

Research Article

Special Section Introduction: Introducing Zacapu archaeology and the Uacusecha project

Grégory Pereira 

French National Centre for Scientific Research (CNRS)/Université Paris I, Paris, France

Abstract

According to Purepecha oral tradition, the ancestors of the Uacusecha dynasty that ruled Michoacan at the beginning of the sixteenth century began their epic in the Zacapu region. The importance of this region also lies in the research carried out since the early 1980s that led to the elaboration of a regional sequence outlining the trajectory of pre-Hispanic societies centuries before the emergence of the Tarascan state.

New research carried out on the area since 2009 has clarified this reference framework and opened new perspectives. The research focused on the Malpaís volcanic flows and its immediate surroundings. It addressed the transformations experienced by pre-Hispanic societies between A.D. 500 and A.D. 1580, and their interactions with the volcanic environment with unprecedented analytical detail. The joint contributions of remote sensing, archaeological fieldwork, dating, and geological study participate in renewing a diachronic approach of this unique landscape of northern Michoacan.

Resumen

Tradicionalmente, la investigación sobre la civilización tarasca se centra en la cuenca de Pátzcuaro, sede del reino a principios del siglo dieciséis. Sin embargo, la región vecina de Zacapu también jugó un papel clave en la comprensión de la génesis de este poderoso estado mesoamericano. La importancia de esta región es subrayada en primer lugar por la propia tradición oral purépecha, transcrita en la *Relación de Michoacán*, que sitúa el primer acto de la epopeya del linaje real cerca de la ciudad de Zacapu. La importancia de la cuenca de Zacapu para la arqueología de Michoacán radica también en las investigaciones realizadas desde principios de la década de 1980 en el marco de una serie de proyectos arqueológicos. Dichas investigaciones permitieron elaborar un marco de referencia regional que traza la trayectoria de las sociedades prehispánicas varios siglos antes del surgimiento del estado tarasco.

Los trabajos recientes realizados en el marco del Proyecto Arqueológico Uacúsecha (2009–2019) y del Proyecto Mésomobile (2015–2018) en el área del Malpaís y su entorno inmediato han permitido precisar este marco de referencia y abrir nuevas perspectivas. Ofrecen la posibilidad de abordado con un detalle analítico sin precedentes las notables transformaciones experimentadas por las sociedades prehispánicas entre los años 500 y 1580 d.C., y sus interacciones con el entorno volcánico. Las aportaciones conjuntas de la teledetección (datos obtenidos por LiDAR en 2015 sobre una zona de 91,3 km²) del trabajo de campo arqueológico, de la datación y del estudio geológico del complejo volcánico participan en la renovación de un enfoque diacrónico a menudo descuidado en los estudios derivados de LiDAR.

At the arrival of the Spaniards, the Zacapu region seemed to hold a peripheral position in the great state system established by Tariacuri and his successors, the geopolitical core of which was located in the Patzcuaro Basin (Pollard 1993). At the end of the Postclassic period, the Lake Zacapu Basin was entirely under the rule of the Irecha of

Tzintzuntzan. The first census conducted by Antonio de Caravajal in 1523, barely a year after Cristóbal de Olid and his men conquered the capital of the Tarascan empire (Espejel 2011; Warren 1989:85–90), indicates that this area was under the authority of two main *cabeceras*. The lord of Huaniqueo controlled the northeastern part of the basin, while the southwestern part was under the dominance of the lord of Cumanchen (Comanja). Zacapu and Naranjan were part of this second entity, and acted as *sub-cabeceras*. The census of Caravajal portrays a region with a relatively limited and dispersed population. For the southern

Correspondence author: Grégory Pereira, email: gregory.pereira@cnrs.fr

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Table 1. Zacapu Basin chronology. Adapted and completed from Michelet 1992.

Period	Zacapu Basin phases	
Early Colonial	Cuarum*	A.D. 1522–1625
Late Postclassic	Tariacuri	A.D. 1450–1522
Middle Postclassic	Milpillas	A.D. 1200–1450
Early Postclassic	Palacio	A.D. 900–1200
Terminal Epiclassic	La Joya	A.D. 800/850–900
Epiclassic	Lupe	A.D. 600–800/850
Middle Classic	Jaracuaro	A.D. 500–600
Early Classic	Loma Alta 2–3	A.D. 100–500
Terminal Preclassic	Loma Alta I	100 B.C.–A.D. 100

* The Cuaurum phase was defined recently from the discovery and excavation of the site of Mich. 415—Las Iglesias (see Lefebvre et al. 2023).

and western sectors of the basin, the census reports between 341 and 782 dwellings, or 1,900–4,379 inhabitants, with the widely used coefficients (Migeon 1991, 2016:23). Even if we consider the effects of minimization evoked by several authors (Espejel 2011; Migeon 2016; Warren 1989:89–90) and double the number of inhabitants, by taking into account settlements in the territory of Huaniqueo (304–822), we are still a long way off the 80,000 inhabitants estimated by Gorenstein and Pollard (1983) for the Patzcuaro Basin at that time.

Despite these figures, which may seem very low, Zacapu and its region played an essential role in the ideology of the rulers of Tzintzuntzan. According to Alonso de La Rea (1882 [1639]:44–45), the prestige of Zacapu in the eyes of ancient Purepecha people was comparable to that of ancient Rome for Christians. According to the chronicler, the *cazonci*, accompanied by the great lords of the kingdom, made an annual pilgrimage to the city to make offerings in a temple dedicated to Curicaueri. The importance of the city is also underlined by the long justification drawn up by Tariacuri to exhort his nephews to become masters of the city (Alcalá 2000 [1541]:464–566). This symbolic pre-eminence was undoubtedly largely due to the region's role in the Uacusecha epic, as recounted in the annual festival of Equata Cónsquaro (Alcalá 2000 [1541]:333–340). During this major ceremony, the *petamuti* reminded the subjects of the kingdom of the history of the reigning lineage and of the many twists and turns that accompanied peregrinations in early times. This history is one of migration that began when a Chichimeca group, the Uacusecha, arrived in the Zacapu Basin around the thirteenth century under the aegis of their leader, Hire Ticatame. Their stay in the region seems to have been rather short and ended as a result of conflicts with indigenous populations, who finally managed to drive out the Chichimeca, who went on to find refuge on the northern shore of Patzcuaro Lake. But beyond these misadventures, the Zacapu episode is undoubtedly mentioned because it is marked by an important event: the first

alliance between the Chichimeca and local inhabitants, sealed by the marriage of Hire Ticatame and a Naranjan princess. This event prefigures the network of alliances that the Uacusecha were able to set up to establish their power throughout the region.

For the archaeology of Michoacan, the region of Zacapu is also important for its rich and still relatively well-preserved heritage, but also because of the numerous research programs carried out there. It is indeed in this zone that one of the first regional-scale research programs was launched at the beginning of the 1980s (Michelet 1992; Michelet et al. 1989). Many important research studies had been conducted prior to that in the state, but they often focused on a specific site or period. The Michoacan Project laid the foundations for approaching the evolution of settlement systems over time, owing in particular to the construction of a chronology of 1,600 years, which is still a reference today (Table 1). The Uacusecha Archaeological Project (2009–2019) continues that research, subsequent research conducted in the 1990s. Some of the results of the project will be presented in this special section of *Ancient Mesoamerica*.

The present article aims to put this new research into a broader perspective, combining knowledge about the north of Michoacan with research carried out in the Zacapu region. Recent developments—in particular, the acquisition of LiDAR data—provide us with the possibility of revisiting some of the major issues of regional archaeology and open up new perspectives.

The Zacapu region: geographical context

The Zacapu region is located on the northern edge of the Michoacan highlands (Figure 1) and is part of the Trans-Mexican Volcanic Belt (Demant 1992; Mahgoub et al. 2017; Reyes-Guzmán et al. 2018). From a geological point of view, the landscape presents characteristic features. Like many of the great depressions of the Trans-Mexican Volcanic Belt, the Zacapu depression was an endorheic lake basin (250 km²) surrounded by Quaternary volcanic mountains rising more than 2,000 m above sea level (Demant 1992; Dorison et al. 2018; Reyes-Guzmán et al. 2018; Tricart 1992). The climate and vegetation are of tropical mountainous type (Dorison 2019; Labat 1992), but it also differs from the more southerly regions (the Patzcuaro Basin and Meseta Tarasca) in that it is at a slightly lower altitude, which determines a warmer and less humid climate. Before it dried up at the beginning of the twentieth century, the body of water at the bottom of the basin (the Ciénega) was also shallower than that of Patzcuaro, and probably also less easily navigable (Arnauld et al. 1993; Pétrequin 1994). The Zacapu Basin, like the neighboring Cuitzeo Basin, is in fact a lower plateau of the highlands preceding the great alluvial valley of the Lerma River to the north. The region is thus at the crossroads of two large ecosystems that also correspond to two pre-Hispanic cultural areas: the cold and humid Tarascan highlands in the south, and the lower and more arid northern regions of the Bajío.

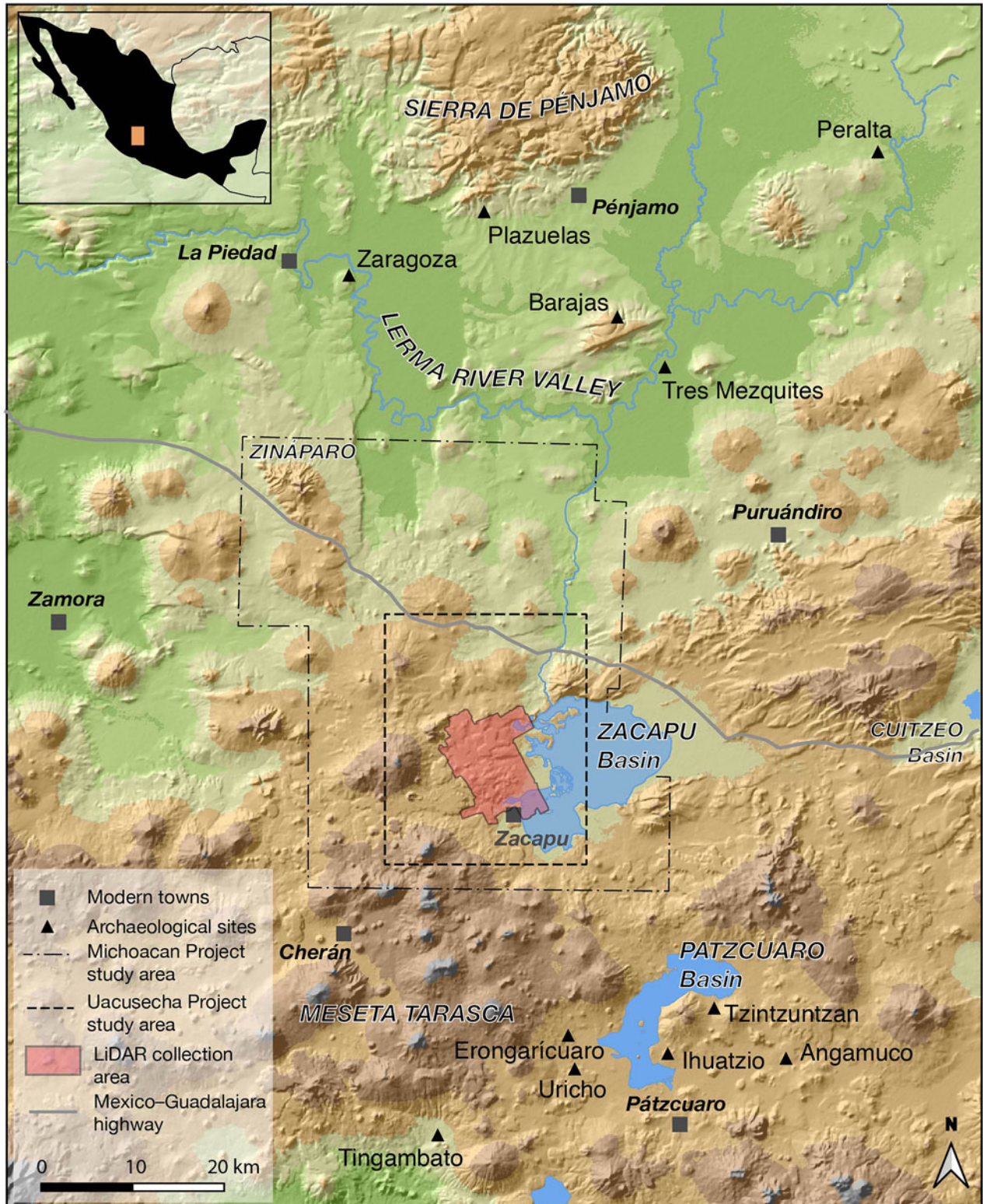


Figure 1. Map of northern Michoacán, showing the location of the studied area and the surrounding regions and major known sites.

By this specific location, the region of Zacapu is involved in two macro-regional issues: the emergence and organization of the Tarascan state specific to the Michoacán highlands (Gorenstein and Pollard 1983; Pollard 1993, 2008), and the

fluctuations of the northern Mesoamerican frontier and the migrations associated with it (Armillas 1964, 1969; Braniff C. 1994). It is the convergence of these two major issues that makes the archaeology of the Zacapu region unique.

Research history in the Zacapu region

Interest in the archaeology of the Zacapu region dates back to the end of the nineteenth century and to the first explorations conducted by Carl Lumholtz in his famous 1896 expedition to northern and western Mexico (Lumholtz 1986 [1904]; Lumholtz and Hrdlička 1898). Despite these early beginnings, research prior to the 1980s was scarce and limited (Caso 1930; Freddolino 1973). At the outset of the Michoacan Project, fewer than 10 sites were reported in the scientific literature (Michelet 1992:16) and archaeological excavations had mainly concerned the site of Palacio (Forest 2020).

The early 1980s thus marked a turning point. At that time, two projects brought new data on the Zacapu Basin. The ENAH Patzcuaro-Cuitzeo Project, directed by G. Sapiro (Espejel 2014:52–54), organized prospection on the southern bank of the basin in 1983 and 1984, resulting in the identification of about a hundred sites. Unfortunately, this research was interrupted by the accidental loss of the project leader. The Michoacan Project developed by the Centro de Estudios Mexicanos y Centroamericanos (CEMCA), under the direction of Michelet (1992), began at the same time for a period of five years (1983–1987). It covered an area of 1,000 km², extending from the foothills of the Meseta Tarasca in the south to the Lerma River Valley in the north, and included the western part of the Lake Zacapu Basin. The primary objective of the project was to reconstruct, in the long term, the evolution of settlement patterns throughout the study area, involving extensive survey of sites and the setting up of a reliable chrono-ceramic sequence through radiocarbon dating (Michelet 1992; Michelet et al. 1989:79–80). The research carried out recorded 366 settlements of all types (see Michelet 1992:18–33), 66% of which could then be dated from the study of material collected on the surface (pottery collected in 70% of the sites), in test pits (108 at 70 sites), or extensive excavations (seven sites). With the exception of two rock shelters found in the northern portion of the zone that could be assigned to the Paleoindian and Archaic periods (Faugère-Kalfon 1996:125–130), the remaining sites are placed in a sequence (Table 1) beginning at the end of the Preclassic period (100 B.C.) and extending to the Late Postclassic (A.D. 1500).

Research then rapidly focused on more specific questions that were studied in greater depth. Systematic survey and excavation carried out by Arnauld and colleagues (1993) in the Lomas sector made it possible to approach the question of the settlement of the lake area and to define the cultural complexes of the Late Preclassic, Classic, and Epiclassic periods (Loma Alta, Jaracuaro, and Lupe phases). The in-depth study of the Loma Alta site revealed significant development at the end of the Preclassic and the beginning of the Classic period (Carot 2001, 2004). Research conducted by Faugère-Kalfon (1996) in the Vertiente Lerma zone (southern Lerma watershed) documented fluctuations in the settlement in relation to the broader changes on the northern Mesoamerican frontier. In the same sector, the large obsidian deposits of

Zinaparo-Varal were studied in detail by Darras (1999), providing new knowledge on the systems of exploitation and distribution of this vital resource. Finally, Postclassic settlement is particularly well-represented in the volcanic heights of the Zacapu Malpaís, where intensive research has been conducted on urban settlement organization (Michelet 1988; Michelet et al. 1988, 2005; Migeon 1984, 1991, 2015) and burial practices (Puaux 1989).

At the end of this first phase of studies, the main lines of settlement in the region had already been outlined (Arnauld and Faugère-Kalfon 1998) and some important results had been highlighted: (1) the Late Preclassic and Classic settlement was centered on the lake area; (2) the Epiclassic occupation corresponded to the colonization of all the ecosystems in the region; (3) an abandonment process occurred in the northern sector (Vertiente Lerma) in the twelfth to thirteenth centuries; (4) while in the Zacapu Malpaís area, important urban settlements were formed and abandoned before the arrival of the Spaniards in the region.

New research followed this substantial and founding work, exploring various aspects of the region's archaeological past. From 1988 to 1991, a new phase of the Michoacan Project (named Michoacan II), directed by M.-C. Arnauld and P. Pétrequin, investigated the evolution of the environment in the Zacapu Basin through a program of sediment coring in the ancient lake (Pétrequin 1994). This interdisciplinary research documented an 8,000-year-old paleoenvironmental sequence and identified the first evidence of agricultural land clearance dating back to the beginning of the second millennium B.C. (a period still unknown to archaeology). Unfortunately, sedimentary records corresponding to the last two millennia were not preserved, depriving us of valuable information on environmental conditions during the periods documented by archaeology.

The decade of the 1990s saw the development of new research as part of three distinct projects. First, the project, Ciénega de Zacapu, led by M. E. Fernández-Villanueva (Centro Regional INAH Michoacan) in 1992 and 1993 (Fernández Villanueva 1992) focused on the site of El Palacio, which had been little studied until then by researchers of the Michoacan Project. This involved the partial topographic survey of the site and the excavation of a habitation dated to the Milpillas phase. Then, work carried out by S. Pulido Méndez and his team (Dirección de Salvamento Arqueológico of INAH) in 1994, during the construction of the Maravatio-Zapotlanejo section of the Mexico-Guadalajara highway, extended the inventory of existing sites (Pulido Méndez et al. 1995, 1996). The construction of the highway in the northwestern part of the lake basin and in the Vertiente Lerma area provided the opportunity for new surveys, extending to about 6 km on either side of the new road. In the first sector, which was still unexplored at the time, 43 settlements were identified, while 55 sites were located in the second sector (including several already inventoried in the 1980s). Finally, new research took place from 1993 to 1997, as part of a third phase of the Michoacan Project (named Zacapu Project), directed by M.-C. Arnauld. This initiative was less concerned

with extending survey coverage (only four new sites were identified) than with developing further questions that had arisen based on earlier survey results. Four themes were developed:

- (1) The archaic occupation of the region was further documented by the exhaustive excavation of the Los Portales Cave (Mich. 389), where remains of pre-pottery settlement, dated to 5200 to 2000 B.C., were recovered (Faugère-Kalfon 2006).
- (2) The settlement patterns in the Lomas area were clarified by the in-depth study of the sites of Loma Alta (Carot et al. 1998) and Potrero de Guadalupe (Pereira 1997, 1999). Extensive excavations yielded new data on the occupational sequence, architecture, and burial practices at these sites for the period A.D. 1–900. This research was continued from 1996 to 1998 as part of the Architecture de Loma Alta project, directed by P. Carot, which revealed the important architectural development of the site and some of the ritual activities that took place there (Carot and Ponce López 1997; Carot et al. 1998).
- (3) The systems of exploitation and distribution of obsidian were completed by the excavation of the sites of El Durazno (Mich. 407) and Las Iglesias del Cerro de la Cruz (Mich. 101), two workshops in use for the production of prismatic blades during the Postclassic, located at some distance from the Zináparo-Varal deposits (Darras 2008).
- (4) Finally, new research was carried out on the large urban settlements of the Malpaís (Michelet 1998, 2000; Michelet et al. 2005; Migeon 1998). In fact, while research conducted in the 1980s made it possible to locate a large number of sites, detailed but incomplete plans had only been plotted for the site of Las Milpillas (Mich. 95), accompanied by extensive excavations. In order to better grasp the extent of the postclassic settlements on the Malpaís, their chronology, and to conduct population estimates, a systematic survey was carried out on the sites of El Infiernillo (Mich. 38) and Malpaís Prieto (Mich. 31), supplemented by more succinct operations (partial plans and surveys) at El Palacio (Mich. 23) and other smaller sites.

These latter works clarified settlement patterns in the Malpaís and its immediate surroundings. The results indicated that the large settlements of the Milpillas phase (A.D. 1200–1450) had been able to house 13,500–16,500 inhabitants and that their development may have involved a significant influx of exogenous population (Michelet 2008). Indeed, while some earlier settlements (Lupe, La Joya, and Palacio phases) were known, particularly in the southern part of the Malpaís, they did not seem to be sufficiently numerous to envisage a natural increase in the local population. It was therefore logical to assume that a large part of the Milpillas settlement phase was the result of migration that occurred from the thirteenth century onwards, originating in northern regions (Michelet et al. 2005). Furthermore, the absence of typological markers

from the Tariatari phase in most of the studied sites showed that the Malpaís settlements had been largely abandoned long before the Spanish conquest. Finally, evidence of abandonment rites observed in the hearths of houses in several of these sites implies that this abandonment was not sudden, but organized (Migeon 2003). The archaeological data obtained in Zacapu thus seemed to validate, in part, the narrative recorded in the *Relación de Michoacán*. However, it also showed quite a different reality from that of the narrative, particularly in terms of the scale and nature of the phenomenon, and raised other questions.

The Uacusecha archaeological project

The decade of the 2000s marked a pause in the research conducted in Zacapu. During this period, the researchers involved in the Michoacan Project decided to undertake research in the Bajío region that would open up new perspectives on the integration of this region with the northern Michoacan. In particular, the results obtained in the Barajas Massif, located on the northern bank of the Lerma River, some 40 km north of the Zacapu Basin, clarified settlement variations in this part of the Bajío region, where sedentary occupation came to an end around the ninth to tenth centuries (Migeon and Pereira 2007; Pereira et al. 2001, 2005). It thus preceded the abandonment of the Vertiente Lerma zone and suggested a gradual contraction of the northern border towards the southern highlands. It could therefore be assumed that the population movements accompanying this contraction took the form of repeated displacements over short distances, marked by successive reorganizations of settlement networks.

The resumption of research as part of the Uacusecha Archaeological Project (2009–2019) was consistent with the questions raised by movements at the northern border, of which the Chichimeca migrations reported by the *Relación* were only the last episodes (Pereira 2016, 2018). This return to Zacapu allowed us to re-examine previously obtained data and to consider them from the perspective of a long-term process. Additionally, initial data could be enhanced by the use of new methods and approaches. These should lead to a better characterization of the urban phenomenon of the Zacapu Malpaís and place such phenomenon into a diachronic perspective, and the context of broader social change that led to or pre-dated the formation of the Tarascan state.

The early stage of the project (2009–2014) sought to characterize the societies that lived in the urban areas of the Malpaís during the thirteenth and fourteenth centuries. Admittedly, many results had been acquired during previous research. However, the latter still offered a partial view of the occupation of the Malpaís and the use of new, previously unavailable methods made it possible to update various aspects of our knowledge. The contributions of GPS mapping, GIS processing of spatial data, and, finally, LiDAR coverage (from 2015 onwards) allowed us to envisage site organization with considerably increased resolution. In this context, the spatial analysis of the urban sites was largely completed and systematized

by Forest (2013, 2014, 2018, 2020), highlighting the logic of urban organization and inter-site variations. In addition, the extensive excavations carried out on the site of Malpaís Prieto provided new data on the domestic and ceremonial life of these supposedly Chichimeca urban populations. The excavation of four domestic units, corresponding to different socioeconomic sectors of society, provided a wealth of information on domestic architecture, material culture, and resource management (Forest et al. 2018; Pereira and Forest 2011; Pereira et al. 2012). Operations conducted in the main ceremonial center of the site (Pereira and Michelet 2018; Pereira et al. 2018b) provided new insights into architecture, spatial organization, and ritual practices. Finally, the stratigraphic data obtained during the various excavations, combined with absolute dating, enabled us to specify the duration of site occupation and to explore patterns of site formation and abandonment (Pereira et al. 2021).

The materials recovered also open new avenues of research for the study area. The study of pottery led to the development of a new technological approach to Postclassic productions (Jadot 2016), which shows the existence of discontinuity in vessel-shaping processes compared to earlier productions. Lithic productions in obsidian (analysis carried out by V. Darras and M. Forest) and dacite/andesite (analysis carried out by O. Quezada, UNAM) enable us to envisage the supply networks of the Malpaís Prieto urban community. The archaeozoological study of the faunal remains, for its part, has brought to light, in a systematic manner, the use of fauna for both food and ritual purposes (Manin 2015, 2018; Manin et al. 2015). The implementation of a soil-sampling protocol for the systematic extraction of archaeobotanical remains, moreover, has resulted in the development of carpological and anthracological analyses (Elliott and Pereira 2015). Human remains have been studied and are still undergoing studies related to morphology (Natahi 2019; Natahi et al. 2019), bone modifications related to activities and pathologies (ongoing analysis conducted by I. Barrientos, UNAM), isotopic signatures (analyses of carbon, nitrogen, and oxygen carried out by A. Manin, Muséum national d'histoire naturelle, and of strontium by D. Price, University of Wisconsin, as part of the ANR Mésomobile Project), and paleogenetics (analyses conducted by X. Roca Rada as part of a Ph.D. dissertation under the direction of B. Llamas, University of Adelaide). Finally, a program of radiocarbon (AMS) and archaeomagnetic dating (sampling of the hearths and the analyses were carried out by A. Chauvin and M. Gómez-Paccard, University of Rennes) has been carried out in order to improve occupation sequence resolution of all four Malpaís urban settlements sites (Pereira et al. 2021).

In a second phase of the project, initiated in 2014, research has been extended beyond the boundaries of urban settlements in order to place them in a broader regional and diachronic perspective. One aim was to define the hinterland of these sites in order to better understand their territorial influence and the possible impact of their

agricultural supply activities on soils and landscapes (Dorison 2019). The second was to assess the extent to which the Middle Postclassic urban settlements in the Malpaís formed a break with respect to previous (Epiclassic and Early Postclassic) or later (Recent Postclassic and Colonial) phases of occupation, and to re-evaluate the consequences of the changes observed in different spheres (settlement networks, exploitation of resources, mobility of populations). From this perspective, it was necessary to define the occupation of all the Malpaís volcanic flows and their immediate surroundings, and to compare the evolution of this area with other neighboring areas.

This new research was made possible by the ANR research program “Mésomobile: Mobilités, territoires et mutations sociopolitiques dans le centre-ouest de la Mésoamérique,” which funded a large number of analyses and field studies. As part of this program, a LiDAR coverage of 91.3 km² was carried out over almost the entire Malpaís and its immediate surroundings. The results presented in this special section were greatly enhanced by this new source of information, which has been used to address a variety of issues.

Before introducing specific topics in this section, some general information on the operations carried out in recent years is called for. During the second phase of the Uacusecha Archaeological Project, new surveys were undertaken in and around the Malpaís, as well as in the surrounding areas. The objective was to improve the archaeological map of the zone and its chronology. Thus, new visits were organized in already known sites in order to refine their geolocation, and to characterize their size, organization, and chronology. These new surveys also recorded 64 new sites, detected by pedestrian survey (20) or thanks to LiDAR data (44). Surface artifact collections, test pits, or more extensive excavations (sites Mich. 415, 416, 428) were carried out at 29 of these new sites. Other previously recorded sites were explored and surveyed further and more systematically, which greatly clarified their chronology. The ongoing analyses of the collected material remains have supported the improvement of the regional chronology (Table 1) and expanded our knowledge on diverse aspects, such as economic organization, human populations, or ritual practices, aspects that will only be mentioned briefly in this special section.

Finally, it is important to note that this novel research benefited greatly from the fruitful collaboration of archaeologists with the volcanologists from the Instituto de Geofísica at the Universidad Nacional Autónoma de México, who, under the direction of C. Siebe, are carrying out in-depth research on the eruptive sequences of the highlands of Michoacan and, more particularly, those of the Zacapu Basin (Mahgoub et al. 2017; Reyes-Guzmán et al. 2018; Siebe et al. 2014). This work has characterized and dated the Zacapu Malpaís volcanic formations. Such results are important to investigate the exploitation of lithic resources and the evolution of the landscape under the effect of eruptions.

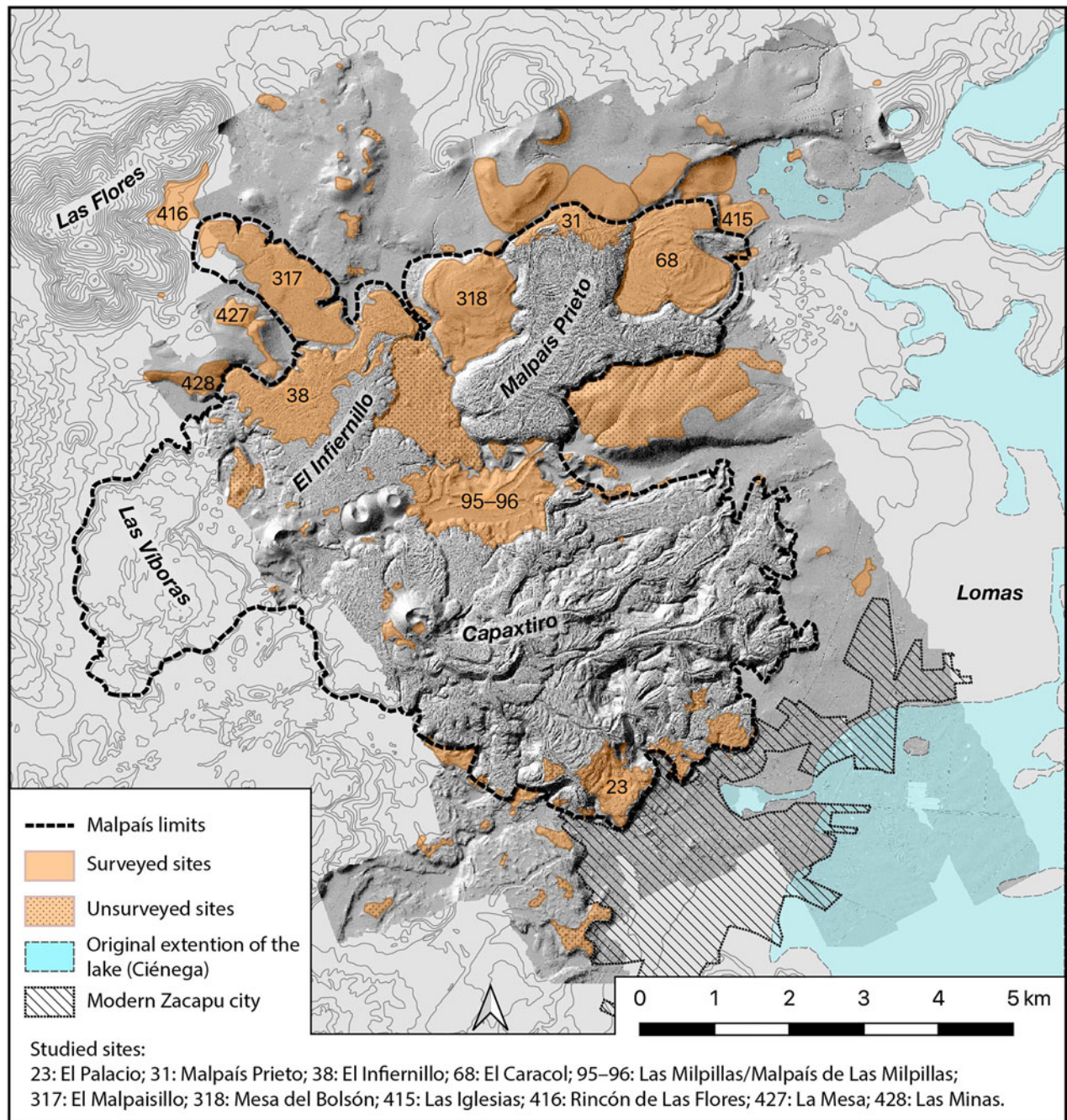


Figure 2. Distribution of sites located in the area covered by LiDAR in and around the Zacapu Malpaís.

Archaeology and landscape in northern Michoacán: revisiting the archaeology of the Zacapu Malpaís from the perspective of LiDAR data

Since its first introduction to the field of Mesoamerican archaeology in 2009 (Chase et al. 2011), the application of light detection and ranging (LiDAR) has steadily advanced our knowledge of archaeological sites and their environment. The data obtained by airborne laser scanning and data processing adapted to the detection of archaeological topographical anomalies (Fernandez-Diaz et al. 2014) suddenly multiplied the perception of an archaeological reality

that had long been hampered by the visual barriers imposed by vegetation. For Chase and colleagues (2012), this new technology marks a genuine revolution for Mesoamerican archaeology, in light of the new perspectives it offers for revealing the innumerable sites preserved in forest environments (Fisher et al. 2017). There is no doubt that the resulting data not only change our perception of diverse types and dimensions of sites (Canuto et al. 2018; Inomata et al. 2020), but they also enable us to observe the landscapes in which they are located on an unprecedented scale and with unparalleled precision, revealing innumerable transformations brought about by humans over time.

The archaeology of Michoacan has benefitted greatly from these new advances over the past few years. The first study on the subject was conducted in 2013 as part of the LORE-LPB project, directed by C. Fisher (Chase et al. 2012; Cohen 2016; Fisher and Leisz 2013; Fisher et al. 2019). Applied to the *Malpaís* of Rancho Seco (southeast of the Patzcuaro Basin), it revealed considerable pre-Hispanic settlement at the Angamuco site, which gave rise to research studies focused mainly on the urban organization of this settlement occupied during A.D. 300–1530.

The huge archaeological potential of the Zacapu Malpaís area understandably motivated the LiDAR coverage of this area. This operation was coordinated by J.C. Fernandez-Diaz of the National Center of Airborne Laser Mapping (University of Houston) and was carried out in March 2015. It led to the acquisition of data over an area of 91.3 km², which includes a large part of the volcanic flows of the Malpaís, as well as the areas bordering it to the north, east, and south. The accuracy of the generated digital elevation model is 50 cm per pixel, thus offering sufficient resolution to detect a large number of topographic changes of anthropogenic origin. The LiDAR coverage extends over a total of 84 sites (Figure 2), 40 of which had been previously identified. New data from these sites have considerably improved the quality of information, as most of them were only very partially known. The extension and organization of a number of these sites could thus be reassessed by means of various computer-mapping operations (Dorison 2019; Forest et al. 2020), combined with field campaigns conducted between 2015 and 2019 (Pereira et al. 2016, 2018b). The LiDAR data also located 44 new sites, only nine of which have been verified in the field so far. Based on their morphological characteristics, 35 unverified sites were associated with a chronological period—however, they must be explored in the future.

Until now, research focused on two main areas: the northern part of the Malpaís, characterized by a high concentration of sites that include three of the four urban settlements; the southeastern part of the Malpaís, separated from the first by the imposing Capaxtiro flow, where lies the site of El Palacio-La Crucita (Mich. 23), as well as satellite sites. In addition, the LiDAR-derived data have opened new avenues for volcanology research in the area, documenting, among other things, the formation processes of the Malpaís Holocene flows (Reyes-Guzmán et al. 2021).

In this special section of *Ancient Mesoamerica*, we aim to present the recent results of archaeological research at the Zacapu Basin that integrates LiDAR data. We emphasize an important aspect, difficult to address in LiDAR-based research: the diachronic evolution of the local landscape. Indeed, although the image generated with LiDAR data gives the illusion of a photographic snapshot, it is obviously the result of the long evolution of landscapes and the extraordinary corpus of anthropogenic features displayed was formed in different temporalities. Landscape was continuously reshaped from 3200 B.P. (the first major Holocene eruptions; see Mahgoub et al. 2017) to March 2015. The challenge is thus to map the large number of features “exposed” by the LiDAR data, but also to place them in

the temporal framework in which they can be correctly interpreted. Although we are still far from completing the interpretation of the 91.3 km² covered by the LiDAR survey, the following contributions shed light on several critical episodes of this long history.

The present compilation proposes six contributions addressing diverse facets of the archaeology of the Zacapu region. They have in common the use of LiDAR data as an important source complementary to archaeological fieldwork. But these data, above all, are used to address specific issues and a diversity of approaches (micro-regional settlement patterns, intra-site organization, agrarian features, geo-archaeological approaches, volcanology, volcanic stone quarry systems) and periods (mainly from the Classic/Epiclassic period to early Colonial times). It illustrates how the Malpaís volcanic flows have been alternately considered as attractive and repulsive, and how the combination of human and volcanic activities contributed to shaping the northern Michoacan highlands landscape and societies.

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