Chapter 17
Development of Pressure Blade Technology in North-Central and Western Mexico

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17.1 Introduction

Among the numerous Mesoamerican studies on obsidian blade production, several stress as a particularly significant factor the sociopolitical complexity of the societies in which it developed (for examples, see Santley 1984; Santley et al. 1986; Spence 1981, 1987; Clark 1987, 1989). The latest publications led by Kenneth Hirth (Hirth and Andrews 2002; Hirth 2003, 2006), which describe the mechanisms regulating obsidian blade production, distribution, and consumption in several regions of Mesoamerica at diverse periods of pre-Hispanic history, make clear the large diversity of social and political contexts in which the technology developed.

Despite uncertainty as to its place and moment of origin, the prismatic blade is present in most regions of Mesoamerica from the Early Pre-Classic, more precisely from 1200 B.C. However, some regions, especially in North-Central and Western Mexico, are noticeably different (Fig. 17.1). In these areas, the prismatic blade was an imported product that was not introduced until the end of the Pre-Classic period, and its technology then developed along various paths without – a priori – any spatial logic. On the other hand, during the Proto-Classic (A.D. 1–250; Table 17.1), percussion blade manufactures acquired increasing importance in the lithic systems alongside flake and bifacial industries. Pressure blade technology was only introduced at the end of the Epi-Classic (A.D. 750–900), for the Mexican Far West, and the end of the Early Post-Classic (A.D. 900–1100), for the Northern Michoacan, replacing the older tradition of obtaining percussion blades.

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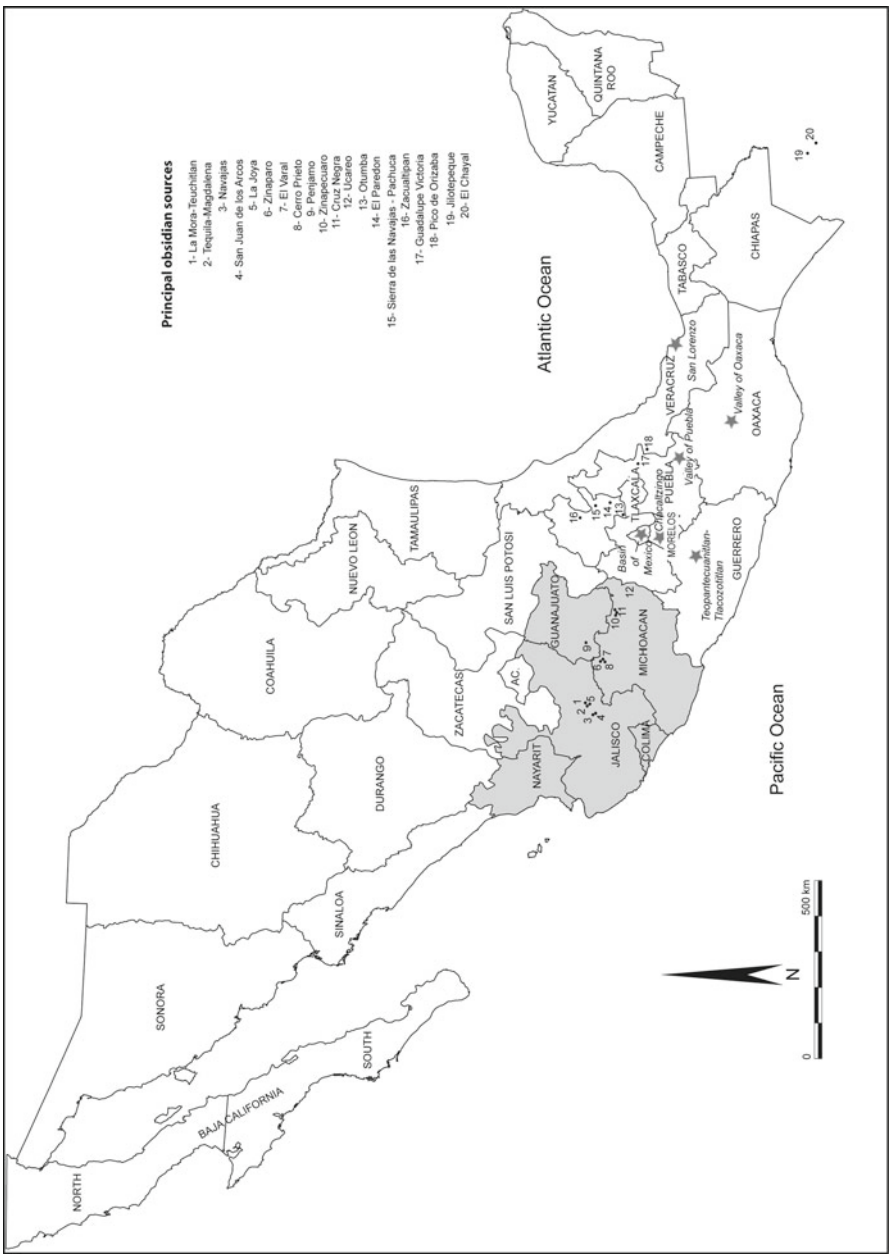

Fig. 17.1 Western area and principal obsidian Mesoamerican sources mentioned in the chapter (Drawing by V. Darras)

Table 17.1 Chronological chart of Mesoamerica and regions mentioned in the chapter

	Period	Jalisco central highlands (Beekman and Galvan 2006) Nayarit/ Colima	Jalisco highlands (Beekman and Weigand in press)	Zacapu region (Michelet 1992) Northeast Michoacan (Oliveros 2004)	Lerma/ Acambaro (Darras and Faugère 2005; Hernandez 2006)	Basin of Mexico
1500						
1450						Azteca IV
1400						Azteca III
1350	Late post-classic				Late Acámbaro	Azteca I
1300				Milpillas *Development of the prismatic blade technology*	Early Acámbaro	
1250						
1200						
1150	Middle post-classic		Aztatlan			
1100						
1050						
1000						Mazapan
950			*Development of the prismatic blade technology*			
900	Early post-classic			Palacio	Perales Terminal	
850				La Joya		
800			Teuchitlan II			
750		El Grillo				
700				Late Lupe		
650	EPI-classic			*Ucareo*		Coyotlatelco
600				*Prismatic blades*	Perales	Metepec
550			Teuchitlan I	Jarácuaro		
500	Middle classic					
450		Late Tabachines		*Pachuca and Ucareo*		
400				*Prismatic blades*		Xolalpan
350		?		Loma Alta 3	Choromuco	
300			Ahualulco			
250	Early classic			*Pachuca and Ucareo*	Mixtlán 2	Tlamimilopa
200				*Prismatic blades*		

(continued)

Table 17.1 (continued)

	Period	Jalisco central highlands (Beekman and Galvan 2006) Nayarit/ Colima	Jalisco highlands (Beekman and Weigand in press)	Zacapu region (Michelet 1992) Northeast Michoacan (Oliveros 2004)	Lerma/ Acambaro (Darras and Faugère 2005; Hernandez 2006)	Basin of Mexico
150		Middle Tabachines				
100						Miccaotli
0				Loma Alta 2	Mixtlán 1	Tzacualli
50	Proto-classic or	Early Tabachines	Late El Arenal			Cuicuilco
100	Terminal pre-classic			Loma Alta 1	Transition	
200			Early El Arenal			
300						
400	Late pre-classic				Late Chupicuaro	Ticoman
500						
600			San Felipe		Early Chupicuaro	
700	Middle pre-classic					
800						
900		Capacha				
1000						
1100						*Presence of the prismatic blade technology*
1200						
1300	Early pre-classic					
1400						
1500				El Opeño		

We put forward here a synthesis of the available data for two regions of North-Central and Western Mexico: one set from the Jalisco Highlands and the other from Northern Michoacan and the Middle Lerma Valley, also referred to as Bajio. Studying the lithic systems developed by the populations living in these regions allows us to focus on the conditions under which pressure blade technology appeared and explore various hypotheses. In what way did social and political factors interact with its development? Why such a delay for its adoption, despite the abundance of high-quality obsidian sources and the early existence of particularly dynamic cultural centers?

17.2 The Beginnings of the Prismatic Blade in Mesoamerica

Though the origin of the technique, the moment in which it appeared, and how it expanded are not perfectly known (see the works of Parry 1994; Hirth and Flenniken 2002; Darras 2005a), the studies on the Pre-Classic period in the Mesoamerican highlands and lowlands show the obsidian prismatic blade was present at several settlement sites in the Early Pre-Classic from 1200 B.C. The most precise data concerns the Olmec site of San Lorenzo (Cobean et al. 1971, 1991), on the Gulf coast, the Mexico Valley sites (Niederberger 1976; Boksenbaum 1978; Boksenbaum et al. 1987), and, finally, several establishments in the Tehuacan and Oaxaca valleys, in the highlands of South-Central Mexico (MacNeish et al. 1967; Pires-Ferreira 1975, 1976; Elam et al. 1994) and the Maya lowlands. Prismatic blades are also observed during this period in the State of Guerrero (Niederberger 1976, 1986, 1987). In Morelos, prismatic blades appear between 1050 and 900 B.C. (Grove 1974, 1987; Burton 1987). They are always found as finished products, and without any other artifacts, such as cores or preparation flakes and blades, to indicate on-site production. Cores, although still rare, begin to appear in a few settlement sites in the Basin of Mexico toward 1000 B.C., such as those of Zohapilco (Niederberger 1976), Tlapacoya (Narez 1990), Tlatilco (Niederberger 1987), or Coapexco (Boksenbaum 1978; Boksenbaum et al. 1987). At the site of Chalcatzingo (Morelos), workshops producing prismatic blade appear about 700 B.C. (Grove 1987; Burton 1987).

From as early as 800 B.C., the whole of Central and Southern Mesoamerica was using prismatic obsidian blades and most of the regions were embedded in long-distance exchange networks. Geographically, prismatic blades covered a geocultural area affected, directly or indirectly, by the Olmec phenomenon. Characterization analyses have revealed the diversity of supply sources, but the two sources supplying the bulk of the raw material for making prismatic blades have been found to be Otumba and, more significantly, Ucareo-Zinapecuaro (Michoacan) in the Eastern part of our research area (Figs. 17.1, 17.2).

In general, the data available for the Early and Middle Pre-Classic period is insufficient to determine how prismatic blades were produced; the earliest sites to manufacture blades are still unknown. Boksenbaum (1978); Boksenbaum et al. (1987) proposed a scenario in which traveling craftsmen prepared cores close to obsidian deposits and then produced and distributed the blades throughout the settlements, thereby creating a consumption market and an extended network of dependence. Overall, the information available today designates Highland Central Mexico as a crucial region, which, owing to the abundance and quality of its obsidian deposits, seems to have been the prime mover involved in the invention of pressure blade technology and the organization of production systems with long-distance circulation networks.

But whereas most of Mesoamerica is involved in the prismatic blade phenomenon, the regions in North-Central and Western Mexico remained outside of the process, despite the fact that Ucareo – one of the main deposits to have played a leading role in this economy – is far to the West.

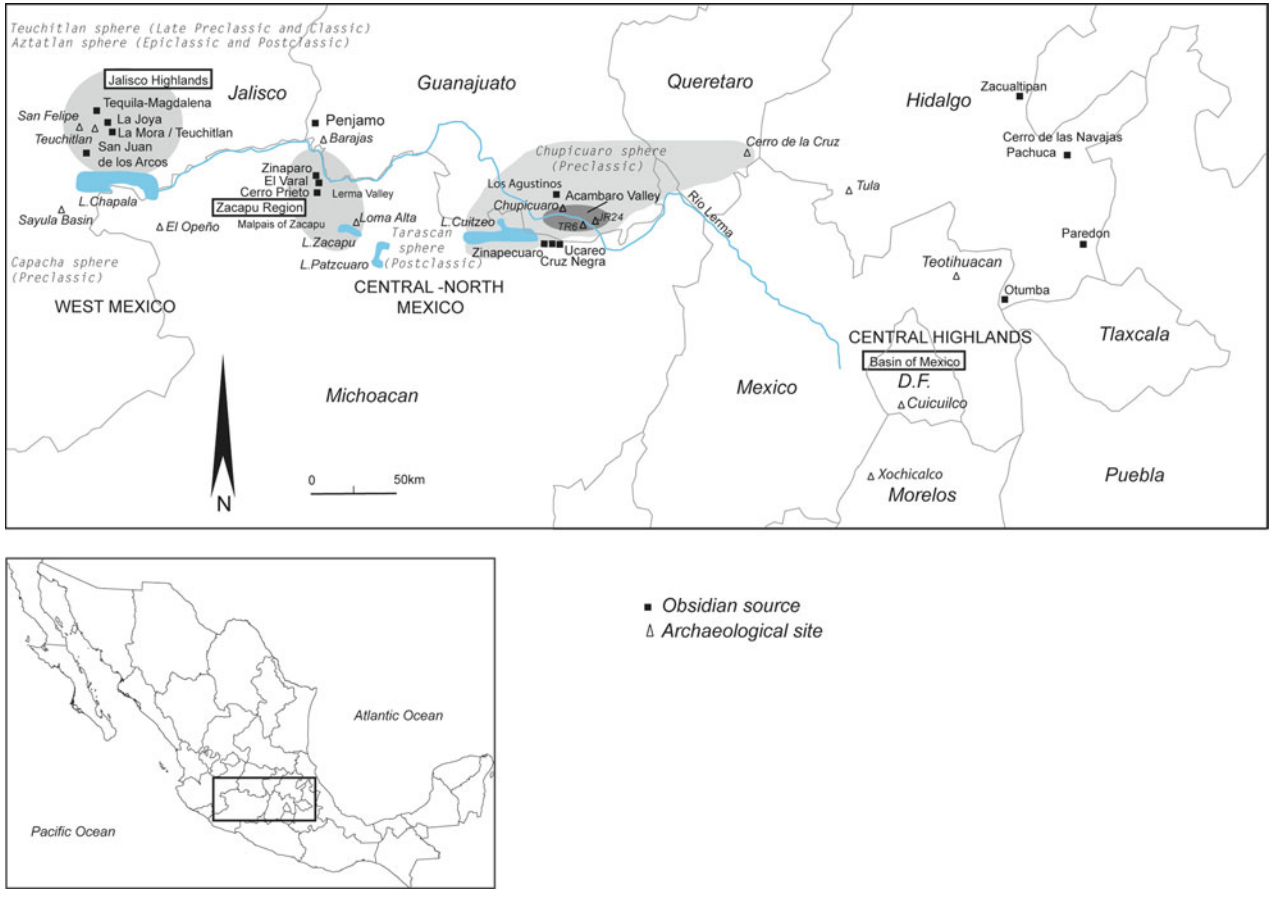

Fig. 17.2 West and North-Central Mexico (Drawing by V. Darras)

17.3 Obsidian in North-Central and Western Mesoamerica

The regions in North-Central and Western Mexico are integrated as one of the ten geocultural areas defined by Paul Kirchhoff in his 1943 definition of Mesoamerica (Western Mexico). This area brings together the modern States of Michoacán, Jalisco, Colima, and Nayarit and a part of the States of Guanajuato, Guerrero, Zacatecas, Durango, and Sinaloa (Figs. 17.1, 17.2). Traversed by the trans-Mexican neovolcanic axis, the whole region is rich in lithic raw material, especially obsidian, since it contains various sectors with excellent quality deposits that were all systematically exploited during the pre-Hispanic era (Fig. 17.2). For the purposes of this chapter, we will focus upon Teuchitlan, in the State of Jalisco, which comprises numerous deposits and mine workshops, including those of La Mora-Teuchitlan, Tequila-Magdalena, San Juan de los Arcos, and La Joya and Navajas; the Zinaparo region in North-Western Michoacan, with three different sources – El Cerro Varal, El Cerro Zinaparo, and El Cerro Prieto; and finally, in the North-East corner of the same State, the Ucareo-Zinapecuaro complex consists of three sources – Ucareo, Zinapecuaro, and Cruz Negra.

Most of the regions in this cultural area have long been considered marginal, as they do not meet all of the criteria required for being really "Mesoamerican," and so have not been the subject of extensive long-term archaeological studies. As a result of this lack of interest, the archaeological information available for the area is uneven in both quantity and quality and is clearly behind the advances achieved in the other regions of Mesoamerica. Numerous efforts undertaken over the last 20 years have now mitigated this notion of marginality, and today, research as a whole tends to stress the idea of multiple trajectories, certainly characterized by their originality, but fully involved in the more global Mesoamerican dynamics. Nevertheless, despite a definite renewed interest in the issues, research on the lithic industries plays a minor, even nonexistent, role. In reality, technological studies have not been developed, and only those carried out in Northern Michoacan and Guanajuato (Darras 1993, 1994, 1999, 2005a, 2005b, 2008; Lodeho 2007; Healan 1997, 2002, 2003, 2004, 2005) are relevant to our study. Data on the Jalisco Highlands is still incomplete, despite several publications on the subject (Soto de Arachevaleta 1982, 2005; Weigand and Spence 1982; Spence et al. 2002; Esparza and Ponce Ordaz 2005).

17.4 Early and Middle Pre-Classic Obsidian Industries in Western Mexico

Archaeological knowledge of Early and Middle Pre-Classic occupations in all the regions of Western Mexico comes exclusively from the evidence of burials. This period is known through two cultural traditions called "El Opeño" and "Capacha" (Fig. 17.2). The first tradition developed between 1500 and 1000 B.C. and the second between 1000 and 800 B.C.: they were thus contemporaries of the main cultural

centers of Central Mesoamerica, notably the Gulf coast (Olmecs) and the Basin of Mexico. The characteristics of burial furnishings indicate that they were agrarian societies with complex sociopolitical and religious organization (Kelly 1980; Oliveros 2004). The observations on the lithic industries come from artifacts recovered from fill deposits or burial offerings. At El Opeño in North-Western Michoacan, a region where the nearest obsidian sources are approximately 40 km away, the obsidian material appears to consist of flake industries and bifacial tools; the latter artifacts are generally found as burial offerings[1] (Oliveros 2004). As for the Capacha tradition archaeological contexts, found in the modern States of Colima and Jalisco – zones where the nearest obsidian sources are roughly 30 km away – they generally yield reduced quantities of this material, mainly in the form of flakes and projectile points (Kelly 1980; Mountjoy 2004). Obsidian blades, prismatic or nonprismatic, are completely absent (Kelly 1980: 83). Finally, in the Jalisco Highlands, the sparse information available for the San Felipe phase (about 1000–300 B.C., although still poorly dated) (Weigand 2000: 65) is also remarkable for the absence of blade industries and the exclusive existence of flake industries and bifacial production.

17.5 Blade Industries in the Jalisco Highlands

Blade production in the Mexican West raises a certain number of issues – chronology in particular – owing to the extreme complexity of its archaeological contexts.[2] Today, we benefit from only one really thorough study on the obsidian technologies used in the specialized workshops at the Teuchitlan site[3] (Soto de Arachevaleta 1982, 2005), occupied mainly from the beginning of our era to A.D. 700, but afterward also occupied by Aztatlan tradition populations[4] (about A.D. 900; Fig. 17.2).

[1] The obsidians' provenance has not been determined.

[2] We mean this situation is linked to the complexity of the stratigraphic contexts.

[3] The Teuchitlan site has given its name to a cultural phenomenon that developed in the modern States of Jalisco, Colima, and Nayarit between 300 B.C. and A.D. 900. It is mainly defined by circular public architectural complexes: a circular patio was bordered by a circular platform backed by several rectangular buildings and surrounding a central circular pyramid (these circular complexes are named Guachimonton). The other distinctive features of the Teuchitlan tradition are shaft tombs and the production of large clay and hollow anthropomorphic figures. The peak of the Teuchitlan tradition may be placed between A.D. 400 and 700 (Beekman and Weigand, 2000, 2010).

[4] The Aztatlan tradition refers to a cultural phenomenon that developed in the Mexican West and North-West, in the modern States of Jalisco, Nayarit, Durango, and Sinaloa, between A.D. 900 and 1,350/1,400. Based on the characteristics of certain features of its material culture (its pottery above all), several authors have associated it with the Mixteca-Puebla complex (which refers to a particular ceramic style and iconography), while others have found links with the Toltecs. In general, these authors agree on attributing the Aztatlan tradition to foreigners coming from the Central Highlands (Mountjoy 2000). Their success seems to have been due to prolific and diversified craftsmanship – copper working, work in shells, pottery, obsidian debitage – and a very structured widespread trading system (see Mountjoy 1990; Kelley 2000).

Based on studies of more than 200,000 artifacts recovered from surface collections and excavations in the obsidian workshops, this work describes two types of blade debitage carried out simultaneously: percussion and pressure, although without reconstituting the details of their respective reduction sequence (Soto de Arachevaleta 2005: 274). This major work has acted as the starting point for other publications suggesting the presence of prismatic blade technology in the Teuchitlan region from the Proto-Classic, i.e., the beginning of our era (Weigand 2000; Spence et al. 2002). All the same, these suggestions do not accord with recent archaeological data from stratigraphic excavations. These underline the systematic absence of prismatic blades from layers previous to the Epi-Classic, i.e., before the ninth century A.D. (Beekman, 2007, personal communication; Calgaro 2007; Lopez personal communication in 2007; Reveles 2005; Liot et al. 2006). On the other hand, the same research attests to the presence of tools made from obsidian macroblades. This finding may even apply to the Teuchitlan site: although it is true that prismatic blades are found in abundance there, they always appear on the surface, and Esparza and Ponce Ordaz stress that their presence occurs above all in Epi-Classic and Early Post-Classic contexts together with a diminution of macroblade artifacts (2005: 150). These "anomalies" have made us take a second look at the issue of pressure blade debitage chronology and revise the available literature, in order to date its beginnings more precisely. This revision, enhanced by exchanges with several specialists in Jalisco highland archaeology (in particular Phil Weigand, Chris Beekman, Lorenza Lopez, Catherine Liot, and Javier Reveles), has enabled us to reach the conclusion that the prismatic blade most probably remained a very rare artifact until the Epi-Classic period and supports the hypothesis of a late development for its technology.

17.5.1 The Prismatic Blade During the Final Pre-Classic and Classic Periods

So far, no archaeological records dated with certainty to these periods have yielded prismatic blades. In reality, when they are found, they come from long-distance exchanges. Phil Weigand notes the presence of a pressure blade of green obsidian from Pachuca (a deposit in the State of Hidalgo more than 500 km away) in the Capilla sector at Teuchitlan (Spence et al. 2002: 71). Other examples in green obsidian, also from Pachuca, have been found in the Basin of Sayula in contexts thought to date from the beginning of the Sayula phase (A.D. 550–1000, Reveles 2005: 368; 2007, personal communication). These blades, which are mainly surface finds, have a single-facet punctiform platform (Reveles, 2005: 359, personal communication). These few foreign artifacts, associated with rare "Thin Orange" sherds, are evidence of the existence of circulation routes, albeit little-used, between the Mexican West and the Central Highlands (Weigand 1990, 1993). In reality, in these very Western regions, the prismatic blade's manifestation in lithic assemblages coincides with the local development of its technology.

17.5.2 Percussion Blade Industries: A Regional Tradition Widely Predominant During the Classic Period

In spite of the unanswered questions connected with pressure blade debitage, all of the available information for the Western regions of Mexico confirms that, as early as the Proto-Classic period, obsidian working had acquired an essential place, as seen in jewelers' ornamental work in the form of pendants, pectorals, beads, mirrors, anthropomorphic figurines, etc. Similarly, tools made from macroblades, such as scrapers and large bifacial knives, find an important place in the archaeological assemblages. In addition, the fact that the greatest Teuchitlan civic-ceremonial centers were placed next to high-quality obsidian sources is evidence of the material's strategic importance.

The first signs of percussion blade production can be perceived in the Arenal phase (300 B.C.–A.D. 200). In their 2002 publication, Spence et al. mention two blades designated as "flake blades,[5]" as part of a surface collection gathered on the El Arenal site in the Basin of Eztatlan. This collection of 75 artifacts is made up of scrapers, bifacial pieces, and the two irregular blades whose description is not given. According to the same authors, surface collections gathered from at least five sites dated without any possible distinction from the Arenal to the succeeding phase – Ahualulco (A.D. 200–400), located in the Tequila Valley – attest to the existence of an industry producing both large irregular blades (flake blades), generally having a single-facet platform, as well as more regular blades (fine blades). They also mention the occurrence of ground platforms and ask whether the abrasion technique used for ornamental objects was transferred to blade technology and the preparation of core platforms (Spence et al. 2002: 66). According to the same authors, unlike the Arenal phase shaft tombs, which contained particularly rich obsidian furnishings of ornaments (pectorals, beads, pendants, etc.) and so-called ritual objects (bifacial knives) (ibid.: 65), certain shaft tombs from the Ahualulco phase seem to have yielded blade macrocores. One of them – Las Cuevas – yielded seven macrocores, the largest of which measured 45 cm long and 25 cm wide (ibid.: 66). Other shaft tombs excavated by Galvan Villegas (1991) in the Atemajac Valley (Jalisco) also contained blade products – some retouched bifacially: burial 17 yielded an incomplete blade in black obsidian with bifacial retouches 12 × 2.4 cm, which must have measured about 18 cm (ibid.: 181); a large blade of 19 × 4.2 × 1.3 cm made from red obsidian was found in grave 18 (ibid.: 184). These tombs, according to a revision by Beekman (Beekman and Galvan 2006; Beekman 2006), seem to date from the Tabachines phase (300 B.C.–A.D. 600), and most probably from the Middle Tabachines subphase (100 B.C.–A.D. 200).

[5] To describe their material, the authors divided the blades into two large categories: "flake blades and fine blades." The former are "more roughly formed and generally broader, with somewhat irregular edges and dorsal arrises" (in English) (Spence et al. 2002: 63). The latter are "narrower and highly regular in form, with linear dorsal arrises" (in English). No indication is given about the proximal parts.

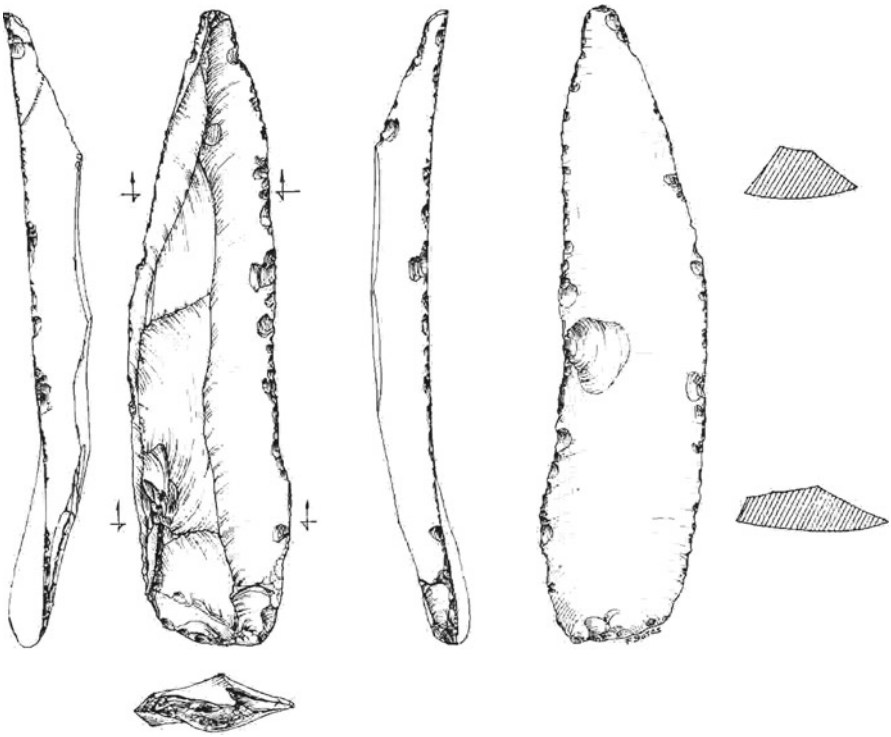

Fig. 17.3 Macroblade found in the Teuchitlan workshop (in Soto de Arachevaleta 2005: 147, Fig. 2: picked and ground platform – no scale)

As for research at the site of Teuchitlan – considered to be the regional capital – it showed the artifacts made from obsidian macroblades are widely prevalent in the lithic assemblages, alongside nonspecialized flake industries. Surface collections generally supply blade products from at least two *chaînes opératoires*, one using percussion and the other pressure (see, e.g., Esparza and Ponce Ordaz 2005). As we have mentioned, Soto's research examined the technological aspects of this blade production, studying a production workshop 200 m from the ceremonial center (1982, 2005). Besides the evidence for pressure blade production, his work casts light on the manufacture of macroblades by direct percussion from conical cores,[6] of which the average dimensions are 6.3 cm wide (±2.2 cm), 19.7 cm long (±5.8 cm), and 3.5 cm thick (±0.4 cm) (Soto de Arachevaleta 2005: 145; Fig. 17.3). The author mentions the predominance of faceted or ground platforms, both for percussion and

[6] Of the 229,421 artifacts collected from this workshop, only 52 correspond to cores or core fragments. Twenty-three of them have a prepared platform, 3 smooth, 7 faceted, and 11 ground. But these cores are not differentiated nor connected to a particular *chaîne opératoire*.

for pressure blades.[7] These macroblades were used as blanks for making a variety of tools, mostly distal scrapers and bifaces. Soto's studies do not enable the precise reconstruction of the *chaînes opératoires* associated with the two techniques, and integrating certain categories of artifacts, for example, macroblades, in one or the other production process. For this reason, several questions remain unanswered: What were the stages followed for one or the other process? What was the final form of the cores used for percussion? How can the very small proportion of this category of objects in the workshop be explained? How is it possible to explain the coexistence of three types of platforms – implying three types of preparation – for a single category of artifacts? Was the pecking and grinding technique really used to prepare the striking platforms for supplying percussion macroblades? Or was it rather used on the cores for pressure blade production?

Lastly, in the Sayula Basin, some 60 km South of the Tequila Valley in a region without obsidian deposits, evidence for the existence of percussion blade production is found from the Late Usmajac phase (200 B.C.–A.D. 300; Valdez et al. 2005). More precisely, macroblades detached by direct percussion appear during the first century A.D. (Reveles 2005: 359; 2005, personal communication) and may have been used in connection with exploiting salt. According to Reveles, they were not manufactured in the Sayula Basin but imported as finished products. Furthermore, characterization analyses indicate the deposits of Las Navajas and San Juan de los Arcos, about 40 km to the North, were the main supply sources. Little information is available on these obsidian deposits, but surface observations made at several quarry workshops associated with that of San Juan de los Arcos indicate production mainly consisted of percussion macroblades. A lot of blade refuse has been found there, including numerous exhausted macroblade cores with average dimensions varying between 15 and 22 cm long, 10 and 16 cm wide, and 3 and 5 cm thick. These percussion cores are tabular in form with a totally flat face and rectangular cross section. They have a single-facet and oblique platform, more rarely faceted, and the blades were removed only from one of the two principal faces, the unused face with cortex or bearing percussion scars.

The data from the westernmost regions thus seems to suggest the existence of percussion blade production from the very beginning of our era. Moreover, this technology seems to have been predominant throughout the Classic period. The final purpose of these reduction sequences seems to have been to produce macroblades or blades as blanks for instruments such as scrapers or bifacial knives. The *chaînes opératoires* used for this technique are still not very well understood, and numerous questions remain unanswered, such as when the pecking and grinding technique was first developed and how it was used. In any case, we think the exploitation of certain deposits, such as San Juan de Los Arcos, could have been connected

[7] Of the 7,327 macroblade platforms it has been possible to examine, 3,287 were grinding and 2,595 had a multifaceted surface – the others being with a single facet or cortical. Among the complete blades or proximal fragments obtained with the pressure technique, which number 13,394, 7,562 have ground platform, 3,791 multifaceted platforms, and 1,856 single-facet platform.

to these industries. Although the *chaînes opératoires* cannot be known in detail, most of the production from the workshops of this deposit is highly similar to that from the Zinaparo – El Varal workshops 200 km to the East – where we have worked – and which we shall discuss below.

17.5.3 Pressure Blade Technology: A Late Development Connected to the Aztatlan Tradition (A.D. 800/900–1350)

Just as for percussion, the conditions under which pressure blade production was developed in are still not understood in the most Western regions of Mexico. Notwithstanding a few publications proposing that the technology was present in the Teuchitlan zone from the beginning of the Classic (Soto de Arachevaleta 1982; Spence et al. 2002), it now appears established that it did not arise until later during the Epi-Classic, probably from the ninth century, and really only spread from the Early Post-Classic, i.e., from A.D. 900. Recent archaeological studies associate its development with the rise of the Aztatlan tradition (Beekman personal communication in 2007); Lopez personal communication in 2007; Reveles 2005; Mountjoy 2004). When it appears, whether in ceremonial or residential areas, the prismatic blade is made from regional obsidians – the La Joya deposits above all, but also Teuchitlan – La Mora and Magdalena –Tequila. The La Joya source, producing mainly green-colored obsidian, is especially interesting since the start of its systematic exploitation coincided with the development of pressure blade workshops on the island of Las Cuevas-Atitlan in the Teuchitlan Lake Basin. According to Weigand (1993: 220; Weigand and Spence 1982; Spence et al. 2002: 72–73), this island went in for large-scale production of prismatic blades – workshops spread over 15 ha having been identified. The obsidian arrived from the La Joya deposits across the lake in polyhedral cores. Nothing is known about production organization or the *chaînes opératoires*, but according to available information, the whole production process was carried out there in order to produce finished blades. The blades extracted were quite large – on average 2 cm wide, about 15–20 cm long, and 5 mm thick. Weigand mentioned the largest prismatic blade found measured 30 cm long and 2 cm wide (personal communication in 2007), and in the Sayula Basin, a blade made from La Joya obsidian was 22.5 cm long with a width less than 2 cm (Reveles, personal communication in 2007). All these blades have a ground linear but well-defined platform and are also slightly curved (Fig. 17.4).

Most of the production from the Las Cuevas workshops is dated from the Early and Late Post-Classic period and should be related to the development of the Aztatlan cultural complex. This was the time when most sites in the West began to make regular use of prismatic blades – all coming from the main Jalisco deposits, La Joya in particular. According to various authors, the circulation of certain varieties of obsidian and artifacts like prismatic blades was controlled by the elites (Liot et al. 2006, 2007; Lopez-Mestas 2007). In the Sayula Basin, for example, the site of La Peña – occupied from the Early Post-Classic by Aztatlan tradition populations

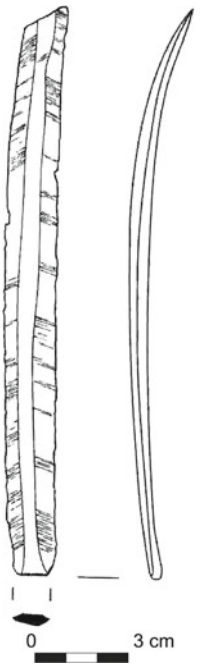

Fig. 17.4 Prismatic blade found in the Sayula basin (in Reveles 2005: 365, Fig. 5d)

foreign to the local substratum – seems to have monopolized a certain number of specialized activities, including pressure blade production, and have supplied the rest of the basin (Liot et al. 2006, 2007).

So, according to information available today, blade pressure technique first would appear in the Highlands of Jalisco right at the end of the Classic or at the start of the Early Post-Classic, i.e., between A.D. 800 and 900. Prismatic blade production progressively supplanted percussion blade, and its development seems to have been closely connected to the rise of the Aztatlan cultural tradition.

17.6 Blade Industries in Northern Michoacan and Middle Valley of the Lerma

Let us now take a close look at the situation in North-Central Mexico, more precisely North Michoacan and the Middle Valley of the Lerma, between the Jalisco Highlands and the Central Highlands (Fig. 17.2). Owing to its geographic situation, between two particularly remarkable influential regions (Teuchitlan and Basin of Mexico), but also to the intersection of other cultural spheres (hunter gatherers, Mazahua, Otomis, etc.), this region has always been considered a strategic communication route, a corridor in which certain political entities destined to play an essential role in the history of Central Mexico crystallized (see, e.g., Brambila and

Crespo 2005). Looking beyond remains such as monumental architecture, ceramics, or mortuary features, less prestigious evidence such as lithic industries also contributes to the debate about the regional cultural identity between the Pre-Classic and the Late Post-Classic. The many archaeological studies that have been conducted in this region since the mid-1980 enable us to have a global view and reconstruct behavior relating to the lithic economy quite clearly.

17.6.1 The Prismatic Blade During the Pre-Classic and Early Classic: A Rare Product Obtained Through Medium and Long-Distance Exchange

As in most Mesoamerican regions, when the prismatic blade appears in North-Central Mexican lithic assemblages, it does so as a foreign product, acquired through medium and long-distance exchange networks. Its presence is only attested from the Late Pre-Classic (400–100 B.C.).

The first archaeological data on the region's trajectories concerns the Chupicuaro culture, which developed during the Middle and Late Pre-Classic, between 600 B.C. and A.D. 250 (Porter Noé 1956). An interdisciplinary project has been ongoing since 1999 in the Acambaro Valley, considered the culture's heartland (Darras and Faugère 1999, 2007). Its objective is to reconstruct the population dynamics with the aim of obtaining a clearer idea of the role of Chupicuaro in the regional and supraregional processes. The three main concerns are to identify the origins of the Chupicuaro peoples, who formed agrarian societies with a complex sociopolitical organization; to better understand the cultural content at the peak period, between 400 and 100 B.C.; and to comprehend the nature of its relations with neighboring populations, especially in the Basin of Mexico (Darras and Faugère 2007; Darras 2006). In the Chupicuaro region (Fig. 17.2), the technical systems developed using obsidian were structured around flake industries, producing expedient instruments and a few categories of standardized tools. The populations of the Acambaro Valley mainly supplied themselves from the three regional sources[8] (Cruz Jimenez, personal communication in 2005; Lodeho 2007); geographic proximity seems to have been a significant, but not decisive, criterion for the strategies adopted.[9] The high proportions of eroded cortex flakes, as well as the identification of

[8] The three deposits of the nearby region are Los Agustinos, Ucareo, and Zinapécuaro. Some distant deposits are also found (Cerro Zinaparo and Cerro Varal, 150 km to the West and Pachuca 200 km to the East).

[9] Variability from one site to another is found: site JR 24, on the right bank, was massively supplied from the Los Agustinos deposit (77.5%), 20 km as the crow flies, and next from Ucareo (12.5%), on the left bank and at the same distance; the deposit of Zinapecuaro, also on the left bank but 40 km away, only represents 5%. On the other hand, for site TR6, on the left bank, 63.8% of the obsidians came from Los Agustinos, only 16 km as the crow flies, but on the other bank of the river; 13.3% came from Ucareo – the closest deposit: 15 km – and 9% from Zinapécuaro (32.5 km away). The rest comes from distant sources. The Ucareo results will be discussed below.

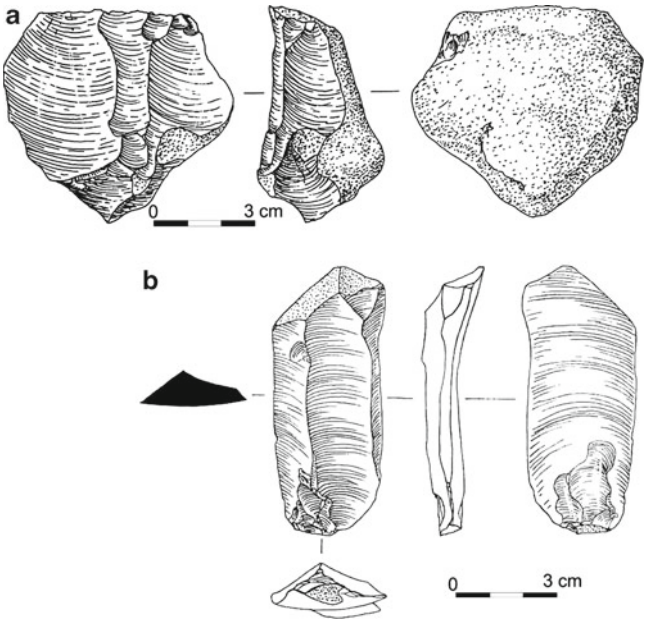

Fig. 17.5 (**a**) Unipolar core (JR 24–319) and (**b**) percussion short blade with cortical platform in Chupicuaro (JR 24–56) (Drawing by F. Bagot)

unworked nodules of moderate weight, between 0.5 and 2 kg, show that the raw material was obtained from surface collections and that it reached the sites without having been prepared at the quarry. Typo-technological study of assemblages collected at two settlements in the valley[10] (Lodeho 2007) reveals three types of production using distinct methods: multidirectional debitage, "salami-slicing" with nodules long in shape, and direct unipolar percussion debitage, to produce short unstandardized blades (Fig. 17.5a, b). These different types of production needed only a limited technical investment, but produced a varied range of flakes capable of being used either directly, without intentional modifications as an instrument, or to make various categories of specialized tools. Unipolar flakes were sought to meet the aim of obtaining blanks more suitable for making pedunculate scrapers. The blanks made with these debitage systems seem to have met the needs of these populations and allowed tool sets to be made for the whole range of tasks required.

Alongside these local industries, some imported artifacts have been identified, including very rare prismatic blade segments at site TR 6 (Fig. 17.6). These specimens were collected from layers dated between 300 and 100 B.C. and constitute 0.2% of the Late Chupicuaro phase obsidian collection (2,494 artifacts). They consist of four mesial fragments and one distal, made with translucent gray-black obsidian

[10] Sites JR 24 and TR 6 excavated as part of the Chupicuaro project (directed by V. Darras and B. Faugère).

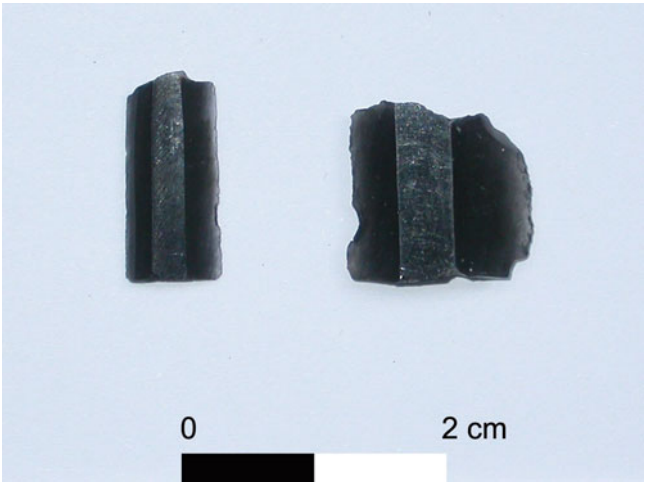

Fig. 17.6 Prismatic blade fragments found at Chupicuaro (TR 6–79) (Photo by V. Darras)

from the Ucareo source.[11] It is interesting to observe that only the excavations at TR 6 yielded artifacts of this kind as neither the excavations at JR 24, about 10 km away as the crow flies, nor those at Chupicuaro, between 1946 and 1947, recovered prismatic blades. These five examples are the only evidence of pressure blades coming from stratigraphic contexts that can be confidently assigned to the Late Pre-Classic in this region of Mexico.

Not until the transition period between the Pre-Classic and the Classic – commonly called Terminal Pre-Classic or Proto-Classic (100 B.C.–A.D. 250) – does the presence of the prismatic blade become more evident in the lithic assemblages in the Western and North-Central regions. This artifact is then found next to flake industries made from regional obsidians, or basalts and andesites also of regional origin.

The sites occupied during this period developed in the lake basins of the North-Central region (Acambaro Valley, Cuitzeo Basin, Patzcuaro Basin, Zacapu Basin, Fig. 17.2). Archaeological investigations have yielded green obsidian prismatic blades from the source of Pachuca at a distance ranging from 200 km (Acambaro Valley) to 320 km (Zacapu Basin, Fig. 17.2) depending on the site (Darras 1993; Darras and Faugère-Kalfon 2007; Carot 2001; Filini and Cardenas 2007; Macias Goytia 1990; Pereira 1999). Additionally, several of these sites, such as Loma Alta, also acquired blades in translucent gray-black obsidian from Ucareo (Manzanilla Lopez 1984; Darras 1999; Pereira 1999, personal communication in 2007). The first instances of green prismatic blades in these various regions were associated with the rise of Teotihuacan in the Valley of Mexico. But, although these products were circulated, they are found in only moderate proportions and in particular contexts – such as burials (Fig. 17.7; Darras 1993; Carot 2001). The blade represented a special and

[11] Analyses by B. Gratuze and S. Boucetta, IRAMAT, Orleans (*Institut de Recherche sur les Archéomatériaux*).

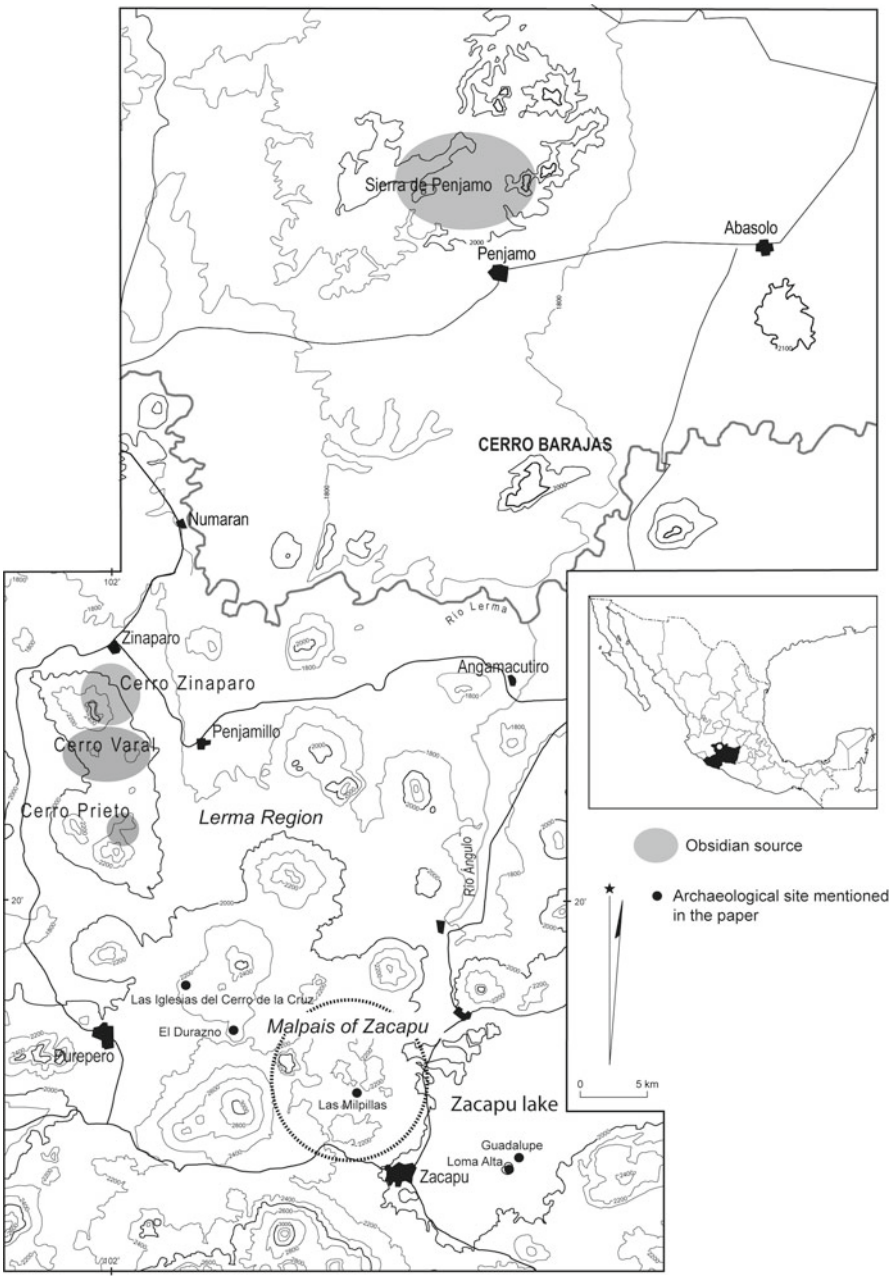

Fig. 17.7 Pachuca green prismatic blades found at Loma Alta (S3 C.7) (Drawing by F. Bagot)

unusual object, perhaps acquired and used by a certain fringe of the population involved in the interaction networks emanating from Teotihuacan. The contexts that they are found in, and the fact that they show no intentional retouching, nor obvious usewear, seem to indicate a specific use – perhaps linked to bloodletting rituals (Darras 1993, 1998; Pereira 1999; Carot 2001).

During the Late Pre-Classic and Early and Middle Classic – and in the whole region of Central-North and Western Mexico – the obsidian prismatic blade evidently remained a rare object acquired through exchange. But its relatively constant proportions in the lithic collections indicate a real and stable presence in the long- and middle-range circulation networks. There were two networks, which were probably independent of each other. The first was directly linked to the Basin of Mexico and Teotihuacan, covering a distance between 200 and 350 km depending upon the context being studied; this network provided the green blades. The second was linked to the Ucareo deposit North-East of Michoacan, covering an area between 20 (Acambaro Valley) and 120 km (Zacapu Basin); this network provided the black-gray blades.

17.6.2 The Particularity of Ucareo, Michoacan

This obsidian source has a special place in the history of the prismatic blade technology. Located in the North-East of Michoacan, it seems to have played a leading role since the Early and Middle Pre-Classic within the obsidian circulation networks in Central and Eastern Mesoamerica. The provenance analyses of the obsidian artifacts recovered at the Olmec sites of San Lorenzo or La Venta, and contemporary sites in the Oaxaca Valley and the Basin of Mexico, show that this deposit was an essential source, comparable to Barranca de Los Estetes (Otumba) or El Chayal (Guatemala) (Boksenbaum et al. 1987; Cobean et al. 1971, 1991; Elam et al. 1994). Furthermore, Ucareo ranks, alongside Otumba, as one of the first sources to supply the raw material used to make the prismatic blades recovered from these consumer sites. This importance increased over the following centuries as it became the main supply source for sites in Central Mexico, such as Xochicalco, between A.D. 650 and 900 (Hirth 1995, 2002, 2006), and Tula, between A.D. 900 and 1200 (Healan 1997, 2002, 2003, 2004, 2005). Healan's research conducted in the Ucareo-Zinapecuaro region since 1994, investigating the nature of obsidian exploitation between the Epi-Classic and Post-Classic, and the region's relations with Tula, has not been able to reveal evidence for obsidian extraction and transformation during this early period. The earliest archaeological evidence in this region for the systematic exploitation of obsidian sources and workshops connected to pressure blade technology dates from the Epi-Classic or Early Post-Classic period. If Healan's research results cast more light today on how Ucareo obsidian was produced and how it reached Tula, it must be admitted we are still in the dark as to how and by whom the deposit was exploited during the Pre-Classic to Middle Classic period. What is certain, however, is that those who exploited the resource from the Pre-Classic to the Early Post-Classic must

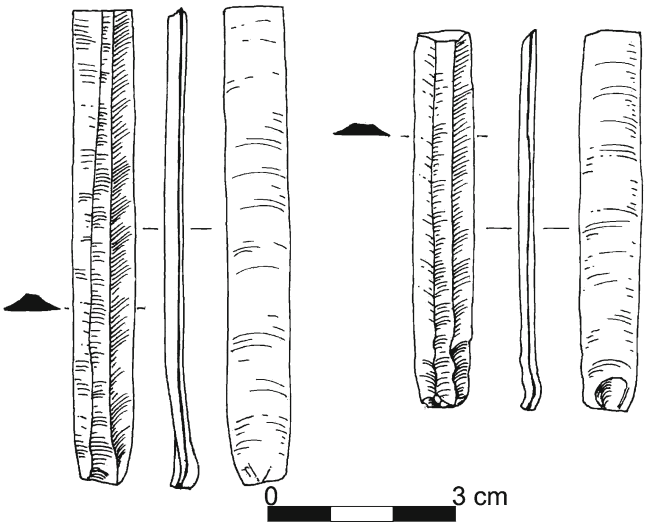

Fig. 17.8 The Zacapu region, Michoacan (Drawing by V. Darras)

have taken part in more than merely local – or even regional – dynamics and that they were involved in the long-distance circulation and interaction networks that remained foreign to the people of Western Mexico.

17.6.3 Blade Industries in the Classic Period (Middle Classic and Epi-Classic)

In the North-Central region, particularly in Zacapu, the end of the Classic was marked by two concordant phenomena: on the one hand, the prismatic blade became noticeably scarcer in the lithic assemblages and, on the other, the percussion blade industries became more essential.

17.6.3.1 The Prismatic Blade: An Increasingly Rare Artifact

The various projects carried out by the CEMCA[12] in the Zacapu region (Fig. 17.8) between 1983 and 1997 (Michelet 1992; Arnauld et al. 1993; Darras 1993; Pereira

[12] Archaeological research has been carried out here by the Centre of Mexican and Central American Studies (CEMCA, Mexico) and the CNRS (*Centre National de la Recherche Scientifique* – National Scientific Research Centre) between 1984 and 1997. This research has resulted in several doctoral theses and various publications.

1999) showed that from the Jarácuaro phase (A.D. 550–600) – and especially from the Early Lupe (A.D. 600–700) – the quantities of green blades decreased significantly whereas the black blades from Ucareo continued to be acquired, albeit moderately. This trend grew stronger over the three following centuries: during this time period, the green Pachuca blades disappeared and only a few gray-black specimens have been recovered. For example, the research realized south of the Middle Río Lerma River shows prismatic blades as the exception there (Faugère-Kalfon 1989). Surface collections and the 19 stratigraphic pits undertaken in 12 of the most important sites characterized by a civic-ceremonial architecture and dating to the Late Lupe to Palacio phases (A.D. 700–1200) yielded 13 prismatic blade segments, including only two from the excavations (0.1% of the obsidian collection, which comprises a total of 1,739 artifacts), all on material from Ucareo.

The information available for the sites dated to the same period in the North-Eastern region of Michoacan, near the Ucareo deposit, describes a similar situation (Healan 2002: 33; Healan 2005: 175–177). According to Healan, the production from the Ucareo workshops, consisting of polyhedral cores for pressure blade production, was reserved exclusively for Central Mexico, more specifically for the site of Tula. The populations living close to Ucareo consumed very few or no prismatic blades, probably because they had no interest in this type of artifact. All the same, Healan suggests that the archaeological site which may have been involved in the exploitation activities of the Ucareo deposit, named Las Lomas and located in the valley of the same name, seems to have had workshops carrying through the entire prismatic blade production process (Healan 2004, 2005). These products may have been destined for a closer consumption market; the few prismatic blade segments found on the Epi-Classic and Early Post-Classic sites in the Middle Valley of the Lerma could have come from workshops of Las Lomas.

The near disappearance during the sixth century of the Pachuca prismatic blade, the presence of which in the regions studied is known to have been tied to the influence of Teotihuacan, seems to be due to the evolutions taking place in the Basin of Mexico in the middle of the sixth century. It is known that the fire which destroyed the ceremonial center of Teotihuacan in A.D. 550 appears to have accelerated the metropolis' decline (Manzanilla 2003), causing the administrative and economic power structures to fall apart and, consequently, a probable disruption of certain long-distance circulation networks.

17.6.3.2 The Rise of Percussion Blade Industries During the First Millennium A.D.

While the pressure blade industries remained marginal in the second part of the Classic period, the percussion blade technology rose to a dominant position. However, unlike the Jalisco Highlands, where this type of industry was well established at the beginning of our era, it developed later in the regions under discussion. The lack of technological data on the San Juan de los Arcos production processes does not allow the two regions to be compared rigorously. However, the surface observations we

made at the latter site allow a possible morpho-technological correlation with Northern Michoacan production processes, which will be worth confirming through further research. If this technological correspondence was to be confirmed, it could be surmised that the technology we shall describe below could be the result of technological borrowing from the populations of the Jalisco Highlands.

In fact, the archaeological work carried out in the Zacapu region, in the North of Michoacan, indicates the existence of percussion blade industries at least from the sixth century A.D. (Jarácuaro phase A.D. 500–550). Found alongside flake debitage – which made possible the development of expedient and unstandardized tooling – and prismatic blades acquired through the exchange discussed above, the first evidence was found at the sites of Loma Alta and Guadalupe (Darras 1993; Pereira 1999; Carot 2001). It is interesting to note the coexistence of the two types of blades for this period. The excavations in 1986 at Loma Alta yielded a total of 377 lithic artifacts, including 173 in obsidian, nine macroblade fragments from Cerro Varal, one point from an irregular blade, and three knives with basal fixation notches made from a large blade (Darras 1993: 170–181). The burials at the Guadalupe site, excavated by Pereira, resulted in the collection of 293 lithic artifacts – 234 of which were obsidian. Among the latter are six pedunculate points from large blades and five bifacial knives made from large-sized blanks (Pereira 1999: 127–128). Physicochemical analyses have confirmed Cerro Varal as the obsidian source. The blades, all fragmented, are wide (between 2.5 and 3 cm) and thick (0.5–0.75 cm), and the platforms, noticeable on proximal samples, are oblique, wide, and single faceted. The presence of these blades in contexts dated to the Late Classic indicates that the obsidians from Cerro Varal and Cerro Zinaparo were used from this time. But as we shall see, the first evidence for systematic exploitation of the Cerro Varal and Cerro Zinaparo deposits, as well as the development on site of specialized workshops, dates from the beginning of the eighth century A.D.

The same archaeological work has brought to light important changes during the eighth century, at which time an expansion took place from the Zacapu Basin toward a more Northern region on the Southern side of the Lerma Valley. This expansion could be explained by significant demographic pressure in the Zacapu Basin and a resulting need to colonize new agricultural land (Faugère-Kalfon 1989, 1996; Faugère in press). This research has shown a dispersed settlement pattern, characterized by agricultural sites organized around small civic-ceremonial centers with autonomous political and economic organization. These developments in the regional settlement pattern coincide with the earliest exploitation of the two obsidian deposits in the Zinaparo massif (Cerro Varal and Cerro Zinaparo) and the one in Cerro Prieto. Prior to this period, the deposits were used to meet the needs of local populations. The obsidian exploitation was accompanied by the establishment of a population of farmers and craftsmen in the Zinaparo massif, who carried out the production logistics from mining activities to large-scale manufacture of obsidian blades. The earliest evidence for human occupation of the Zinaparo massif dates only from the late seventh to the early eighth century A.D. The population reached its peak toward A.D. 800, with 21 farming and/or artisanal settlements established at the obsidian deposits or in their immediate vicinity (Darras 2008).

The 14 identified production centers consist of major extraction areas – both subterranean and opencast – and quarry workshops, usually adjacent and extending up to several hectares (Darras 1994, 1999, 2008). The thousands of tons of obsidian waste that resulted from this activity pile up on depths of up to two meters.[13] The purpose of 13 of these production centers was to obtain by percussion, using andesite hammerstones, blades of varied shapes and sizes – often transformed on the spot into tool preforms. This production process was carried out by means of two debitage methods, neither involving heavy technological investment in core preparation.[14] The first was performed on angular blocks of variable dimensions, sometimes on macroflakes, on which a single-facet or multifaceted strike platform – generally very oblique – was prepared straight away. Use was made most often of the blocks' natural edges to detach the first blades; the following were then removed alternately from a single production face. The cores were generally thrown away when they were too flat or thin to allow further blades to be extracted. These cores show – in their residual state – a tabular morphology, rectangular or subtriangular in form and rectangular in cross section, with a totally flat debitage surface most often opposite an unworked cortical surface (Fig. 17.9). The removed blades showed a certain morphological variability and were not really standardized. Their dimensions could vary considerably depending on the initial dimensions of the obsidian blocks (Fig. 17.10a–c). The residual cores have a length varying from 10 to 23 cm, a width between 11 and 17 cm, and an average thickness of 4 cm. As for the blades, they have a width of between 2 and 5 cm, are 10–25 cm long, and are between 5 and 10 mm thick. The other production method started with smaller nodules or by using very thick macroflakes. Decortication was followed by preparing a horizontal striking platform, from which unipolar flakes were detached, so as to create longitudinal arises and finally obtain more regular blades. Production took place on the circumference of a conical core. The aim of this method was to produce small blades, no more than 10 cm long and between 1.5 and 2.5 cm wide.

The macroblades produced by the first method were generally retouched as tool preforms in the quarry workshops and were used as blanks for scrapers and unifacial or bifacial tools (Fig. 17.11a–c). Some were used to make bifacial knives, carefully formed by means of pressure retouching. The smallest blades, obtained with one or the other method, were more rarely preformed in the workshops. In general, these blades, when found in settlement sites, turn out to have small basal fixation notches and were used as knives.

The studies on the distribution of these products demonstrate the regional importance of the quarries and workshops of the Zinaparo massif over at least four centuries, since the percussion blades that were produced were distributed to settlement

[13] The study concerned a collection of 74,994 obsidian artifacts collected from a total of five investigatory excavations in the workshops of four production centers (Darras 1999).

[14] The last production center is on the Cerro Prieto, 3 km south of the Zinaparo massif. The obsidian found here is of inferior quality. The zones of activity extend for 8 ha and include opencast extraction sectors and workshops specialized in the manufacture of unipolar cores and bifacial preforms.

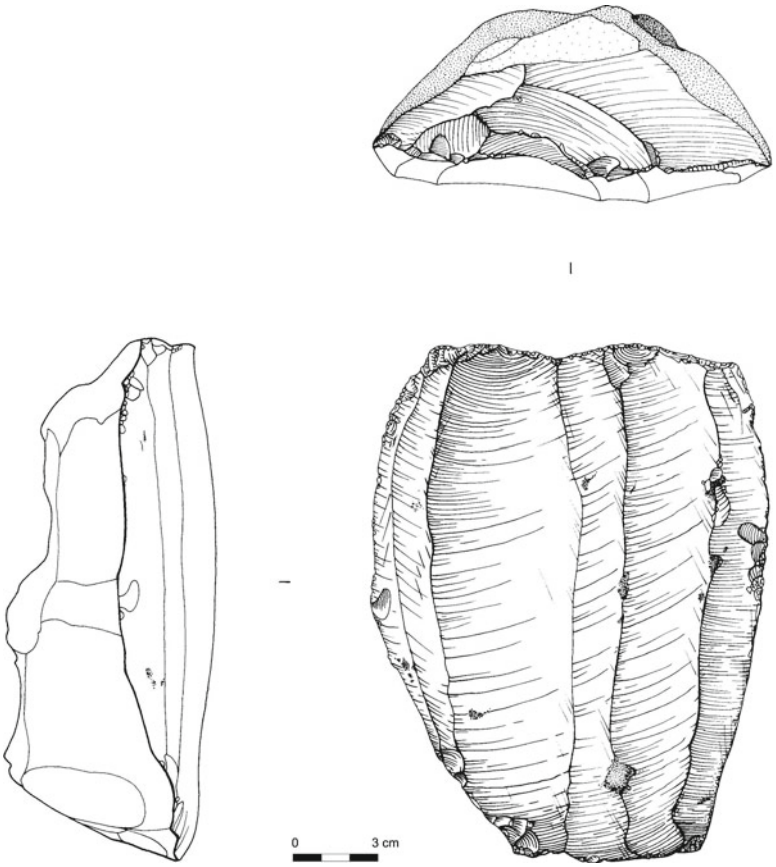

Fig. 17.9 Obsidian blade percussion core (Mich. 156 surface) (Drawing by F. Bagot)

sites in the region of the Lerma Valley and Zacapu (Darras 2008). Healan (2005) observed for this same period that the populations of the Ucareo-Zinapecuaro region, culturally close to the populations in the Middle Lerma Valley, also relied on percussion blade debitage. Nonetheless, we have no further information about the production of this kind in these obsidian deposits, although Healan (personal communication in 2006) mentions the presence of cores with a similar morphology to those of Zinaparo.

17.6.3.3 Pressure Blade Technology: A Late Development Related to the Rise of Tarascan Culture

The lithic traditions of this region are thus dominated, during the Classic (A.D. 250–900) and Early Post-Classic periods (A.D. 900–1200), by flake production in

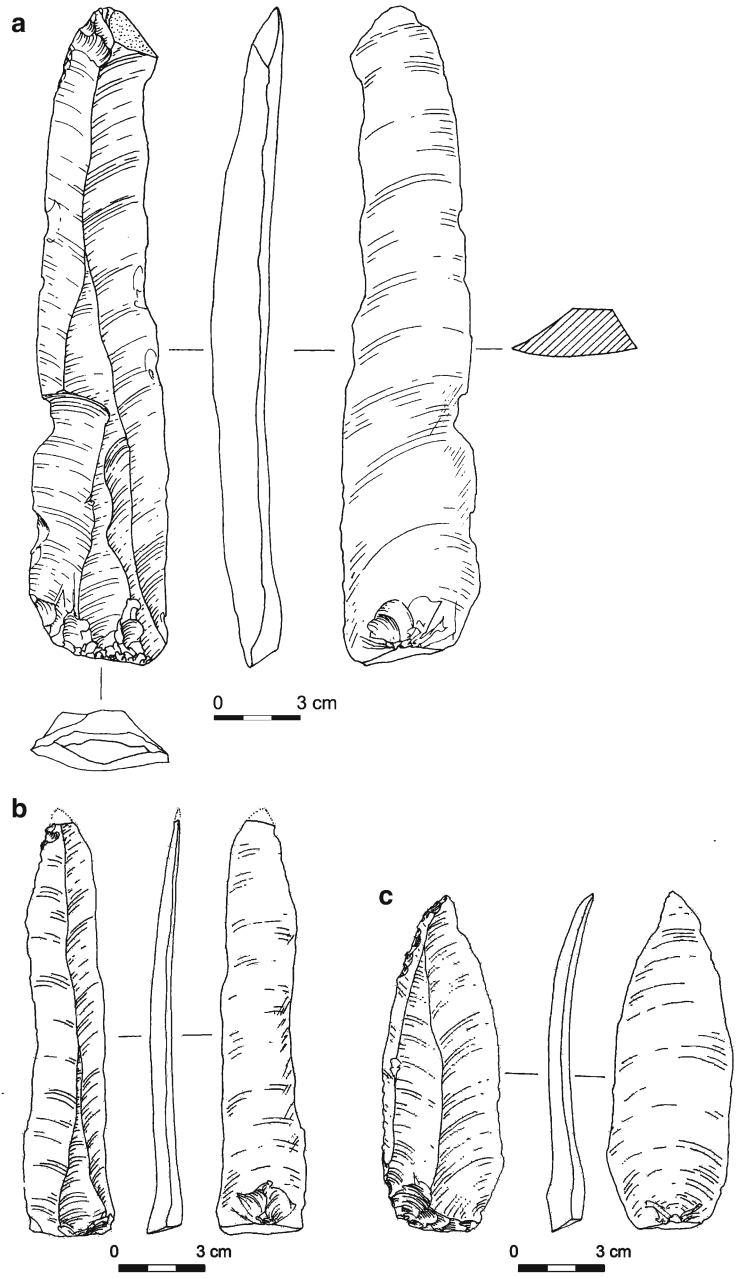

Fig. 17.10 (**a**) Macroblade (Mich.156, CNC). (**b**) Blade (Mich.117, S1.C.1.). (**c**) wide and short blade (Mich.117,S1.C.1.) (Drawing by F. Bagot)

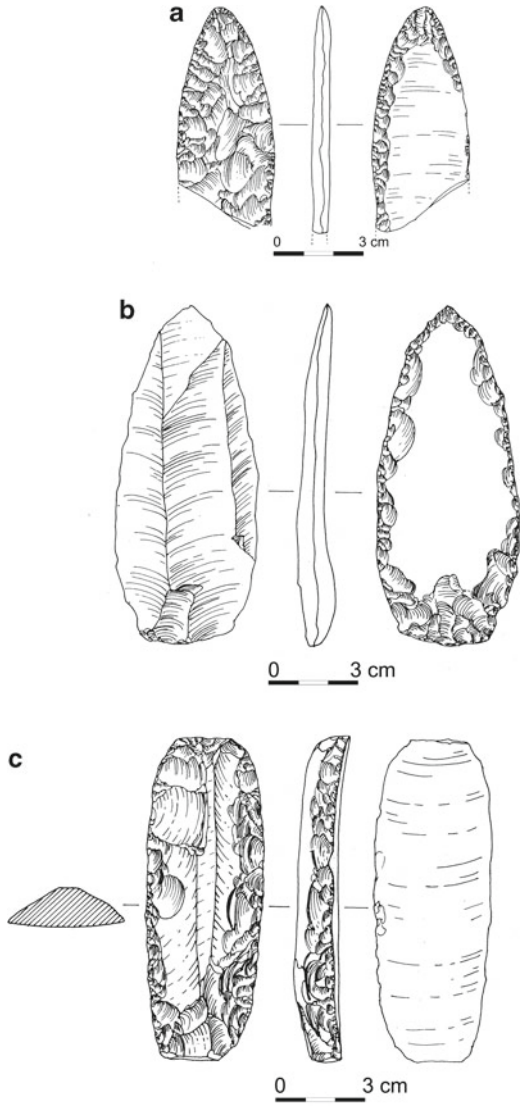

Fig. 17.11 Tools blanks on percussion blades: (**a**) Mich.117 C.1. (**b**) Mich.158, surface. (**c**) Mich.151, surface (Drawing by F. Bagot)

the domestic sphere, on obsidian and on andesite or basalt, and, as we have just explained, by percussion blade production.

Between A.D. 1100 and 1200, Northern Michoacan was the theater for important changes observed in the spatial and social reorganization. The Lerma Valley region was abandoned by most of its population, and the obsidian mine workshops of the Zinaparo region ceased their activity (Faugère-Kalfon 1996; Darras 1998). At the same time, spectacular population growth became apparent in the Zacapu region – most especially in the Malpaís sector, about 20 km South of the Lerma Valley region: new settlements appeared while the existing sites grew significantly (Migeon

1990; Michelet 1998). The Zacapu Malpaís at this time had a concentration of 18 settlements – several of urban character – harboring a numerous population. The population estimates for only four of them (representing a surface of about 4 km^2) vary between 10,000 and 12,000 persons (Michelet 1998). These regional transformations in settlement patterns represent important social and political evolutions within Tarascan society, culminating in the fourteenth century in the creation of a centralized state with its capital in the Patzcuaro Basin[15] (Pollard 1993, 2003; Migeon 1998; Michelet et al. 2005; Michelet 1998; Darras 2005b).

The study of obsidian artifacts from the region's Post-Classic sites has shown that the lithic systems had also undergone deep transformations. The most radical change lay in the disappearance of percussion blade tooling and the local development of pressure blade production, with significant consequences on the populations' consumption habits: the prismatic blade became a very commonplace artifact, consumed in great quantities by every level of Tarascan hierarchy. What happened, and how did this change in blade technologies take place?

While the Zinaparo massif hamlets and mine workshops were abandoned, five settlements, with high concentrations of obsidian waste on the surface, appeared halfway between the Zinaparo obsidian deposits and the major Tarascan sites in the Malpais of Zacapu (Fig. 17.8). The work carried out there (Darras 2009) has shown that two of them were thirteenth century creations, while the three others give evidence of an occupation going back to the Early Post-Classic (A.D. 900–1200). In both cases, however, the activity of the obsidian workshops developed during the Milpillas phase (A.D. 1200–1450). Nonetheless, the few differences observed in the morphological characteristics of the various localities – and certain strategies adopted for the production, notably in choice of raw materials, workshop localizations, and general level of organization – seem to indicate a slight chronological variation: prismatic blade production seems to have developed in two of the oldest settlements initially and then to have been continued by the others in slightly different ways (Darras 2009).

The *Las Iglesias del Cerro de la Cruz* site is installed on the slopes of the volcano of the same name at an altitude of 1,800 m. It is composed of a small civic-ceremonial center located at the higher level, of a residential zone with a system of agricultural terraces on the slope, and three sectors for obsidian transformation. Two sectors are below and immediately adjacent to the residential zone, and the third is isolated about 1,000 m North-East of the site. The three concentrations have a surface of between 150 and 200 m^2 and cover irregular terrain, characterized by small basalt outcrops.

[15] The Tarascans formed an ethnic group mainly occupying the modern State of Michoacan. At the time of the Spanish conquest, the Central Highlands of Mesoamerica were dominated by two rival powers: the Aztecs in Central Mexico and the Tarascans in the West. Just as for the Aztec empire, the Tarascan kingdom was a late creation, dating from the Late Post-Classic. It was centralized politically, administratively, and economically. The Michoacan project, carried out by the CEMCA between 1982 and 1996, was concerned, in part, with understanding the beginnings of the social and political processes that resulted in the kingdom's consolidation. The choice of the Zacapu region was made on the basis of ethnohistorical evidence from the only sixteenth century account relating the official history of the Tarascan people and which designated Zacapu as their place of origin.

The *El Durazno* site, which was only occupied during the Milpillas phase, is located on a basalt plateau close to Malpaís of Zacapu. It is a hamlet composed of two main platforms with the remains of several houses surrounded by agricultural zones, today including high quantities of andesite tools. Of the four obsidian concentrations, three seem to be directly associated with the residential zones with dimensions of 20–150 m², while the fourth, of more than 250 m², is located in a sector characterized by small basalt outcrops 75 m from the second residential platform.

The contents of the two well-analyzed obsidian concentrations refer to the production of prismatic blades, and all the stages of reduction are represented, from the decortication flakes and microdebitage up to the residual cores; the finished products, i.e., the third series prismatic blades, are extremely rare. The average depth of the deposit varies between 15 and 22 cm depending on the workshop, and the density of the waste can also vary from one workshop to another: for instance, 19 kg of obsidian waste were collected within a perimeter of 3 × 4 × 0.15 m at the Las Iglesias de La Cruz workshop no. 2, and 31 kg from a pit 2 × 2 × 0.15 m from the Durazno workshop no. 2.

The optical and physicochemical analyses show only one variety was used at the Las Iglesias del Cerro de la Cruz site, coming from Cerro Varal, and 20 km to the North. On the other hand, analysis of the El Durazno obsidians indicates two varieties were mainly used – one coming from Cerro Varal and the other, grayish-green in color, from Penjamo, a source 80 km to the North. In spite of the variations in distance from one deposit to the other, the acquisition strategies were the same: the high proportion of decortication flakes and blades indicates the craftsmen were supplied with blocks either unprepared or freed of a part of their cortex. The supply was probably direct, and the nature of the cortex could be an indication that the blocks had been extracted, although we have not been able to prove the existence of extraction mines dating to the Post-Classic.

The *chaîne opératoire* followed to obtain the prismatic blades was the same for the two localities. No raw material or polyedrical cores have been found in these workshops, which suggests that all of the blocks selected at the deposits and brought back to the workshops had been reduced. The dimensions of the cortical flakes and other sizeable products (particularly residual cores) indicate that these blocks were small, not exceeding 15 cm long and weighing 1.5–2 kg; they were generally angular blocks easy to start working. Without going into the details of the *chaîne opératoire,* it may be said that the final objective was to make prismatic blades of dimensions varying between 0.7 and 1.8 cm, with an average width of 1.2 cm and between 0.2 and 0.4 mm thick. The residual cores come in varying sizes: at the site of Durazno, the smallest core is 6 × 3.4 × 1.7 cm and the largest 9.2 × 2.6 × 1.7 cm, whereas at the Las Iglesias de la Cruz site, slightly bigger dimensions are found, the smallest measuring 10.2 × 2.6 × 2.1 cm and the largest 11.5 × 3.2 × 2 cm (Fig. 17.12a). Core fragments found at the site indicate that some may have reached up to 13 cm in length and thus would have allowed the production of blades of a similar length (Fig. 17.12b). Globally, it can be seen that the preparation blades were equally moderate in size – between 6 and 13 cm – which seems to indicate that the initial blocks were no larger (in their debitage axis) than the residual cores.

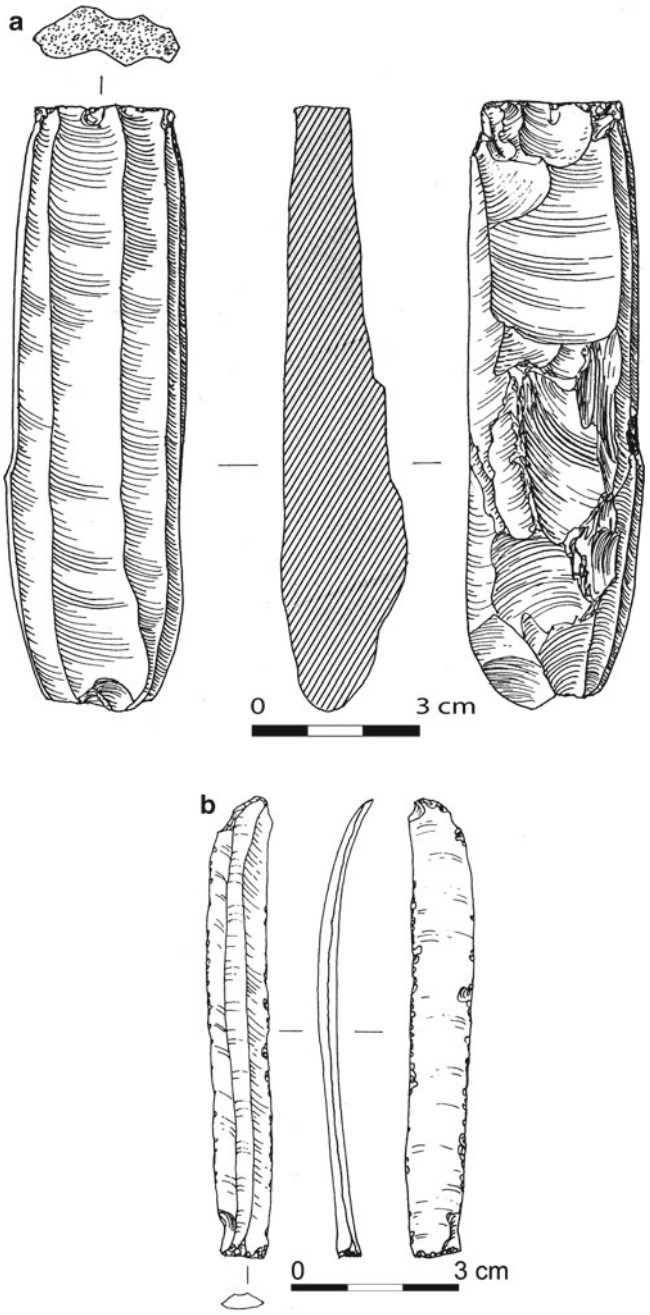

Fig. 17.12 (**a**) Tarascan pressure cores, Mich. 101. (**b**) Prismatic blade, Mich. 95 (955-I20 niv1) (Drawing by F. Bagot)

Broadly speaking, the reduction stages were as follows: blocks were shaped with decortication flakes and brought to final polyhedral form after blade makers created a multifaceted platform that was subsequently pecked and ground. It is important to stress that a number of flakes and percussion blades also were identified with ground platforms (7.3%), indicating that grinding occurred early in the preparation sequence, and that the percussion reduction progressed using this ground platform. Blade makers usually took advantage of natural ridges to removed cortical flakes and blades; when these were absent, a crested ridge was created to remove crested blades (4.2%). Percussion and pressure blades were removed from a single face of the core leaving its opposite side in cortex or with multidirectional negative scars (Fig. 17.12a). The size of the exhausted cores and finished blades indicates that most blades ranged from 9 to 12.5 cm in length and 0.8 to 1.4 cm in width.

The research at the Tarascan sites of the Malpais of Zacapu and, in particular, the analysis of the collection of obsidian recovered at the site of Milpillas, one of the largest Tarascan settlements in this sector, have shown 48.2% of the obsidian artifacts found in the excavations consisted of prismatic blade segments (Fig. 17.12b). These blade segments were used as blanks for tools, most often expedient, used in cutting soft materials. The study of their spatial distribution among the various excavated structures does not reveal any quantitative and qualitative differences that would imply difference of access. On the contrary, everything indicates undifferentiated mass consumption, both for domestic and probably also more ritual tasks, such as self-bloodletting (Darras 1998, 2005).

In the North of Michoacan, and most especially in the region of Zacapu, the Middle Post-Classic period is thus marked by an important technological change: the introduction of pressure blade technology. This technique was developed in small settlements, distant from the supplying deposits (between 20 and 80 km), but near the urban settlements of the Malpais of Zacapu. Our research has revealed specialized part-time activity by families of farmers/craftsmen, who were involved in the whole production cycle – from obtaining the raw material from the deposits up to distributing the products among the consumer sites.

17.7 Discussion

The examination of several archaeological contexts in two key regions in Western Mexico clearly indicates that the obsidian prismatic blade was not a commonplace item. Today, all of the archaeological data points to the same conclusion: in spite of a precocious production center in the Ucareo area, exclusively connected with the populations of Central and Southern Mexico, the populations living farther to the West adopted prismatic blade technology at a particularly late date. This adoption occurred at a variable pace and did not follow a clear spatial logic progressing from the traditional production places.

The conditions for the development of pressure blade technology in the Jalisco Highlands are visibly different from the pattern evident in Northern Michoacan.

In the first region, the available data seems to show that this technology was acquired two centuries before the Northern Michoacan, though the latter is closer to Central Mexico. In the same way, when the technology developed, the sociopolitical contexts showed significant differences. In one case, prismatic blade production and distribution may have been controlled by elite groups (Liot et al. 2006, 2007); in the other, they were assured by independent craftsmen pursuing their specialized activity within a very flexible framework. Whichever the case, none of these variations contradict the following observations: a priori, all of these populations satisfied the conditions required for acquiring the technology[16] – "unlimited" high-quality obsidian reserves, sociopolitical stratification, complex economic organization, demographic density assuring a potential market, and contacts with the populations possessing the skills and expertise. But then, why did it not develop before? We will examine below the various scenarios that could explain the behavior of the pre-Hispanic populations of these regions between the Pre-Classic and Late Post-Classic.

17.7.1 The Pre-Classic: Technocultural Choices or Ethnic Control?

During the Early Pre-Classic period and the beginning of the Middle Pre-Classic (1500–800 B.C.) – for which archaeological remains have been found in North-West Michoacan and the States of Jalisco and Colima – ignorance of the prismatic blade, as a manufactured product, was probably due to the absence of well-established commercial networks between Western Mexico and the Central Highlands. When these artifacts started to circulate, i.e., during the third century B.C. in some Chupicuaro sites, it was in very small quantities and made with obsidian from Ucareo, a deposit very close to the geographic core of the Chupicuaro culture. In fact, the regional situation cannot be discussed without reflecting on a comparison with the role played by the sources of Ucareo-Zinapecuaro throughout the Pre-Classic.

First, the hypothesis that during the Middle and Late Pre-Classic period these sources were controlled can be put forward. During the Middle and Late Pre-Classic, the Ucareo deposit was on the Southern margins of Chupicuaro territory,[17] on the frontier of a region culturally related to the Valley of Mexico.[18] The research of Healan and (Hernandez 2000) in the zone of Ucareo-Zinapecuaro has revealed that sites occupied by the Chupicuaro were concentrated on the shores of the Lake of Cuitzeo, near

[16] In fact, Clark (1987) suggests the abundance of raw material and access facilities to the deposits, as well as the degree of complexity of the societies' social organization (strong hierarchization), are the conditions for development of prismatic blade technology.

[17] The limits of this territory still have to be defined – the Northern limits in particular. They are determined by ceramic, technological, and stylistic criteria.

[18] Ceramic characteristics of the Ticoman or Cuicuilco I to IV phases of the Basin of Mexico.

the Zinapecuaro obsidian deposit[19] located farther to the West, and were about 10 km from the Ucareo Valley (Hernandez 2000) – although this does not seem to have yielded any traces of Pre-Classic occupation. This information suggests that Ucareo was not integrated into Chupicuaro territory (Hernandez 2006) and was exploited by other populations, of distinct ethnic origin. Physicochemical analyses, however, have shown that the Chupicuaro groups of the Acambaro Valley acquired a part of their raw material from Zinapecuaro and Ucareo, even if the Los Agustinos deposit was their main source. Still, the nodules acquired were small and came from surface collecting: Were these strategies guided by technocultural choices or were these "constrained" strategies, adapted to a context of restricted access? There is no doubt the populations living near Ucareo could pick up their raw material from the thousands of nodules exposed across a wide area through erosion, without having access to the concentrations of the better-quality large blocky material located at the deposit's core. But is the hypothesis that non-Chupicuaro populations controlled access to the Ucareo deposit really reasonable? Actually, the absence of Pre-Classic settlements (and non-Chupicuaro) on the spot or nearby would seem to rule this idea out.

On the other hand, the scenario in which Ucareo was at the boundary between two cultural regions – not apparently controlled by either group – could be much more relevant. In this case, the deposit would have been used by two groups of different origins with different interests, and, consequently, each would have exploited the deposit in a different way. The raw material acquisition strategies of the Chupicuaro groups may have been guided by precise requirements. The adoption of prismatic blade technology may have served no purpose, owing to the existence of local well-established lithic systems that perfectly fulfilled the Chupicuaro groups' needs.

On another level, a consideration of the forms of organization of prismatic blade production at the Ucareo deposit may help us to understand why the local populations did not acquire the technology. Data on the Pre-Classic exploitation of obsidian at Ucareo is still limited; however, the fact that mines and quarry workshops for this period have not been identified is not proof that they did not exist (Healan 1997). Nonetheless, some indications suggest that it is improbable that the whole manufacturing process took place on the spot: firstly, as stated earlier, there is no Pre-Classic settlement in the immediate vicinity of the Ucareo deposit; secondly, the prismatic blades were mainly destined for a supraregional market, in the regions of the East and South-East.

Additionally, for the Epi-Classic period, Healan (2002: 33) notes that only the first part of the *chaîne opératoire* took place at Ucareo, and that it consisted in configuring polyhedral cores, which were then transported over long distances toward their places of manufacture, such as Tula. This form of organization was by far the most common in Mesoamerica, since prismatic blades were generally manufactured in secondary workshops, sometimes far from the obsidian source (see Clark 1987,

[19] While still being of good quality, this deposit does not present the same potential as Ucareo, especially as far as the size of the blocks is concerned. Healan has shown that its systematic exploitation dated above all to the Late Post-Classic and was by the Tarascans (2005).

1988, 1989; Hirth 2006; Hirth and Andrews 2002; Parry 2002; Spence 1981, etc.) Thus, this information suggests a similar pattern for the Pre-Classic and the Early Classic. The groups involved in the production of prismatic blades from Ucareo obsidian could not have lived nearby. Their strategies for obsidian procurement probably involved cyclical trips and short-term stays that would have enabled blocks to be acquired and/or transformed into polyhedral cores, which were then transported back to the residential areas where they produced pressure blades.

No part of this scenario, however, explains how the technology was acquired. Why did the groups in possession of the savoir faire not transmit it to the local populations? It is difficult to imagine a lack of contact, but what was the nature of their relations? Could the cyclical travels and short stays on the spot and the segmentation of the *chaîne opératoire* be sufficient explanatory factors? Could it be that those with the job of procuring the material did not have all the skills to manufacture prismatic blades and were merely responsible for acquiring the raw or shaped blocks? It is possible that, if the reduction sequences were not entirely realized on the spot, and if the workers only came periodically for restricted periods, transmission of the technical knowledge could have been limited – the locals having only a partial and approximative understanding of the technological process, its purpose, and its usefulness.

The rarity of prismatic blades in the lithic assemblages of the Chupicuaro populations appears to support this hypothesis.[20] In this scenario, if the blades were manufactured far to the East, far from the Ucareo sources, if this production was not mainly for the Chupicuaro populations, and if the latter did not have relationship with the producers, then it is predictable that few blades would actually reach them. This would have been especially true if the artifact held no practical or symbolic meaning to the Chupicuaro people.

Consequently, we suggest that the absence of the prismatic blade technology in the Chupicuaro region could have resulted from a combination of three phenomena: on the one hand, the ways in which the producer groups were organized did not ease transmission of the technical knowledge to the region supplying the raw material, on the other, the absence of demand on the spot, probably owing to firmly rooted lithic traditions which were well adapted to the locals' needs, and, lastly, the absence of well-established interaction with the places in which the blades were manufactured.[21] In the heart of Chupicuaro territory, obsidian was a plentiful and easily accessible resource, just like basalt and andesite, and the various *chaînes opératoires* used – particularly unipolar debitage to obtain small short blades – made accessible the whole range of tools required by the people who lived there. Without rejecting the

[20] The variations observed from one Chupicuaro site to another also support this view: the Pre-Classic occupation levels of site TR 6 are for the moment the only ones to yield prismatic blades.

[21] This agrees with what has been found during our research: throughout the early and during the first half of the Late Chupicuaro phase, little archaeological evidence has been found showing well-established contacts with Central Mexico, commercial or otherwise (Darras 2006; Darras and Faugère 2007).

possibility of restricted access to the prismatic blade market, or deliberate retention of technical expertise by the groups possessing it, the hypothesis of a technocultural choice led by autosufficiency seems most reasonable to us today.

17.7.2 The Situation from the Proto-Classic to the Middle Classic: The Prismatic Blade – An Article for the Elite?

In contrast to the situation described for the Pre-Classic, the archaeological data for the extreme end of this period followed by the Early and Middle Classic shows the regional consumption of black and green obsidian prismatic blades was part of the general cultural evolution in North-Central Mexico, within which the interactions with Central Mexico – in particular with Teotihuacan – became more dynamic. In the Jalisco Highlands, Teotihuacan's influence is attested but seems definitely more discreet. In the Center-North, the metropolis's influence is perceptible to varying degrees in architectural patterns, pottery decoration techniques, iconography, and certain prestige goods (Carot 2001; Filini and Cardenas 2007; Filini 2004; Gomez and Gazzola 2007; Saint Charles 1996). Green prismatic blades were thus among the items circulating in most of the Center-North sites touched by the aura of Teotihuacan. However, based upon the present state of knowledge, we suggest the regional use of the prismatic blade was limited to special circumstances – ritual uses in particular – since the contexts in which the artifact is found give it a strong symbolic value. Its presence in particular seems to represent adhesion to an ideological model incarnated by Teotihuacan. As the prismatic blade became a useful and meaningful artifact, the question is raised as to why pressure blade technology was not adopted then, given that high-quality obsidian deposits were plentiful in the region. However, since the consumption market was restricted and probably reserved for special activities, the technology's local development may not have been justified. Also, if the use of the artifact was the privilege of a restricted number of people, for economic and/or symbolic reasons, the latter had no interest in promoting its local development. Finally, and clearly apart from the artifact itself, the variety of obsidian – in this instance, translucent green obsidian – could have had a particular symbolic value and have made the elites dependent on this circulation network.

17.7.3 Raw Material Abundance: A Brake on the Development of Technology During the Classic Period?

Several authors working in Mesoamerica see the development of pressure blade technology as a technical solution to the problem of managing the raw material efficiently, thus maximize the use of the obsidian blocks' potential (Clark 1982, 1987; Healan 2002, 2005; Hirth 2006; Hirth and Andrews 2002). It appears clearly that "the distance between obsidian sources and consumers sites … and the transportation

costs affected how obsidian was worked in different regions and that a considerable amount of technological variation may be a response to economizing scarce resources in areas of high demand" (Hirth and Andrews 2002: 9).

In Central and Eastern Mesoamerica, during the Pre-Classic and Classic, prismatic blade technology development and logistics seem to have been strongly driven by leading regions distant from the obsidian sources (Olmec area, Puebla, Morelos, and Oaxaca). The consolidation of the web formed during the Early and Middle Pre-Classic in any case created a permanent substratum: most of the regions that were significantly touched by prismatic blades during this period remained as such. Later, during the Classic, very important populations centers emerged in the Central Highlands (see, e.g., Teotihuacan, Xochicalco, and Tula), which were also far from the obsidian sources that they used.[22] On the other hand, if we take the case of the populations in the West, we see that those of the Teuchitlan heartland are established at the hub of a vast system of deposits of excellent quality with an incalculable and inexhaustible supply of obsidians – black, gray, green, and red. In the Zinaparo region, deposits are located within a territory that was relatively well populated but characterized by a dispersed settlement pattern. So in these two regions, the obsidian sources and their surroundings were permanently occupied by a relatively numerous population of farmers and craftsmen. Settling close to sources may have been the result of a techno-economic strategy.

The direct percussion blade traditions produced unstandardized macroblades and blades of variable dimensions and thicknesses. Owing to the debitage methods used, this technique did not allow a maximized use of the obsidian cores – only a limited number of blades could be extracted (Darras 1999). Meanwhile, the craftsmen's decision to install themselves right next to the extraction areas meant that they had all the raw material they needed close at hand. Could the abundance of raw material and ease of access be enough to explain their technological traditions' perpetuity? Research done in the workshops of the Zinaparo region has shown the artisans did not need to be economical with their raw material and that they could choose to be highly profitable without exploiting cores efficiently (Darras 1999). This way of organizing production may thus have made it unnecessary to adopt a new technology, which certainly gave higher yields but was far more exacting in time and technical investment.

Lastly, we may recall percussion blade technologies enabled the production of a whole range of blanks for manufacturing certain types of tools, such as macroblade scrapers, bifacial knives, finely retouched with pressure, or again knives with basal fixation notches. Since these specialized products completed nonspecialized flake industries able to produce one-off nonstandard instruments, one may wonder if the adoption of the new technology was justified – given the well-established lithic traditions perfectly adapted to the local populations' needs.

[22] Teotihuacan is located 25 and 50 km, respectively, from its two favorite sources – Otumba and Pachuca. Xochicalco and Tula functioned synergetically with Ucareo at a distance of 250 km and more than 150 km, respectively.

17.7.4 Organization of Bajio Classic Cultures

Quite apart from these pragmatic reasons, the characteristics of the Classic cultures of the Lerma Valley or Bajio may open fruitful ways of thinking. At the end of the Classic period and in the Early Post-Classic (A.D. 800–1100), all the Center-North of Mexico was affected by two phenomena: several population movements occurred and autonomous regional developments were reinforced. The social and political context was then marked by a strong segmentation of the power structures, whether political, economic, or religious. The patterns of implantation in the macroregional space reflect this segmentation: on one hand, neighboring centers are found crystallizing an important population, embodying a politico-religious power (e.g., the site of Plazuelas or the massif of Barajas; Migeon and Pereira 2007; Pereira et al. 2005), and, on the other hand, vast rural zones with dispersed settlements run by small civic-ceremonial sites (Faugère, in press). In this macrocontext, and particularly in the region on the South margin of the Lerma River, the organization of the sites – both spatial and architectural – seems to reflect intercommunal competition and tensions (Faugère, in press). It is interesting to note that the systematic exploitation of the obsidian sources of Cerro Varal and Zinaparo, as well as the development of percussion blade production, occurred within this particular regional framework. The blade makers were culturally affiliated with the populations occupying the rest of this side of the Lerma Valley and the region of Zacapu, who were their main clients, while restricted circulation of obsidian from Zinaparo into more Northern regions – such as the Barajas massif – has been found (C. Andrieu, personal communication, 2007). Actually, it seems that blade production from the Zinaparo region mine workshops had a strictly regional impact going no farther than about 50 km East, South, and West.

Accordingly, can ignorance of pressure blade technology be explained by the nature of the social and political structures of populations in the Bajio? Did their social organization and territorial implantation prevent the acquisition of this technology? As their region, interconnected to the obsidian deposits in the Zinaparo massif, was not very densely populated, might the effective lack of a market of consumption explain this absence?

17.7.5 The Political and Social Conditions for Its Appearance in the Post-Classic

Studies carried out in the Jalisco Highlands and Center-North of Michoacan have shown that prismatic blade expertise and production appeared at the same time as a series of social and political phenomena. We are not able to discuss how the technology appeared in the first region, except to repeat that it was associated with a new tradition, called Aztatlan; so we shall focus on what we know best: the North of Michoacan.

For this region, one has every right to wonder whether the technological changes could have something to do in one way or another with the social and political evolutions. Certainly, only in the twelfth century did a certain number of elements favorable to this technology's development come together: concentration of a very numerous population in a restricted territory – which meant the prospect of a dense, stable, and regular market of consumption – and progressive political changes tending toward more complex power structures – concluding in the fourteenth century with the consolidation of a centralized state governed by a Tarascan sovereign (Darras 2005b). By the end of the twelfth century, the unification of the territory was still incomplete, and the regions of Zacapu and Patzcuaro seem to have experimented with an organization involving the cohabitation of several rival lineages (Darras 2008, 2009; Michelet 1998). Curiously, it was in this rather unstable political situation that the technology developed: at the time it was practiced within a flexible framework, in which control upstream – access to raw material deposits, production – and downstream – distribution and consumption – seem to have been nonexistent or insignificant (Darras 2008, 2009). Control by the Tarascan authorities is imperceptible in the archaeological record, although it may have existed indirectly through tribute payments. Our research suggests that the artisans produced the prismatic blades alternately with other unspecialized subsistence activities, such as agricultural activities (Darras 2008, 2009). Responsible for the whole production process from procuring the raw material to selling the goods, and with no intermediaries, the Tarascan blade makers of the Zacapu region were independent. Distribution was probably through market networks, mentioned in ethnohistorical documents (Relación de Michoacan 1977; Pollard 1993; Pollard and Vogel 1994), but the identification of residual prismatic cores and some preparation blades in several consumer sites could also suggest the craftsmen were itinerant as well and reduced their prismatic cores where they sold the blades.[23] The absence of a control infrastructure and the ways in which the profession was practiced could also explain the vulgarization of the prismatic blade, which became the most widespread artifact in the Tarascan peasant's toolkit. In this way, a very clear correlation can be established between the evolution of Tarascan social and political structures and the development of pressure blade technology: probably the authorities favored its development and the very wide diffusion of its products. In contrast, however, while the process of centralization and unification could be expected to be accompanied by augmented supervision of certain craft productions, a great freedom can be seen in the ways the technology was put into practice. This situation differs from the model upheld by Clark (1987), who insists the technology's logistics could only have been managed by elite groups, but also from the situation described by Pollard for the Patzcuaro Basin, the core of the Tarascan kingdom, during the fifteenth

[23] The presence of residual cores and a few preparation blades is not enough, however, to infer the passage of itinerant craftsmen. These residual cores may have been acquired deliberately to be recycled and used for other purposes.

century. This suggests the Tarascans exploited Ucareo and the prismatic blades were distributed under the control of the reigning dynasty (Pollard 2003: 232).[24] This is explicitly described in the *Relación de Michoacan*, in which the prismatic blade makers appear as members of the Assembly of the Uris, directly subordinated to the authority of the sovereign (*Relación de Michoacan* 1977). The situation we find in the Zacapu region may then reflect a complex situation, with great upheavals, in which the process of unification and centralization was only beginning and still had no impact on the organization of craft activities.

17.7.6 The Economic Variable: A Technical Choice Guided by the Quest for Profit?

During the Late Post-Classic, the abandonment of the area along the South bank of the Lerma and the subsequent redevelopment in Zacapu moved the people farther away from the obsidian deposits and forced them to reorganize their activities. This distance (which remained moderate) could have favored the adoption of a new production logistic and thus prismatic blade technology. The distance that they had to travel implied regular movements, and the transport of the raw material to the workshops could have resulted in a concern for using raw material efficiently, and justified a heavier technical investment. These observations would be in line with the results of other authors' research (Healan 2005: 177; Hirth and Andrews 2002).

Lastly, the very significant widespread of the prismatic blade – which characterized all of the Tarascan settlements in the region of Zacapu, but also in Ucareo – could be explained by improvements in technical knowledge. According to Healan (2002: 35; 2009: 110), the systematic grinding of pressure platforms, which became generalized during the Late Post-Classic, would have facilitated the detachment of prismatic blades and made the skills easier to acquire. In addition to this technical bonus – which, according to this author, would have reduced many production errors – one may wonder if the general simplification of the *chaîne opératoire*[25] did not favor and accelerate skill learning and ensure better efficiency. In any case, the development of the technology in the region studied was accompanied by an immediate widespread of the prismatic blade (Darras 2008, 2009).

[24] Healan's research confirms the Ucareo deposit came under Tarascan control during the Late Post-Classic.

[25] Two factors could have favorite the simplification of the "*chaîne opératoire*": all the stages of the reduction sequence were carried out in one place, and the blade makers had the possibility to select small angular blocks producing small prismatic blades.

17.7.7 How Were the Skills Transmitted?

The study of the prismatic blade workshops in the Zacapu region has permitted a technological correspondence to be made with other contemporary collections. It is remarkable that the *chaîne opératoire* followed was, broadly speaking, identical to that followed at the Aztec site of Otumba and at Tenochtitlan (Cassiano 1991; Garcia Velázquez 1990; Parry 2001, 2002): blade removal on a single-core face, abrasion of the future pressure platform during percussion stages, rarity of pressure platform rejuvenation, and production of short blades no more than 13 cm long – on average between 10 and 11 cm. These similarities suggest that pressure blade making at Zacapu followed the same principles as the Aztecs of the same period. However, the work of Healan (2003, 2005, 2009) in the Ucareo deposits has proven the long tradition of pressure blade production and quite clearly shown the generalization of prismatic blade production during the Middle Post-Classic, i.e., with the rise of the Tarascan culture. It is, therefore, probable that the development of the technology in the Tarascan region started at Ucareo in contact with populations already in possession of it. The skills were then transmitted to the populations in the Zacapu region from this initial core between A.D. 1100 and 1200. What is certain is that the prismatic blade makers of Zacapu shared the same material culture and were indeed Tarascans.

17.8 Conclusion

The obsidian prismatic blade can be considered a technocultural marker for the Mesoamerican identity of the peoples who made or used it. Thus, its rarity in the Western archaeological records could be an argument in favor of their marginal and unique character.

In this way, changes in the prismatic blade's status may illustrate the role of the ideological factor. During the Pre-Classic period, it clearly was not economically useful and on the ideological level was meaningless for these populations. It was not until the Early and Middle Classic – with the exportation throughout nearly all Mesoamerica of an ideological and religious model crystallized by Teotihuacan – that the prismatic blade acquired a meaning for the elites of many groups. However, at the end of the Early Classic phase, the decline of the metropolis's supremacy and the prevalence of regional developments – characterized by their withdrawn and rural character – entailed the disappearance of this artifact, which had no techno-functional advantage over the local industries. For the elites, the prismatic blade was now devoid of symbolic connotations. Finally, the blade's widespread use during the Middle Post-Classic could be related to improvements in technical knowledge, thereby facilitating its generalization and associated loss of value – both economic and symbolic.

However, if the material and social criteria necessary for the implementation of the technology are examined, there can be no doubt that all of these populations

met – at least by the Late Classic – the conditions that permitted its development. But neither the abundance and quality of the obsidians, nor the level of social and political organization, nor the demographic mass, nor the excellence of local technical skills, acted as triggers. On the contrary, the abundance of raw material may well have prevented the adoption of a foreign technology perceived to be less than essential. The percussion blades technologies, directly depending for their implementation and viability on this abundance, enabled a whole range of standardized instruments to be created that were well adapted to the populations' needs.

Based upon the present state of knowledge, the absence of a market – due to technocultural preferences sustained by the advantages of easy resource access – may thus be a reasonable hypothesis for explaining ignorance of the technology. Its later adoption can be linked to the conjunction of two phenomena: radical transformation of the political and social structures, and technical simplification of the skills.

However, numerous questions remain unanswered, making it difficult to grasp the phenomenon of the prismatic blade in all its complexity. Clearly, to answer them, it is vital to understand how Ucareo-Zinapecuaro was exploited throughout the Pre-Classic and by whom. For the Jalisco Highlands, further research must be undertaken: first of all, the exact reconstitution of the *chaînes opératoires* associated with percussion blade productions, especially those realized at San Juan de los Arcos; then, studying the origin and forms of development of prismatic blade technology at the end of the Epi-Classic. The ways by which the skills were transmitted may enable an understanding of how the populations interacted; a rigorous reconstitution of the technology could reveal the links to other cultural groups – thereby helping to discern the identity of the Aztatlan peoples better.

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References

Arnauld, Marie C., Patricia Carot, and Marie F. Fauvet-Berthelot 1993 *Arqueología de Las Lomas en la Cuenca Lacustre de Zacapu, Michoacán, México.* Cuadernos de estudios Michoacanos 5, CEMCA, México.

Beekman, Christopher 2006 The Chronological context of the central Jalisco Shaft tombs. *Ancient Mesoamerica* 17(2): 239–249.

Beekman, Christopher, and Luis J. Galvan Villegas 2006 The shaft tomb of the Atemajac Valley and their Relation to Settlement. *Ancient Mesoamerica* 17(2):259–270

Beekman, Christopher, and Phil W. Weigand 2010 La secuencia cronológica de la tradición Teuchitlan. In *El Eje Lerma-Santiago durante el Formativo Terminal y Clásico temprano: precisiones cronológicas y dinámicas culturales,* edited by Laura Solar, INAH, México.

Beekman, Christopher, and Phil W. Weigand 2000 *La cerámica arqueológica de la tradición Teuchitlan, Jalisco.* El Colegio de Michoacan/Secretaria de Cultura de Jalisco.

Boksenbaum, Martín W. 1978 *Lithic Technology in the basin of Mexico during the Early and Middle Pre-classic*. Unpublished Ph.D. dissertation, University of New York.

Boksenbaum, Martin W., Paul Tolstoy, Garman Harbottle, Jerome Kimberlin, and Mary Neivens 1987 Obsidian Industries and Cultural Evolution in the Basin of Mexico before 500 B.C. *Journal of Field Archaeology* 14(1): 65–76.

Brambila, Rosa, and Ana Maria Crespo 2005 Desplazamientos demográficos y creación de territorios en el Bajío. In *Reacomodos demográficos del Clásico al Posclásico en el centro de México*, edited by Linda Manzanilla, pp. 155–174. UNAM/INAH, México.

Burton, Susan S. 1987 Obsidian Blade Manufacturing Debris on Terrace 37. In *Ancient Chalcatzingo*, edited by David Grove, pp. 321–328. University of Texas Press, Austin.

Calgaro, B. 2007 Sección 9: Análisis Preliminar de la Lítica. In *Informe Final de la Temporada de 2007, Proyecto Arqueológico Regional Valles de Tequila*. Informe científico del INAH.

Carot, Patricia 2001 *Le site de Loma Alta, lac de Zacapu, Michoacan, Mexique.* Paris Monographs in American Archaeology 9, Archaeopress BAR International Series 920, Oxford.

Cassiano, Gianfranco 1991 La tecnología de navajillas prismáticas. *Arqueología* 5: 107–118.

Clark, John 1982 Manufacture of Mesoamerican prismatic blades: An alternative technique. *American Antiquity* 47: 355–376.

Clark, John 1987 Politics, prismatic blades, and Mesoamerican civilization. In *The organization of core technology,* edited by Jay K. Johnson and Carol A. Morrow, pp. 259–285. Westview Press.

Clark, John 1988 *The lithic artifacts of La Libertad, Chiapas, Mexico. An economic perspective.* Papers of the New World Archaeological Foundation 52. Provo, UTA, Brigham Young University, Utah

Clark, John 1989 Hacia una definición de talleres. In *La obsidiana en Mesoamérica*, editado por Margarita Gaxiola y John Clark, pp. 213–217, Colección Científica 176, INAH, México.

Cobean Robert H., Michael Coe, Edward A. Perry, and Dinkar P. Kharkar 1971 Obsidian Trade at San Lorenzo Tenochtitlan, Mexico. *Science* 174: 666–671.

Cobean Robert H., James R. Vogt, Michael D. Glascock, and Terry L. Stocker 1991 High precision Trace Element Characterization of Major Mesoamerican Obsidian Sources and further Analyses of Artifacts from San Lorenzo Tenochtitlan, Mexico. *Latin American Antiquity* 2(1): 69–91.

Darras, Véronique 1993 La lítica tallada de las Lomas. In Arqueología de las Lomas en la Cuenca lacustre de Zacapu, Michoacán, México, edited by Marie Charlotte Arnauld, Patricia Carot, and Marie France Fauvet-Berthelot, pp. 168–190, Cuadernos de Estudios Michoacanos 5, CEMCA, México.

Darras, Véronique 1994 Les mines-ateliers d'obsidienne de la région de Zinaparo-Prieto, Michoacan, Mexique. *Bulletin de la société préhistorique française* 91(4–5): 290–301, Paris

Darras, Véronique 1998 La obsidiana en la Relación de Michoacan y en la realidad arqueológica: del símbolo al uso o del uso de un símbolo. In *Génesis, culturas y espacios en Michoacan,* edited by Véronique Darras, pp. 61–88, CEMCA, México.

Darras, Véronique 1999 *Tecnologías prehispánicas de la obsidiana: los centros de producción de la región de Zináparo-Prieto, Michoacán.* Cuadernos de Estudios Michoacanos 9, CEMCA, México.

Darras, Véronique 2005a La tecnología de la navaja prismática: una singular invención mesoamericana. In *Reflexiones sobre la industria lítica*, edited by Leticia González Arratia and Lorena Mirambell, pp. 111–134, Colección Científica 475, INAH, México.

Darras, Véronique 2005b Economía y poder: la obsidiana entre los tarascos de Zacapu, Michoacán (fase Milpillas 1200 a 1450 d.C.). In *Reflexiones sobre la industria lítica*, edited by Leticia González Arratia and Lorena Mirambell, pp. 243–298. Colección Científica 475, INAH, México.

Darras, Véronique 2006 Las relaciones entre Chupícuaro y el Centro de México durante el Preclásico reciente. Una crítica de las interpretaciones arqueológicas. *Journal de la Société des Amériques* 92–2: 69–110, Paris.

Darras, Véronique 2008 Estrategias para la producción de Navajas en la región de Zacapu y la Vertiente del Lerma (Michoacán, México) entre el Epiclásico y el Posclásico tardío. *Ancient Mesoamerica 19:* 243–264.

Darras, Véronique 2009 Peasant Artisans: Household Prismatic Blade Production in the Zacapu Region, Michoacan (Milpillas phase 1200–1450 A.D.). *Archaeological Papers of the American Anthropological Association,* Vol. 19(1): 92–114.

Darras, Véronique, and Brigitte Faugère 2007 Chupicuaro, entre el Occidente y el Altiplano central. Un balance de los conocimientos y las nuevas aportaciones. In *Dinámicas Culturales, entre el Occidente, el Centro-norte y la Cuenca de México, del Preclásico al Epiclásic,* edited by Brigitte Faugère, pp. 51–84. El Colegio de Michoacán, Zamora/CEMCA, México.

Darras, Véronique, Brigitte Faugère-Kalfon, Christophe Durlet, Catherine Liot, Javier Reveles, and Cybèle David 1999 Recherches récentes sur la culture Chupicuaro, Guanajuato. Journal de la Société des Américanistes, 85: 343–352.

Elam, J. Michael, Michael D. Glascock, and Hector Neff 1994 Obsidian Artifacts from Oaxaca, Mexico: Source identification and hydration dating. In *Archaeometry of Pre-Columbian Sites and Artifacts,* edited by Peter Meyers and David A. Scott, pp 135–159. The Getty Conservation Institute, Los Angeles.

Esparza, Rodrigo, and Carlos Ponce Ordaz 2005 La obsidiana en el contexto arqueológico de Los Guachimontones, Teuchitlan, Jalisco. In *El antiguo occidente de México. Nuevas perspectivas sobre el pasado prehispánico,* editado por Eduardo Williams, Phil C. Weigand, Lorenza Lopez Mestas y David Grove, pp. 145–170, El Colegio de Michoacan, Zamora.

Faugère-Kalfon, Brigitte 1989 Entre Nomades et Sédentaires : archéologie du versant méridional du Lerma au Michoacan, Mexique. Tesis de doctorado de la Universidad de Paris I.

Faugère-Kalfon, Brigitte 1996 *Entre Zacapu y Lerma: Culturas en una zona fronteriza*. Cuadernos de estudios Michoacanos 7, CEMCA, México.

Faugère, Brigitte In Press Sociedad y poder en el centro-norte de Mesoamérica (600-1200 d.C.): el caso del norte de Michoacán. In *Las Sociedades Complejas del Occidente de México en el mundo mesoamericano. Homenaje a Phil Weigand*, edited by Eduardo Williams, Lorenza López Mestas, and Rodrigo Esparza, El Colegio de Michoacán, Zamora.

Filini, Agapi 2004 Interacción cultural entre la Cuenca de Cuitzeo y Teotihuacan. In *Tradiciones arqueológicas,* edited by Efraín Cardenas García, pp. 307–328, Colegio de Michoacan/ Gobierno de Michoacan, Zamora/Morelia.

Filini, Agapi, and Efrain Cardenas 2007 El Bajío, la Cuenca de México y el estado teotihuacano. Un estudio de relaciones y antagonismos. In *Dinámicas culturales entre el Occidente, el centro-norte y la Cuenca de México, del Preclásico al Epiclásico,* edited by Brigitte Faugère, pp. 137–156, Colegio de Michoacan/CEMCA.

Galván Villegas, Luís J. 1991 *Las tumbas de tiro del valle de Atemajac*, Jalisco. Colección Científica 239, INAH, México.

García Velázquez, Jorge, and Gianfranco Cassiano 1990 La producción de navajillas prismáticas en el Postclásico tardío: El caso de la plaza de la Banca Nacionalizada. In *Etnoarqueología: Primer Coloquio Bosch-Gimpera*, edited by Yoko Sugiura and Mari Carmen Serra, pp. 513–526. UNAM, Mexico City.

Gómez, Sergio, and Julie Gazzola 2007 Análisis de las relaciones entre Teotihuacan y el Occidente de México. In *Dinámicas culturales entre el Occidente, el centro-norte y la Cuenca de México, del Preclásico al Epiclásico,* editado por Brigitte Faugère, pp. 113–136. Colegio de Michoacán, Zamora/CEMCA, México.

Grove, David 1974 *San Pablo, Nexpa, and the early Formative Archaeology of Morelos, Mexico.* Vanderbilt University-Publications in Anthropology 12, Vanderbilt University, Nashville.

Grove, David 1987 (editor) *Ancient Chalcatzingo.* University of Texas Press, Austin.

Healan, Dan M. 1997 Prehispanic Quarrying in the Ucareo-Zinapecuaro Obsidian Source Area. *Ancient Mesoamérica* 8: 77–110.

Healan, Dan M. 2002 Producer Versus Consumer: Prismatic Core-Blade Technology at Epiclassic/ Early Postclassic Tula and Ucareo. In *Pathways to Prismatic Blades. A study in Mesoamerican Obsidian Core-Blade Technology*, edited by Kenneth G. Hirth and Bradford Andrews, Monograph 45, pp. 27–36, The Cotsen Institute of Archaeology, University of California, Los Angeles.

Healan, Dan M. 2003 From the Quarry Pit to the Trash Pit: Comparative Core-Blade Technology at Tula, Hidalgo, and the Ucareo Obsidian Source Region. In *Mesoamerican Lithic Technology. Experimentation and Interpretation*, pp. 153–169, University of Utah Press, Salt Lake City.

Healan, Dan M. 2004 Extracción prehispánica de obsidiana en el área de Ucareo-Zinapecuaro, Michoacán. In *Bienes estratégicos del Antiguo Occidente de México*, edited by Eduardo Williams, pp. 77–112, El Colegio de Michoacán, Zamora.

Healan, Dan M. 2005 Nuevos datos acerca del desarrollo de la tecnología de núcleos prismáticos en la fuente de obsidiana, Ucareo, Michoacán. In *El antiguo occidente de México. Nuevas perspectivas sobre el pasado prehispánico,* edited by Eduardo Williams, Phil C. Weigand, Lorenza Lopez Mestas, and David Grove, pp. 171–184. El Colegio de Michoacán, Zamora.

Healan, Dan M. 2009 Ground Platform Preparation and the "Banalization" of the Prismatic Blade in Western Mesoamerica. *Ancient Mesoamérica 20*: 103–111.

Hernandez, Cristina 2000 A History of Prehispanic Ceramics, interactions, and Frontier development in the Ucareo-Zinapecuaro Obsidian Source Area, Michoacan, México. Unpublished Ph.D. dissertation, Tulane University, New Orleans.

Hernandez, Cristina 2006 La cerámica del periodo clásico en el noreste de Michoacán. In *La producción alfarera en el México antiguo II,* edited by Beatriz L. Merino Carrion y Angel Garcia Cook, pp. 313–334, Colección científica 495, INAH, México.

Hirth, Kenneth G. 1995 The investigation of obsidian craft production at Xochicalco, Morelos. *Ancient Mesoamerica 6*: 251–258.

Hirth, Kenneth G. 2002 Provisioning constraints and the production of obsidian prismatic blades at Xochicalco, Mexico. In *Pathways to Prismatic Blades: A study In Mesoamerican obsidian core-blade technology*, edited by Kenneth G. Hirth and Bradford Andrews, pp. 85–94. The Cotsen Institute of Archaeology, University of California, Los Angeles.

Hirth, Kenneth G. 2006 *Obsidian Craft Production in Ancient Central Mexico. Archaeological Research at Xochicalco.* University of Utah Press, Salt Lake City.

Hirth, Kenneth G. (editor) 2003 *Mesoamerican Lithic Technology. Experimentation and Interpretation*. University of Utah Press, Salt Lake City.

Hirth , Kenneth G., and Bradford Andrews (editors) 2002 *Pathways to Prismatic Blades: A study In Mesoamerican obsidian core-blade technology*. Monograph 45. The Cotsen Institute of Archaeology, University of California, Los Angeles.

Hirth, Kenneth G., and Jeffrey J. Flenniken 2002 Core-blade Technology in Mesoamerican Prehistory. In Pathways to Prismatic Blades. A study in Mesoamerican Obsidian Core-Blade Technology, edited by Kenneth G. Hirth and Bradford Andrews, pp. 121–130, Monograph 45, The Cotsen Institute of Archaeology, University of California, Los Angeles.

Kelley, Charles J. 2000 The Aztatlan Mercantile System: Mobile Traders and the Northwest-ward Expansion of Mesoamerica Civilization. In *Greater Mesoamerica. Cultural Dynamics of West and Northwest of Mexico*, edited by Michael Foster and Shirley Gorenstein, pp. 137–154, Utah University Press.

Kelly, Isabel 1980 *Ceramic Sequence in Colima: Capacha, an early phase*. Anthropological Papers of the University of Arizona 37. The University of Arizona Press, Tucson.

Kirchhoff, Paul 1943 *Mesoamérica.* Acta Mesoamericana, vol. 1, México.

Liot Catherine, Susana Ramirez, Javier Reveles, and Otto Schondube 2006 T*ransformaciones socioculturales y tecnológicas en el sitio de La Peña, Cuenca de Sayula, Jalisco.* Universidad de Guadalajara/INAH, Guadalajara.

Liot Catherine, Susana Ramirez, Javier Reveles, and Carmen Melgarejo 2007 Producción, distribución y relaciones interregionales en la cuenca de Sayula del 500–1100 d.C. In *Dinámicas Culturales, entre el Occidente, el Centro-norte y la Cuenca de México, del Preclásico al Epiclásico,* edited by Brigitte Faugère, pp. 165–200, El Colegio de Michoacán, Zamora / CEMCA, México.

Lodeho, Laure 2007 *L'économie de l'obsidienne à Chupicuaro, Mexique (600 av. J.-C. – 250 apr. J.-C.). Etude typo-technologique de la collection du site TR6*. Master 2 en Archéologie préhistorique et protohistorique, Université de Paris I.

Lopez-Mestas, Lorenza 2007 La ideología. Un punto de acercamiento para el estudio de la interacción entre le Occidente de México y Mesoamérica. In *Dinámicas Culturales, entre el Occidente, el Centro-norte y la Cuenca de México, del Preclásico al Epiclásico,* edited by Brigitte Faugère, pp. 37–50, El Colegio de Michoacán, Zamora /CEMCA, México.

Macias Gotilla, Angelina 1990 *Huandacareo: Lugar de juicios, tribunal*. Colección Científica 222, INAH, México.

MacNeish, Richard S., Antoinette Nelken Terner, and Irmgard Weitlaner- Johnson 1967 *The Prehistory of the Tehuacán Valley, vol 2. The Non Ceramics Artifacts*. University of Texas Press, Austin.

Manzanilla, Linda 2003 El proceso de abandono de Teotihuacan y su reocupación por grupos epiclásicos. *Trace 43:* 70–76, CEMCA, México.

Manzanilla Lopez, Rubén 1984 *Loma de Santa Maria I, Morelia, Michoacán. Un sitio del periodo Clásico mesoamericano.* Tesis de licenciatura, ENAH, México.

Michelet, Dominique 1992 El Centro-Norte de Michoacán: características generales de su estudio arqueológico regional. In El proyecto Michoacán 1983-1987, edited by Dominique Michelet, pp. 12–54, Cuadernos de Estudios Michoacanos 4, CEMCA, México.

Michelet, Dominique 1998 Topografía y prospección sistemática de los grandes asentamientos del malpaís de Zacapu: claves para un acercamiento a las realidades sociopolíticas. In *Génesis, Culturas y Espacios en Michoacán,* edited by Véronique Darras, pp. 47–60, CEMCA, México.

Michelet, Dominique, Grégory Pereira, and Gérald Migeon 2005 La llegada de los uacúsechas a la región de Zacapu, Michoacán: datos arqueológicos y discusión. In *Reacomodos demográficos del Clásico al Posclásico en el centro de México*, edited by Linda Manzanilla, pp. 137–154, UNAM, México.

Migeon, Gérald 1990 Archéologie en pays tarasque. Structure de l'habitat et ethnohistoire des habitations tarasques de la région de Zacapu au Postclassique Récent. Tesis de doctorado de la Universidad de Paris I.

Migeon, Gérald 1998 El poblamiento del malpaís de Zacapu y de sus alrededores, del Clásico al Posclásico. In *Génesis, Culturas y Espacios en Michoacán,* edited by Dominique Michelet, pp. 35–46, CEMCA, México.

Migeon, Gérald, and Grégory Pereira 2007 La secuencia ocupacional y cerámica del cerro Barajas, Guanajuato, y sus relaciones con el centro, el occidente y el norte de México. In *Dinámicas culturales entre el Occidente, el Centro-norte y la cuenca de México, del Preclásico al Epiclásico,* edited by Brigitte Faugère, pp. 201–230. El Colegio de Michoacán, Zamora.

Mountjoy, Joseph 1990 El desarrollo de la cultura Aztatlan visto desde su frontera suroeste. In *Mesoamérica y norte de México. Siglo IX-XII,* Vol. 2, edited by F. Soti Miranda pp. 541–564. Museo Nacional de Antropologia, INAH, México.

Mountjoy, Joseph 2000 Prehispanic Cultural Development along the Southern Coast of West Mexico. In *Greater Mesoamerica. The Archaeology of West and Northwest Mexico,* edited by Michael S. Foster, and Shirley Gorenstein, pp. 81–106. University of UTAH Press, Salt Lake City.

Mountjoy, Joseph 2004 La cultura indigena en la costa de Jalisco, El municipio de Puerto Vallarta. In *Arqueologia del Occidente de México*, edited by Beatriz Braniff Cornejo, pp. 339–370. Universidad de Colima / INAH, México.

Narez, Jésus 1990 *Materiales arqueológicos de Tlapacoya, México.* Colección científica 204, INAH, México.

Niederberger, Christine 1976 *Zohapilco. Cinco milenios de ocupación humana en un sitio lacustre de la cuenca de México*. Colección Científica 30, INAH, México.

Niederberger, Christine 1986 Excavación de un área de habitación doméstica en la capital "olmeca" de Tlacozotitlan. Reporte preliminar. In *Arqueologia e Etnohistoria del Estado de Guerrero.* Primer Coloquio de Arqueología y Etnohistoria del Estado de Guerrero*,* edited by Roberto Cervantes-Delgado, pp. 83–103, INAH/Gobierno del estado de México.

Niederberger, Christine 1987 *Paléopaysages et Archéologie pré-urbaine du bassin de Mexico*. Collection Etudes Mésoaméricaines I-II, CEMCA, Mexico.

Oliveros, Arturo 2004 *Hacedores de tumbas en El Opeño, Jacona, Michoacán.* El Colegio de Michoacan/, Michoacán.

Parry, William J. 1994 Prismatic Blade Technology in North America. In *The Organization of North American Prehistoric Chipped Stone Tool Technologies,* edited by Philip J. Carr, pp. 87–98. Archaeological Series 7, International Monographs in Prehistory, Ann Arbor.

Parry, William J. 2001 Production an Exchange of obsidian tools in late Aztec city-states. *Ancient Mesoamerica* 12: 101–111.

Parry, William J. 2002 Aztec Blade Production Strategies in the Eastern Basin of Mexico. In *Pathways to Prismatic Blades. A study in Mesoamerican Obsidian Core-Blade Technology,* edited by Kenneth G. Hirth and Bradford Andrews, pp. 37–46, Monograph 45. The Cotsen Institute of Archaeology, University of California, Los Angeles.

Pereira, Grégory 1999 *Potrero de Guadalupe. Anthropologie funéraire d'une communauté pré-tarasque du nord du Michoacan, Mexique*. BAR International Series 816.

Pereira Grégory, Gérald Migeon, and Dominique Michelet 2005 Transformaciones demográficas y culturales en el centro-norte de México en vísperas del Posclásico: los sitios del Cerro Barajas (Suroeste de Guanajuato) In *Reacomodos demográficos del Clásico al Posclásico en el centro de México,* edited by Linda Manzanilla, pp. 123–136, UNAM/INAH, México.

Pires-Ferreira, Jane W. 1975 *Formative Mesoamerican Exchange networks with special reference to the valley of Oaxaca*. Memoirs of the museum of Anthropology of Michigan,Vol 3, No. 7, Prehistory and human ecology of the valley of Oaxaca, edited by Kent V. Flannery, Michigan.

Pires-Ferreira, Jane W. 1976 Obsidian Exchange in Formative Mesoamerica. In *The Early Mesoamerican Village*, edited by Kent V. Flannery, pp. 292–306. Academic Press, New York.

Pollard Perlstein, Helen 1993 *Tariacuri's Legacy. The Prehispanic Tarascan State*. University of Oklahoma Press, Norman.

Pollard Perlstein, Helen 2003 Development of Tarascan Core: The Lake Patzcuaro Basin. In *The Postclassic Mesoamerican World*, edited by Kent V. Flannery, pp. 227–237. University of Utah Press, Salt Lake City.

Pollard Perlstein, Helen, and Thomas A. Vogel 1994 Implicaciones políticas y económicas del intercambio de obsidiana des Estado tarasco. In *Arqueología del Occidente de México*, edited by Eduardo Williams and Roberto Novela, pp. 158–182. El Colegio de Michoacán, Zamora.

Porter Noé, Muriel 1956 Excavations at Chupícuaro, Guanajuato, Mexico. *Transactions of the American Philosophical Society* 46, pp. 515–637, Philadelphia.

Relación de Michoacán 1977 [1541] Relación de las ceremonias y ritos y población y gobierno de la provincia de Michoacán. Reproducción facsimilar del Ms IV de El Escorial, reedición con un estudio preliminar de J. Corona Nuñez. Balsal Editores, Morelia.

Reveles, Javier 2005 La lítica de la Cuenca de Sayula. In *Arqueología de la Cuenca de Sayula,* edited by Fransisco Valdez, Otto Schöndube, and Jean Pierre Emphoux, pp. 349–368, UDG-IRD, Guadalajara.

Saint Charles, Juan Carlos 1996 El reflejo del poder Teotihuacano en el sur de Guanajuato y Querétaro. In *Tiempo y Territorio en Arqueología. El Centro-Norte de México*, edited by Ana Maria Crespo and Carlos Viramontes, pp. 143–169, INAH, México.

Santley, Robert 1984 Obsidian Exchange, economic Stratification, and the evolution of complex society in the Basin of Mexico, In *Trade and Exchange Society in Early Mesoamérica*, edited by Kenneth G. Hirth, pp. 43–86. University of New Mexico, Albuquerque.

Santley, Robert S., Janet M. Kerley and, Ronald R. Kneebone 1986 Obsidian Working, Long-distance Exchange, and the Politico-Economic Organization of Early States in Central Mexico. In *Economic Aspects of Prehispanic Highland Mexico*, edited by Barry L. Isaac, pp. 101–132. Research in Economic Anthropology, Supplement 2. JAI Press, Greenwich.

Spence, Michael W. 1981 Obsidian Production and the State of Teotihuacan. *American Antiquity* 46: 769–788.

Spence, Michael W. 1987 The Scale and Structure of Obsidian Production in Teotihuacan. In *Teotihuacan: Nuevos Datos, Nuevas Síntesis, Nuevos Problemas*, edited by Emily McClung de Tapia and Evelyn Childs Rattray, pp. 429–450. INAH/UNAM, México

Spence, Michael W., Phil C. Weigand, and Dolores Soto de Arechavaleta 2002 Production and Distribution of Obsidian Artifacts in Western Jalisco. In *Pathways to Prismatic Blades: a study in Mesoamerican Core-Blade Technology,* edited by Kenneth G. Hirth and Bradford Andrews,

pp. 61–80, Monograph 45. The Cotsen Institute of Archaeology, University of California, Los Angeles.

Soto de Arachevaleta, M. Dolores 1982 *Análisis de la tecnología de producción del taller de obsidiana de Guachimonton, Teuchitlan, Jalisco*, México. Tesis de licenciatura, ENAH, México.

Soto de Arachevaleta, M. Dolores 2005 Teuchitlan: un sitio con especialización en el trabajo. La manufactura de herramientas de obsidiana. In *Reflexiones sobre la industria lítica,* edited by Leticia Gonzalez Arratia and Lorena Mirambell, pp. 135–180*,* INAH, México.

Valdez Fransisco, Otto Schondube, and Jean Pierre Emphoux 2005 *Arqueología de la Cuenca de Sayula.* Universidad de Guadalajara/IRD.

Weigand, Phil C. 1990 The Teuchitlan tradition of western Mesoamérica. In *La época clásica: Nuevos hallazgos, nuevas ideas*, edited by Amalia Cardos de Méndez, pp. 25–54. INAH, México.

Weigand, Phil C. 1993 *Evolución de una civilización prehispánica. Arqueología de Jalisco, Nayarit y Zacatecas.* El Colegio de Michoacán, Zamora.

Weigand, Phil C. 1996 Teuchitlan Tradition of the Occidente of Mesoamerica. *Ancient Mesoamerica* 7: 91–101.

Weigand, Phil C. 2000 Evolution and Decline of a Core of Civilization: The Teuchitlan tradition and the Archaeology of Jalisco. In *Greater Mesoamerica. The Archaeology of West and Northwest Mexico,* edited by Michael S. Foster and Shirley Gorenstein, pp. 43–58. University of Utah Press, Salt Lake City.

Weigand, Phil C., and Michael W. Spence 1982 The obsidian Mining Complex at La Joya, Jalisco. *Anthropology VI* (1–2): 175–188. Stony Brook, Nueva York.