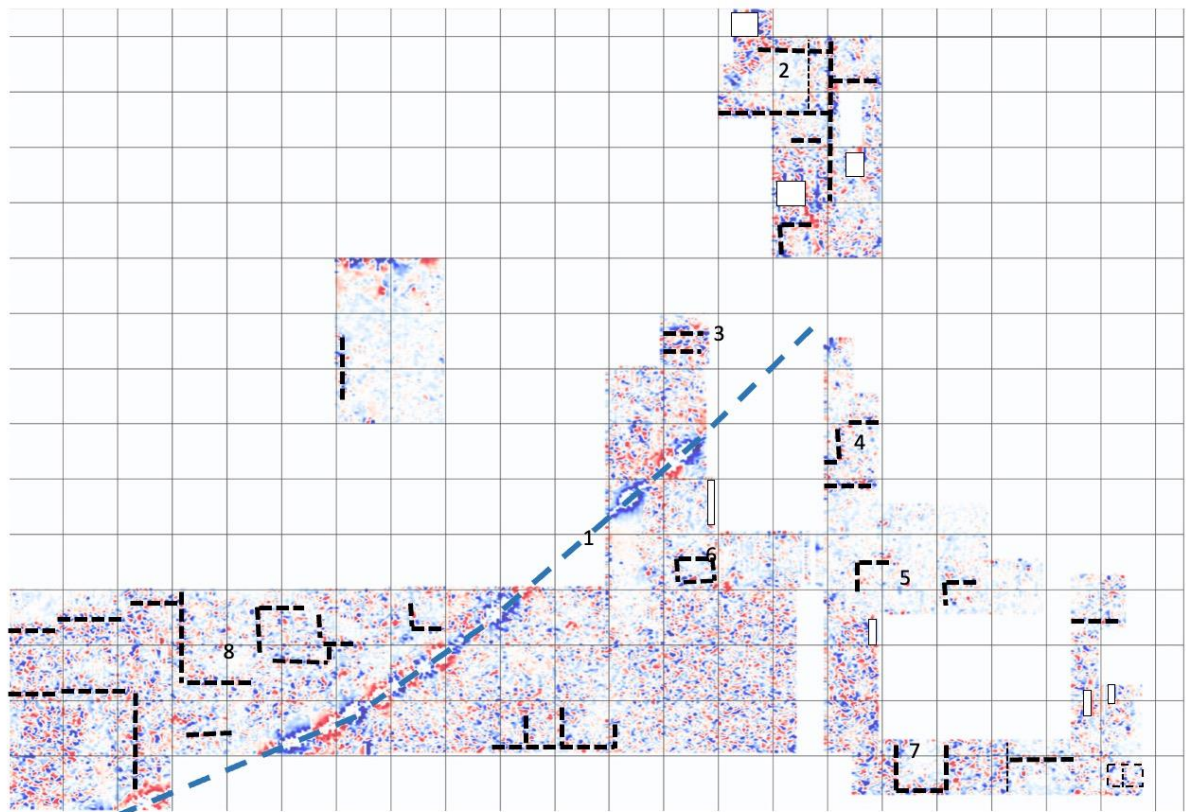


Fig. 3. Map of the magnetic gradient survey and the interpreted linear features.

These walls can be related to the presence of rooms of structures located in the north side of San Juan River. For the moment we could suggest that at least part of the rooms located to the south of the quadrant might be storing rooms, however a deeper investigation on the dimension of the rooms, their limits, and the

investigation of the surface archaeological material distribution, is still needed, and it is in progress. Also, we have taken the first samples to date with archaeomagnetism some of the identified structures along the river, to understand in which phase of the Teotihuacan chronology they were built.

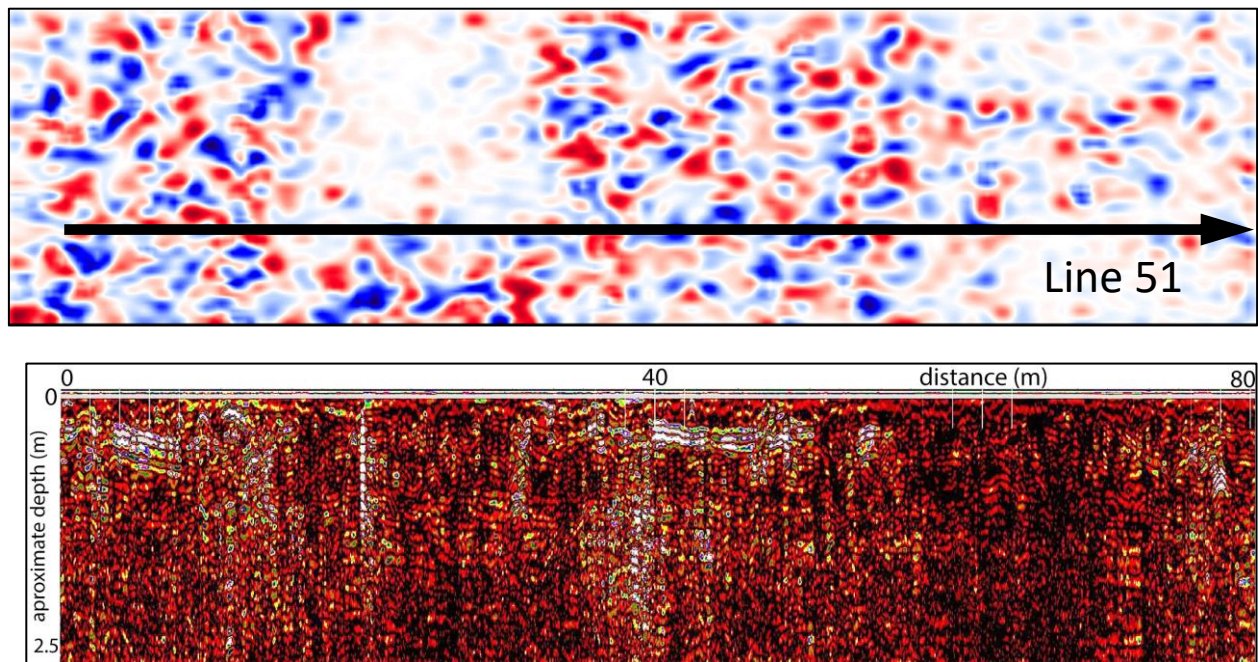


Fig. 7. Comparison between magnetic gradient map of zone 7 and radargram 51.

IV. CONCLUSIONS

The results obtained until now, allow to identify the presence of building's remains below the large plazas built in the last phase of occupation of Teotihuacan that we can record, and confirm the existence of some of the structures already proposed by Millon [4]. These two constructive phases must be better investigated and dated. The georadar study has allowed their identification, but it will be important to have the possibility of carrying out small excavations that would allow to verify these interpretations and take reliable samples to date the construction phases in all the investigated area.

Our work allows to point out that this part of the city suffered a change in the organization of spaces in time, that suggest a different organization of the city itself, monumentalizing spaces in the second phase, by constructing large plazas.

On the other side, in the quadrant N2E1 we identified more and smaller structures than those marked by Millon [8], mainly in the southern part of the quadrant,

close to the river. Although the erosion destroyed at least part of some structures of the northern margin of the river, the relationship of the studied area with the river must be deeply investigated, as it could suggest the presence of buildings devoted to the storage of materials transported through the river. In fact, in this area the San Juan River was modified to run perpendicular to the Street of the Dead, suggesting that the river might have had a crucial role in the city, including the movement of goods. Possibly some of the identified structures could be related to the storage of different materials to be later distributed in the city.

The analysis of the archaeological materials distribution and the chemical residue analysis of the soil samples is also in progress and will be included soon with the rest of the variables to integrate all the information and interpret the use of space in the investigated area. As stated above, our aim is to investigate this area of the city that is located close to the buildings that face the Street of the Dead, but that was not directly related to the street (another point to better investigate in the future), to understand the organization and use of space

in a possible neighbourhood in the center of ancient Teotihuacan.

Preliminary studies suggests that this forgotten area has very interesting information concerning the relationship between the river and the large number of structures built in its northern margin.

Acknowledgments

The project is financed by the Spanish Ministerio de Cultura y Deporte (Ayudas a proyectos arqueológicos en el exterior (2017, 2019, 2022), the Palarq Fundación (2018 y 2019), and it is part of the activities of the Laboratorio de Prospección Arqueológica of the UNAM, the research groups ERAAUB (2021 SGR 00696) and CINAFA (2009 SGR 1078) of the University of Barcelona, as well as the Institute of Archaeology of the UB (IAUB). We thank the Consejo de Arqueología and the Secretaria de Cultura in Mexico for the permission to carry out the project (Oficio 401.1S.3-218/296 and 401.1S.3-219/358).

REFERENCES

- [1] A. Pecci, N. Moragas, A. Ortiz, L. Barba, J. Blancas, Proyecto interdisciplinario para la localización de un centro de barrio en Teotihuacan (México), *Informes y Trabajos: Excavaciones en el exterior*, v.19, 2019, pp. 106-123.
- [2] A. Ortiz, *Determinación de las características de un barrio teotihuacano con arqueometría. El caso de Teopanazgo*. PhD thesis, 2015. UNAM, México.
- [3] L. Barba, El estudio de sitios arqueológicos enterrados desde la superficie, *Anales de Antropología*. v. XXII, 1985, pp. 115-132.
- [4] L. Barba, y L. Manzanilla
"Superficie/Excavación. Un ensayo de predicción de rasgos arqueológicos en Oztoyohualco, Valle de Teotihuacan". *Antropológicas*, n. 1. IIA, p. 19-46. 1988
- [5] J. Blancas, L. Barba, A. Ortiz y D. Carballo
Estudios geofísicos en el Barrio de Tlajinga, Teotihuacán. RIA15-0104, *Revista de Investigaciones Arqueométricas* 1, 1: 10 pp, Octubre de 2015.
<http://www.geofisica.unam.mx/michoacan/ria/>
- [6] A. Ortiz, L. Barba y J. Blancas
Estudios geofísicos en el barrio de San Sebastián Xolalpan, anexo al centro de barrio de Teopanazgo, Teotihuacan. En *Estudios arqueométricos del Centro de Barrio de Teopanazgo en Teotihuacan*. Linda Manzanilla (editora). Coordinación de la Investigación Científica, Coordinación de Humanidades de la Universidad Nacional Autónoma de México. Capítulo 1. Pag: 69-110. 2012. ISBN: 978-607-02-3605-1.
- [7] J. L. Ruvalcaba-Sil, L. Barba, E. Casanova-González, A. Mitrani, M. Muñoz, I. Rangel-Chavez, M. A. Maynez-Rojas and J. Cañetas. Analytical Approach for the Study of Teotihuacan Mural Paintings from the Techinantitla Complex. *Minerals* 2021, 11, 508. <https://doi.org/10.3390/min11050508>
- [8] R. Millon, *The Teotihuacan Map*. University of Texas Press, Austin and London. 1973.
- [9] J. Blancas, *Percepción remota y técnicas geofísicas de prospección para el estudio de un asentamiento del formativo en La Laguna Tlaxcala, México*. Tesis de Maestría de Ciencias de la tierra. UNAM. 2012