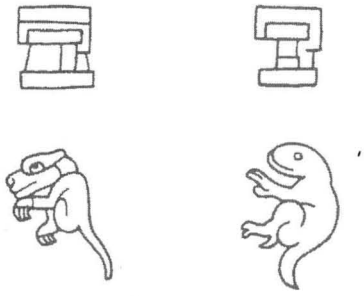
20

Obsidian Exchange Spheres



Geoffrey E. Braswell

Obsidian, a volcanic glass used for manufacturing chipped-stone tools, was the most widely circulated nonperishable good in Mesoamerica. Three factors make it particularly suitable for studying the exchange networks of the Postclassic world. First, because it was principally a utilitarian rather than a prestige item, it is found in a wide variety of contexts at both elite and humble sites. Second, the number of volcanic sources from which artifact-quality obsidian can be extracted is limited; most obsidian used in Mesoamerica came from 29 sources in west and central Mexico, and 12 sources in Central America (figure 20.1). Third, because of their unique geological histories, each source is chemically distinct, and many can be distinguished according to optical criteria or density measurements. It is possible, therefore, to ascertain the geological origin of an artifact and to reconstruct the exchange routes along which obsidian from different sources was traded.

The principal goal of this chapter is to present all published and many unpublished source assignments for obsidian artifacts recovered from Mesoamerican sites dating to the Epiclassic/Terminal Classic, Early Postclassic, and Late Postclassic periods.[1] The data are organized according to broad spatial patterns that I term "obsidian exchange spheres." Sites within a given sphere received obsidian from the same source or suite of sources. Obsidian exchange spheres are not intended to mirror political, ethnic, or linguistic boundaries, although their borders occasionally coincide. Most are much larger than any single Mesoamerican polity, so their existence implies international trade.

In order to examine this international trade, I extend the field of inquiry beyond the borders of Mesoamerica proper (chapter 3). Thus, source-assignment data are provided for sites stretching from the Loma San Gabriel region of southern Durango to Chorotegan communities in northwestern Costa Rica, a linear distance of more than 2,300 km. The inclusion of Gran Nicoya in this survey is justified because many of the Sapoá/Ometepe–period inhabitants of that culture area came from Mesoamerica, made and produced ceramics traded to central Mexico, and used obsidian obtained from sources as distant as northern Hidalgo.

Although the focus of this volume is the Postclassic period, for two reasons I have opted to begin with the Epiclassic/Terminal Classic. First, the decline of Teotihuacan and polities in the Maya lowlands triggered important changes in the structure and organization of prehistoric exchange. The obsidian exchange spheres that coalesced in the Epiclassic/Terminal Classic period continued throughout the Postclassic period. Second, recent research in the northern Maya lowlands has forced a reevaluation of traditional chronology. Just as Tula is the quintessential Early Postclassic city of central Mexico, Chichén Itzá has long been considered the archetype of Early Postclassic Maya civilization. Nonetheless, it has become clear that Chichén Itzá was founded around A.D. 800 and was abandoned about A.D. 1050 (e.g., Braswell 1998a; Cobos 1998; Ringle et al. 1998; Schele and Mathews 1998).[2] In other words, the occupation of Chichén Itzá spans the two centuries of the Terminal Classic period. Since relations between Chichén Itzá and contemporary cities such as Xochicalco, El Tajín, and Tula are relevant to the development of the Postclassic Mesoamerican world, it is appropriate to include the Epiclassic/Terminal Classic in this discussion.

EPICLASSIC/TERMINAL CLASSIC OBSIDIAN EXCHANGE SPHERES (A.D. 650/800–1000/1050)

The period beginning about A.D. 650 in central Mexico and a century or so later in southeastern Mesoamerica

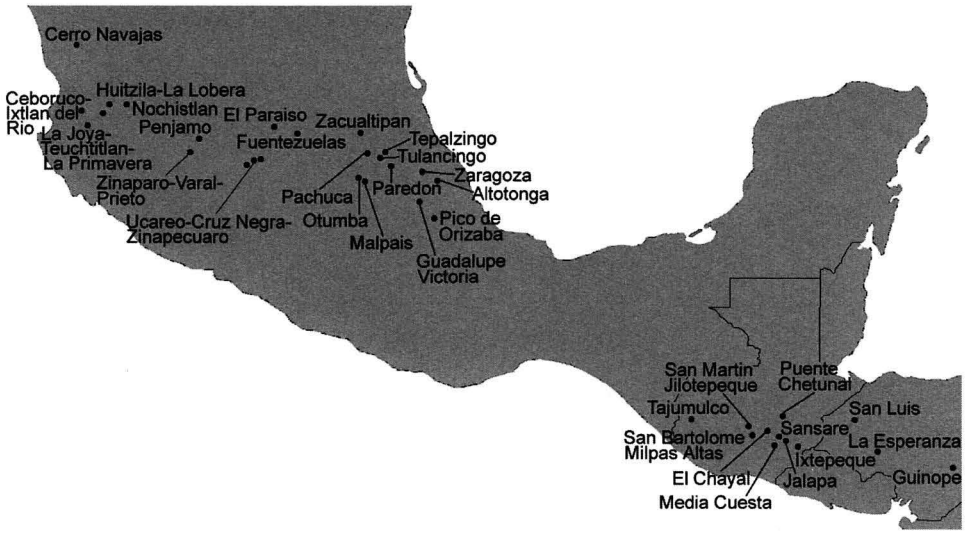


Figure 20.1 Principal obsidian sources of Mesoamerica

saw the disintegration of both interregional and long-distance Classic-period exchange networks. Although the extent and nature of the role played by Teotihuacan in the extraction, production, and exchange of obsidian are a matter of debate (e.g., Clark 1986; Santley 1983, 1989; Spence 1984), the demographic decline of that city represented the loss of the single largest source of demand for obsidian in northwestern Mesoamerica. Similarly, the collapse of Maya polities during the ninth and early tenth centuries minimally entailed a drastic revision in the nature and scale of exchange between the southern highlands and lowlands.

The disintegration of important regional states and the emergence of new power centers during the Classic to Postclassic transition required the formation of new exchange networks. I have identified 11 regional and interregional obsidian exchange spheres that characterize Mesoamerica during this transition (table 20.1 and figure 20.2).FIG. 20.2 NEAR HERE

NORTHWEST MEXICAN SPHERE

Although geographically and politically peripheral to Mesoamerica, northwest Mexico was the mythical home of several central Mexican groups, an important source of a wide variety of semiprecious stones and minerals, and possibly the place of origin of the patio-gallery, the tzompantli, the chacmool, Coyotlatelco ceramics, and the cult of Tezcatlipoca (Weaver 1993:187). For this reason, economic connections with regions to the southeast are of particular interest.

Northwest Mexico is home to a great number of obsidian sources, and this is reflected in the obsidian procurement patterns of sites in the region. Source areas that have been identified on the ground include Huitzila–La Lobera (located along the Jalisco and Zacatecas borders), Nochistlan (Zacatecas), Cerro Navajas (also called Llano Grande, Durango), Ceboruco–Ixtlan del Río (Nayarit), and the La Joya–Teuchitlan–La Primavera source area (sometimes called the Tequila and La Primavera source areas) of Jalisco (figure 20.1). Many more sources, whose geographic locations are not yet known, have been identified through chemical assay. Darling (1998) has identified nine chemical groups (called Unknown-A through -I), and Trombold et al. (1993) may have identified a tenth (called Group Z). Furthermore, many artifacts have chemical compositions that appear unique; that is, at present they cannot be attributed to either a known geological source or an identified chemical group. An assay of 25 artifacts from La Quemada, for example, revealed three known sources (Nochistlan, La Lobera, and Huitzila), two unidentified chemical groups, and nine unique pieces that could not be grouped statistically with each other or other artifacts (Trombold et al.1993). Darling (1998: table 5.3), in an analysis of five more artifacts from La Quemada, has additionally identified obsidian from Pachuca, Hidalgo, and Zináparo, Michoacán. Therefore, these 30 artifacts may have come from as many as 16 distinct sources.

Our understanding of the chronology of sites in northwest Mexico, such as La Quemada and Alta Vista, is changing. It once was thought that these two sites dated to the Early Postclassic period (e.g., Armillas 1969), but it now seems more likely that they span the Classic and Epiclassic periods (e.g., Kelley 1990; Nelson 1990; Trombold 1990). Other sites and regions in northwest Mexico, such as Las Ventanas in the Juchipila Valley, have long occupations beginning in the Formative and lasting until the Colonial period. Sites in the Bolaños Valley often are assigned to only two broad temporal periods: before A.D. 700 and after A.D. 700.

Given the wide variety of sources, poor chronologies, and the preponderance of artifacts that cannot be

Table 20.1

Obsidian procurement patterns for Epiclassic (A.D. 650–1000) northwestern Mesoamerica, Terminal Classic (A.D. 800–1050) southeastern Mesoamerica, and Late Bagaces period (A.D. 600–950) Gran Nicoya

		MEXICAN SOURCES[1]										CENTRAL AMERICAN SOURCES[2]					
REGION/SITE	N	ALT	GDV	OTU	PAC	PAR	PDO	UCA	ZAC	ZAR	OTHER	CHY	IXT	SMJ	OTHER	UNKNOWN SOURCE	References
NORTHWESTERN MESOAMERICA																	
Atzcapotzalco[3]	604			30	11	✓		60	✓	✓							García Chávez et al. 1990
Cantona	58									100							
Cerro d. l. Minas[4]	21		14	19	24			33		10							Elam et al. 1992
Cerro Portezuelo[5]	2				100												Sidrys 1977b
Cholula[6]	89	15	8		18		3	2		54							Hester et al. 1972
Cuajilote	6	33								67							
El Pital[6]	3									67						33	
El Tajin[6]	7							14		86							Jack et al. 1972
Jalieza	50		4	2	24	2	2	4		62							Elam 1993
Lambityeco	3							33		67							Elam 1993
Lower R. Verde[7]	16		6	13	6		13	44		19							Joyce et al. 1995
Matacapan	2504				10												Santley et al. 1984
Mixtequilla Zone[8]	4379		✓	✓	9	✓	25		✓	66							Heller & Stark 1998
Monte Albán	6				17					83							Elam 1993
Southern Isthmus[9]	—	48			✓		✓			50+	✓						Zeitlin 1982
Tula[10]																	
Corral	—				<10			>90									Healan 1993
Terminal Corral	—				~30			~70									Healan 1993
Mixed	33	4		6	9			73									Hester et al. 1973

Table 20.1 continued
Obsidian procurement patterns for Epiclassic (A.D. 650–1000) northwestern Mesoamerica, Terminal Classic (A.D. 800–1050) southeastern Mesoamerica, and Late Bagaces period (A.D. 600–950) Gran Nicoya

		MEXICAN SOURCES[1]										CENTRAL AMERICAN SOURCES[2]					
REGION/SITE	N	ALT	GDV	OTU	PAC	PAR	PDO	UCA	ZAC	ZAR	OTHER	CHY	IXT	SMJ	OTHER	UNKNOWN SOURCE	References
Urichu[11]	33				6			24	6		64						Pollard (this volume)
Xochicalco	116			4	3	1		85	5							2	Hirth 1989
SOUTHEASTERN MESOAMERICA																	
Acapetahua[12]	83				1		5					30		60	4		Clark et al. 1989
Aventura	19											100					Neivens et al. 1983
Becan	49	4										71	10				Nelson et al. 1983
Central Peten Lakes	20											65	20	5		10	Rice et al. 1985
Chicanna	37							3		3		73	22				Rovner 1989
Chichén Itzá	4[13]			25	50			25									Nelson et al. 1977
	2[13]							100									Moholy-Nagy and Ladd 1992
	2745			1	21	8	4	32	1	7		10	12	4			Braswell 1998c
Cobá	4											100					Nelson et al. 1983
	307				1		<1	<1				96	1	2			
Colha	3											100					Dreiss 1988
	199[14]											48	51	1			Dreiss et al. 1993
Copán[15]	551				4			<1				1	94		<1		Aoyama 1999
	518				11			2				3	83	<1			Braswell and Manahan 2001
Cozumel	6				33			17				17	33				Nelson et al. 1983

Table 20.1 continued

Obsidian procurement patterns for Epiclassic (A.D. 650–1000) northwestern Mesoamerica, Terminal Classic (A.D. 800–1050) southeastern Mesoamerica, and Late Bagaces period (A.D. 600–950) Gran Nicoya

		MEXICAN SOURCES[1]										CENTRAL AMERICAN SOURCES[2]					
REGION/SITE	N	ALT	GDV	OTU	PAC	PAR	PDO	UCA	ZAC	ZAR	OTHER	CHY	IXT	SMJ	OTHER	UNKNOWN SOURCE	References
Dzibilchaltun	22											91	5	5			Nelson 1997
Ek Balam[16]	198				2					1		97					Braswell 1998c
Huanacastal[12]	120						3					27		23	48		Clark et al. 1989
Isla Cerritos[17]	38				37		3	45				11	5				Cobos 1998
Izapa[12]	41				5							32		54	10		Clark et al. 1989
Kaminaljuyu	73											97		3			
Labna	123			2	6			6		3		80	3	1			
Lag. Cayo Francesa	12							17				50	33				McKillop 1995b
Las Lomas[12]	327									<1		26	3	70	1	<1	Clark et al. 1989
Las Morenas[12]	105				8		14	3				14	4	36	19	2	Clark et al. 1989
Mango Creek	3											100					McKinnon et al.1989
Nohmul	20											20	80				Hammond et al. 1984
Oxkintok[18]	362			1	44	1		19	<1	<1	8	20	4	2			
Patchchacan	6											83	17				Neivens et al. 1983
Placencia	7											100					McKinnon et al.1989
Quelepa	383											<1	99	<1			Braswell et al. 1994
Rancho Alegre[12]	35											17		74	3		Clark et al. 1989
Rio Arriba[12]	72							6		3		40	6	44		1	Clark et al. 1989
San Gervasio	12											33	67				
San Juan[19]	79				14			2				74	8			2	Guderjan et al.1989

Table 20.1 continued
Obsidian procurement patterns for Epiclassic (A.D. 650–1000) northwestern Mesoamerica, Terminal Classic (A.D. 800–1050) southeastern Mesoamerica, and Late Bagaces period (A.D. 600–950) Gran Nicoya

		MEXICAN SOURCES[1]										CENTRAL AMERICAN SOURCES[2]					
REGION/SITE	N	ALT	GDV	OTU	PAC	PAR	PDO	UCA	ZAC	ZAR	OTHER	CHY	IXT	SMJ	OTHER	UNKNOWN SOURCE	References
Santa Rita Corozal	3											100					Neivens et al. 1983
Seibal	22									5		50	14	32			Nelson et al. 1978
Tenampua[20]	2														100		Braswell et al. 1995
Tikal	5				20							40	40				Moholy-Nagy and Nelson 1990
Tikal-Yaxha transect[21]	2												100				Ford et al. 1997
Tipu[22]	45											56	29			16	Baxter 1984
Topoxte	12											75	17	8			Braswell 2000b
Uxmal	10								10			90					Nelson et al. 1983
	442			<1	5	<1	2	13	<1	5		48	24	1			
Wild Cane Caye[23]	29											41	52		7		McKillop 1996
Xelha[24]	4										25	75					
Xkipche[25]	108			1	2			3	1	2	1	88	4				
Xunantunich[26]	290							<1				81	14	4			J. Braswell 1998
Yaxha	5											40		60			
Yaxuna	33			6	6			39	6			42					Braswell 1998c
Zacualpa[27]	5													100			
GRAN NICOYA																	
Ayala[28]	3													33	67		Salgado 1996
	338								<1				12		88		Braswell 1997

Table 20.1 continued

Obsidian procurement patterns for Epiclassic (A.D. 650–1000) northwestern Mesoamerica, Terminal Classic (A.D. 800–1050) southeastern Mesoamerica, and Late Bagaces period (A.D. 600–950) Gran Nicoya

		MEXICAN SOURCES[1]										CENTRAL AMERICAN SOURCES[2]					
REGION/SITE	N	ALT	GDV	OTU	PAC	PAR	PDO	UCA	ZAC	ZAR	OTHER	CHY	IXT	SMJ	OTHER	UNKNOWN SOURCE	References
Cacaulí I[29]	11											9			91		Braswell 1997
Güiligüisca[30]	46												15		85		Braswell 1997
La Cruz	8														100		
Playas Verdes[28]	34											3	6		91		

Note: Values shown under each source are expressed as percents; ✓ indicates present but no quantitative data available; if no reference is cited, data first appear here.

[1] ALT=Altotonga, Veracruz; GDV=Guadalupe Victoria, Puebla; OTU=Otumba, México; PAC=Pachuca, Hidalgo; PAR=Paredón, Hidalgo; PDO=Pico de Orizaba, Veracruz; UCA=Ucareo-Zinapécuaro-Cruz Negra, Michoacán; ZAC=Zacualtipan, Hidalgo; ZAR=Zaragoza, Puebla.

[2] CHY=El Chayal, Guatemala; IXT=Ixtepeque, Guatemala; SMJ=San Martín Jilotepeque, Guatemala.

[3] Nine "gray" pieces analyzed by NAA, values shown for OTU and UCA are extrapolated from those results.

[4] Oaxaca, Mixteca Baja region, Ñuiñe phase (A.D. 300–800).

[5] Three additional pieces (two UCA, one OTU) are either Epiclassic or Early Postclassic in date.

[6] Chronological placement insecure, perhaps Classic.

[7] Coastal Oaxaca, Yuta Tiyoo Phase (A.D. 550–900).

[8] Sources with ✓ identified chemically in zone. All appear in trace quantities except GDV, which drops considerably after the Preclassic period.

[9] Other Mexican sources not specified.

[10] Corral Phase = A.D. 700–800; Terminal Corral Phase = A.D. 800–900/950. Mixed Epiclassic and Early Postclassic samples chosen to represent full visual variation (i.e., not a random collection).

[11] Michoacán, Lupe-La Joya Phase (A.D. 600–900). Other Mexican is Zináparo-Varal-Preito, Michoacán, source complex.

[12] Chiapas, dated to A.D. 600–1000. Other Central American source (if present) is Tajumulco, Guatemala.

[13] Material of uncertain temporal assignment from Sacred Cenote.

[14] Late to Terminal Classic period.

[15] Ejar-phase contexts (A.D. 950–1050), includes significant quantities of recycled earlier material as well as pieces from fill. Other Central American source is La Esperanza, Honduras.

[16] Samples come from Late and Terminal Classic contexts.

[17] Material dates to Chacpel/Jotuta and Early Jotuta phase (A.D. 750–1050).

[18] Other Mexican source consists of pieces that should be assigned to either Ucareo or Zaragoza.

[19] Includes small quantities from other periods; unknown source most closely matches Tequila-La Primavera complex, Jalisco. Resourced by McKillop (1995).

[20] Other Central American source is La Esperanza, Honduras.

[21] Late to Terminal Classic contexts.

[22] Some of source unknown material probably is from SMJ.

[23] Late to Terminal Classic contexts; other Central American source is "Puente Chetunal," Guatemala.

[24] Chemuyil phase (A.D. 600–900/1000). Other Mexican source is Ucareo or Zaragoza.

[25] Includes some earlier material. Other Mexican source is Huitzila, Zacatecas.

[26] Includes Late Classic material.

[27] Pokom phase.

[28] Granada, Nicaragua. Other Central American source is Güinope, Honduras.

[29] Madriz, Nicaragua. Other Central American source is Güinope, Honduras.

[30] Carazo, Nicaragua. Other Central American source is Güinope, Honduras.

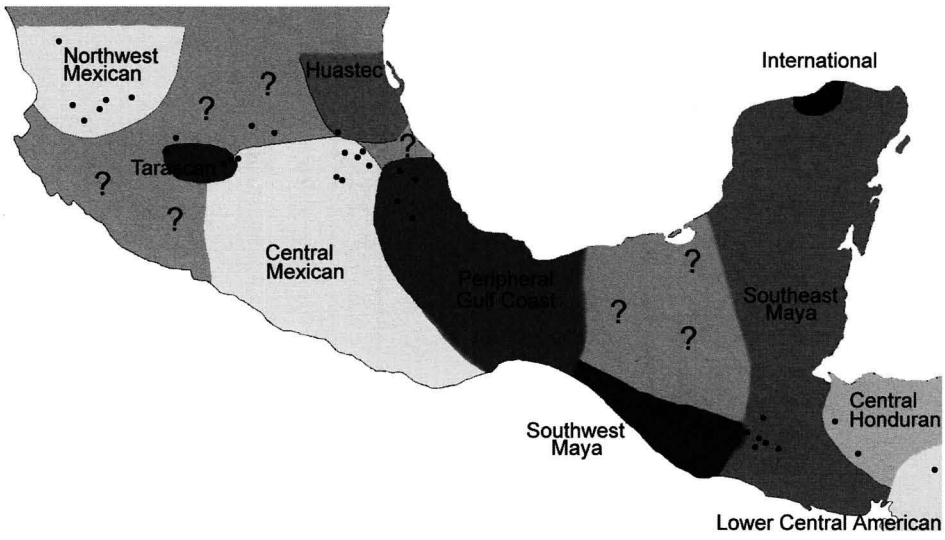


Figure 20.2 Obsidian exchange spheres of the Epiclassic (A.D. 650–1000) and Terminal Classic (A.D. 800–1050) periods

assigned yet to any known volcanic formation, I have not listed any sites in the northwest Mexican sphere in table 20.1. Instead, I discuss procurement data here in an abbreviated form. The interested reader is referred to Darling 1998 and Trombold et al. 1993, from which all the relevant data have been gleaned.

Darling (1998) suggests that two distinct obsidian procurement systems were used in the northwest Mexican sphere. First, most material was procured at local sources and used for ad hoc flake production and biface manufacture. Second, prismatic blades were imported in finished form from the Teuchitlan region of Jalisco, as well as from other areas in the Mesoamerican core. Sites where prismatic blades have been recovered tend to be large regional centers where ceremonial architecture, presumably inspired by Mesoamerica, also has been found. In this respect, the northwest Mexican sphere resembles the lower Central American sphere (see below), located at the opposite extreme of the Mesoamerican world. Prismatic blade importation began in the eighth century and apparently continued until the Spanish conquest.

Darling (1998) analyzed 167 artifacts from sites in northwest Mexico; only 16 are prismatic blade fragments. Eight prismatic blades recovered from sites in the Tlaltenango Valley region of Zacatecas were attributed to the La Joya–Teuchitlan–La Primavera source area. Thus, the inhabitants of the Tlaltenango Valley imported their prismatic blades from the Teuchitlan region of Jalisco. In contrast, most of the non-blade obsidian came from the closer Huitzila-La Lobera source area and Unknown-A, which probably is part of the Huitzila system (Darling 1998:329, table C.1). Two more prismatic blades analyzed by Darling (1998: table C.2) were recovered from sites in the Bolaños Valley of Jalisco and Zacatecas. These were attributed to the Huitzila–La Lobera source area and Unknown-C. Most of the obsidian used to make flakes in this region came either from Huitzila–La Lobera or Unknown-B, -C, or -I. One prismatic blade from the Chapalanga Valley of Zacatecas came from the La Joya–Teuchitlan–La Primavera source area, but a second could not be assigned to any group (Darling 1998: table C.3). In contrast, most of the flakes and flake cores in the Chapalanga Valley came from Unknown-D, -H, or -J. As mentioned above, a single blade fragment from La Quemada came from the Pachuca source. Flakes and chunks from La Quemada and elsewhere in the Malpaso Valley of Zacatecas that were analyzed by Darling (1998: table C.5) came from the Nochistlan, Zináparo-Varal-Prieto, and Huitzila–La Lobera source areas, as well as from Unknown-C and Unknown-E. Finally, three prismatic blades found at sites in the Chalchihuites region of Durango came from the Pachuca and La Joya–Teuchitlan–La Primavera source areas, as well as from an unidentified source. In contrast, most of the ad hoc flakes and cores were attributed to the Cerro de Navajas source area of Unknown-B, -D, and -F (Darling 1998: table C.6). Thus, of the 16 blades from sites in the northwest Mexican sphere analyzed by Darling, 10 came from sources in the Teuchitlan region of Jalisco, and 2 from Pachuca, Hidalgo: both regions are generally considered part of Mesoamerica. One more comes from the Huitzila–La Lobera source area, just north of the Teuchitlan core. As Darling argues, this pattern strongly suggests that prismatic blades found in the northwest Mexican sphere were manufactured in the Teuchitlan region or elsewhere in Mesoamerica and were not made locally.

Obsidian from only two source areas in the northwest Mexican obsidian sphere—La Joya–Teuchitlan–La Primavera and Huitzila–La Lobera—has been found else-

where. A recent study documents the use of La Joya–Teuchitlan–La Primavera obsidian in the Río Marques region of Michoacán (Esparza López 1999). Two more artifacts have been found very far afield at Maya sites dating to the Terminal Classic period. The first, from the minor Puuc center of Xkipché, has been assigned to the Huitzila-2 subsource (table C6.1). The second, from San Juan, Ambergris Caye, most closely resembles material from La Joya–Teuchitlan–La Primavera, but was not assigned unambiguously to that source complex. The presence of these exotic artifacts in the Maya region suggests contact, however indirect, with the Teuchitlan region. Connections between the Teuchitlan region and central Mexico have been demonstrated for the Classic period (e.g., Weigand 1985, 1990). During the period A.D. 700–900, however, the prosperity of the region declined, so it is not surprising that obsidian from these sources has not been found at Postclassic sites outside of west Mexico.

TARASCAN ZONE

Source provenance data for Epiclassic obsidian artifacts in the Tarascan obsidian exchange sphere are limited to just one site, Urichu, located near the western shore of Lake Pátzcuaro (chapter 29). Most obsidian at Urichu is found in the form of utilized flakes from the Zináparo-Varal-Prieto source complex located northwest of the Zacapu Basin. Smaller quantities of obsidian, including prismatic blades, are sourced to the Ucareo-Zinapécuaro–Cruz Negra (henceforth, Ucareo) source complex, as well as to Pachuca and Zacualtipan, Hidalgo. Although the Epiclassic sample is small, it is notable that no obsidian from sources in Querétaro or Guanajuato are present in the collection. Economic ties with distant trade partners to the east were more important than connections to closer sites north of the Tarascan region.

Ceramics from the Ucareo source area that date to the Epiclassic period show no close similarities to pottery from either the Tarascan region or Tula. It is likely, then, that extraction and production at this source were locally controlled (Hernández and Healan 1999). Thus, although a significant quantity of obsidian reached the Pátzcuaro region from Ucareo, the source was outside the boundaries of Tarascan economic and political control during the Epiclassic period.

HUASTEC SPHERE

No data have been published on obsidian procurement patterns in the Huastec region. Nonetheless, several researchers have observed that Huastec pottery can be found at Zacualtipan, the northernmost source in Hidalgo (Cobean 1991; Dan M. Healan, personal communication, 1999). Furthermore, Zacualtipan obsidian, with its characteristic dark black color and low surface luster, has been identified visually at several Huastec sites (Cobean 1991), including the Late Postclassic center of Tamohí (table 20.3). Since Zacualtipan is the only source that appears to be represented in the Huastec region, and only small quantities ever were traded beyond this zone, I tentatively propose that a Huastec obsidian sphere existed in the Epiclassic and Postclassic periods.

Trace amounts of Zacualtipan obsidian have been noted at Azcapotzalco (García Chávez et al. 1990), Urichu (Pollard, this volume), and Xochicalco (Hirth 1989), and in the Mixtequilla (Heller and Stark 1998) and Maya regions (e.g., Braswell 1998c; Nelson et al. 1983). In fact, a small prismatic blade reused as a bipolar core was found at the Ayala site in Pacific Nicaragua, more than 1,600 km from the Zacualtipan source (Braswell 1997).

CENTRAL MEXICAN SPHERE

Epiclassic obsidian procurement patterns in central Mexico reflect a strong dependence on the Ucareo, Michoacán, source. Important regional centers such as Tula (Healan 1993), Xochicalco (Hirth 1989), and Azcapotzalco (García Chávez et al. 1990) received most of their obsidian in the form of cores imported from Ucareo. In fact, obsidian from this source was one of the most widely and intensely traded commodities of Epiclassic Mesoamerica.

Much smaller quantities of obsidian from Pachuca and Otumba also were distributed in Epiclassic central Mexico. Material from the second source, though, was not widely traded beyond the Basin of Mexico and was subject to a remarkably steep drop-off. Azcapotzalco, the nearest important site for which there are published data, received just 30 percent of its obsidian from Otumba during the Epiclassic period (García Chávez et al. 1990).

The fact that only a small quantity of Pachuca obsidian reached Tula during the Epiclassic period suggests that this important source was not yet controlled by the Toltecs (Healan 1993). In fact, given the rather limited distribution of Pachuca obsidian in central Mexico during the Epiclassic period, it seems unlikely that any major polity controlled its extraction or distribution.

PERIPHERAL GULF COAST SPHERE

Epiclassic sites along the Gulf coast and on the Isthmus of Tehuantepec received most of their obsidian from the Zaragoza, Puebla, source. This appears to have been the only extensively exploited Mexican source under the direct control of an important Epiclassic polity. Classic and Epiclassic Cantona, perhaps the most densely populated city in ancient Mesoamerica, is only 8 km south of Zaragoza (García Cook and Merino Carrión 1998; Ferriz 1985).

In addition to Cantona, which received nearly all of its obsidian from the Zaragoza source, Epiclassic samples from Cholula (Hester et al. 1972), El Tajín (Jack et al.

1972), the Mixtequilla region (Heller and Stark 1998), El Pital, and Cuajilote are dominated by obsidian from Zaragoza. It is likely that the majority of Epiclassic Matacapan obsidian also will prove to be attributable to Zaragoza.

Smaller quantities of obsidian from three additional sources within the boundary of this exchange sphere also were exploited in the Epiclassic period, although much less extensively. These sources are Altotonga, Guadalupe Victoria, and Pico de Orizaba.

Figure 20.2 depicts the boundary between the peripheral Gulf coast and central Mexican spheres as passing west of the Valley of Oaxaca and reaching the Pacific coast west of the Isthmus of Tehuantepec. Although we have relatively few data from central and coastal Oaxaca, sites in the western half of the state, including the Mixteca Baja and lower Río Verde regions, received most of their obsidian from Ucareo and the other sources exploited by the central Mexican exchange sphere (Elam 1993; Elam et al. 1992; Joyce et al. 1995). In contrast, sites in the Valley of Oaxaca and on the southern isthmus participated in the peripheral Gulf coast exchange sphere. As distance from the sources increased, however, the boundary between the two spheres became more tenuous.

LOWLAND MAYA SPHERE

During the Late Classic period, the vast majority of obsidian entering the central and northern Maya lowlands came from a single source: El Chayal, Guatemala. This pattern became attenuated during the Terminal Classic period, particularly in the northern lowlands and along the Caribbean littoral.

The declining importance of the El Chayal source may be attributed to two events. First, Kaminaljuyú, the largest Late Classic site in the central Maya highlands, was abandoned sometime in the ninth century. It is often assumed that elites residing at the site oversaw the extraction, production, and export of prismatic blade cores from El Chayal (e.g., Michels 1979), although I know of no evidence from the quarry region that supports this conclusion. Second, the political collapse and abandonment of the Petén during the ninth and early tenth centuries disrupted the overland trade networks that carried El Chayal obsidian into the lowlands. The decline of the lowland Maya obsidian exchange sphere may have been more rapid than suggested by data in table 20.1. Many of the obsidian artifacts found in Terminal Classic contexts at sites such as Topoxté and Calakmul appear to have been reused or scavenged from cores discarded in earlier periods (Braswell 2000b; Braswell et al. n.d.).

Obsidian was an uncommon good at Late Classic sites in the northern Maya lowlands. The overland trade network that supplied obsidian to Cobá, Dzibilchaltún, and sites in the Puuc region during the eighth century was insufficiently organized to bring significant quantities of prepared cores north of the Petén. Fall-off in the concentration of Classic-period obsidian in the central Maya lowlands is rather abrupt. Although more than a million obsidian artifacts were excavated by the Tikal project (Moholy-Nagy 1997), only 515 were recovered during three years of extensive excavations at Calakmul, just 100 km north of Tikal (Braswell et al. n.d.). In fact, jade is more common at Calakmul than obsidian (Braswell et al. 1998).

INTERNATIONAL SPHERE

Beginning about A.D. 800, obsidian began entering the northern lowlands via important ports on the west and north coasts of Yucatán. The first exotic obsidian to reach the northern lowlands in quantity probably came from Zaragoza. Obsidian from that source constitutes 17 percent of the Late Classic sample from Comalcalco, a site in the northwest periphery of the Maya region (Lewenstein and Glascock 1997). Importantly, no material from Ucareo is present in the collection. Late Classic Comalcalco, then, participated in the lowland Maya obsidian exchange sphere but also obtained significant quantities of obsidian through the peripheral Gulf coast exchange network.

An important Terminal Classic port of entry for Mexican obsidian was Isla Cerritos, associated with Chichén Itzá (Andrews et al. 1989). Terminal Classic collections from both Isla Cerritos and Chichén Itzá are dominated by obsidian from distant sources in Mexico, particularly Ucareo and Pachuca, the principal sources exploited by sites in the central Mexican exchange sphere. But the sources found in both collections are quite varied: prepared cores were imported from Zacualtipan in the Huastec sphere, Zaragoza and Pico de Orizaba in the peripheral Gulf coast sphere, and Paredón, a source of high-quality obsidian that was not widely exploited in Epiclassic highland Mexico. In addition to the seven Mexican sources, exhausted cores from all three major Guatemalan sources have been found at Chichén Itzá. Because of the wide variety of sources represented in collections from Chichén Itzá and related sites, they collectively form what I call the international exchange sphere.

Mexican obsidian also is found in the Puuc zone at sites with significant ninth-to-eleventh-century occupations; that is, sites with substantial mosaic-style Puuc architecture. These include Uxmal, Oxkintok, Labná, and Kabah. There is a general decline in quantity of exotic obsidian as the distance from the west coast increases and site size decreases. Although it is possible that Mexican obsidian was received in trade from Chichén Itzá, some probably entered the Puuc region through a

port on the coast. Punta Canbalam, a site now under water, is one candidate. Green obsidian from the Pachuca source is found commonly on the beach near the site (Dahlin et al. 1998).

Obsidian from Ucareo and Pachuca is present at many Terminal Classic Maya sites. Blue-black obsidian from Ucareo and green Pachuca blades with ground platforms are two of the clearest diagnostics of ninth- to eleventh-century occupations at sites throughout the Maya area. For example, more than 13 percent of the obsidian artifacts recovered from Ejar-phase contexts at Copán come from these sources (Braswell and Manahan 2001; see also Aoyama 1999). Still, outside of the international obsidian exchange sphere, the proportion of Mexican material in obsidian collections is generally quite low and decreases as the distance from the Gulf coast and Caribbean shoreline increases.

Within the northern Maya lowlands, there are sharp territorial divisions between sites that received significant quantities of obsidian from Mexican sources and those that did not. Chichén Itzá and Uxmal apparently participated in the same international obsidian trade network, but sites like Cobá and Ek Balam did not.[3]

SOUTHWEST MAYA SPHERE

Sites in the Maya highlands and Pacific lowlands west of Kaminaljuyú participated in an obsidian exchange sphere that began to form as early as the Archaic period (Clark et al. 1989). Although the proportions of the three sources (San Martín Jilotepeque, Tajumulco, and El Chayal) that provided most of the obsidian consumed in this sphere shifted over time, suggesting that several distinct distribution mechanisms operated on the local level (e.g., Clark and Salcedo Romero 1989; Clark et al. 1989), regional procurement strategies were relatively stable until the Late Postclassic.

During the Early Classic period, most of the obsidian consumed in this zone came from the San Martín Jilotepeque source. In the Late and Terminal Classic (A.D. 600–1000), greater quantities of El Chayal obsidian were traded in the sphere, particularly in Chiapas. It seems likely that material from this source entered the western half of the obsidian exchange sphere via a trade route along the Pacific coast. I have observed significant quantities of both San Martín Jilotepeque and El Chayal obsidian at coastal centers such as El Baúl, but have found much less El Chayal obsidian at contemporary sites in the Kaqchikel and K'iche' highlands.

Although no Mexican obsidian is known from Late and Terminal Classic sites in the eastern half of the southwest Maya exchange sphere, a few pieces have been identified at sites in Xoconochco. In particular, Clark et al. (1989) have noted the presence of artifacts from the Pico de Orizaba, Zaragoza, Pachuca, and Ucareo sources at six of seven sites dating to this period. Thus, it seems that small quantities of obsidian were entering the western edge of the zone from both the peripheral Gulf coast and central Mexican exchange spheres.

SOUTHEAST MAYA SPHERE

During the Classic period, Maya, Lenca, and other peoples in southeastern Guatemala, much of western Honduras, and all of El Salvador, relied almost exclusively on Ixtepeque obsidian. This high-quality source provided most of the raw material for making chipped-stone artifacts in this zone; at sites such as Copán, Tazumal, and El Cerén, chert artifacts are less common than obsidian blades from Ixtepeque.

Reliance on Ixtepeque obsidian is notable in parts of western Honduras and eastern El Salvador because La Esperanza, Honduras, is the closest source to sites in these regions (figure 20.1). Furthermore, although La Esperanza material lacks the shiny luster and translucence of Ixtepeque obsidian, material from the Honduran source is well suited for prismatic blade and biface manufacture. Differences in the quality of raw material do not explain the sharply delimited boundaries of the southeast Maya and central Honduran exchange spheres. The ceramic complexes of Quelepa and Tenampua also are quite dissimilar, supporting the hypothesis that little trade took place between eastern El Salvador and central Honduras.

During the Terminal Classic period, the southeast Maya obsidian exchange sphere began to expand, particularly along the Caribbean coast. Ixtepeque was the principal source of obsidian used at Terminal Classic Wild Cane Caye in southern Belize (McKillop 1996), Colha and Nohmul in northern Belize (Dreiss et al. 1993; Hammond et al. 1984), and San Gervasio on Cozumel Island. Significant quantities of Ixtepeque obsidian traveled inland from these coastal ports following major courses such as the Moho, Belize, Mopan, and New rivers, penetrating as far as Xunantunich (J. Braswell 1998), Tipu (Baxter 1984), Topoxté (Braswell 2000b), and Tikal (Ford et al. 1997; Moholy-Nagy and Nelson 1990).

CENTRAL HONDURAN SPHERE

Classic, Terminal Classic, and Postclassic sites in central and northern Honduras received nearly all their obsidian from the La Esperanza source, with smaller quantities coming from Ixtepeque and two low-quality Honduran sources: Güinope and San Luis. In central Honduras, where Lenca and other peoples built mound architecture and ball courts, and produced Uluá polychrome ceramics, obsidian from La Esperanza was used primarily for the prismatic blade industry. There is little evidence for blade production in northeast Honduras, where inhabitants seem to have produced casual flake tools and to have used imported blades.

Table 20.2
Obsidian procurement patterns for Early Postclassic (A.D. 1000/1050–1250/1300) Mesoamerica and Sapoa/Ometepe-period (A.D. 950–1550) Gran Nicoya

		MEXICAN SOURCES[1]								CENTRAL AMERICAN SOURCES[2]					
REGION/SITE	N	OTU	PAC	PAR	PDO	UCA	ZAC	ZAR	OTHER	CHY	IXT	SMJ	OTHER	UNKNOWN SOURCE	Reference
NORTHWESTERN MESOAMERICA															
Cerro Portezuelo[3]	4		75			25									Sidrys 1977b
Jalieza	20	10	10		10			70							Elam 1993
Mixtequilla Zone[4]	1859	✔	2	✔	87		✔	11							Heller & Stark 1998
Rancho Dolores[5]	4								100						Winter 1989
Southern Isthmus[6]	—	~7	~30		~52		✔		✔	✔			✔	✔	Zeitlin 1982
Teopanzolco[7]	107	6	93	1										2	Smith et al. 1984
Tepozteco[7]	85	21	58			21									Smith et al. 1984
Tetla[7]	45	11	82	5										2	Smith et al. 1984
Tula	—		~85	✔		~15									Healan 1993
Urichu[8]	24		8			8	4		79						Pollard (this volume)
Xaracuaro[8]	10					40			60						Pollard (this volume)
Xochicalco[7]	237		49			51									Smith et al. 1984
Yautepec[9]	984	3	93	2		<1			2						Smith et al. 1996
SOUTHEASTERN MESOAMERICA															
Central Petén Lakes	26									19	58	15		8	Rice et al. 1985
Chuisac[10]	1214									9	1	90			Braswell 1996
Cihuatan	20									35	60	5			Fowler et al. 1987
Colha	10										100				Hester and Shafer 1983
False Caye	3		67							33					McKinnon et al. 1989
Frenchman's Caye	2		50							50					McKinnon et al. 1989
Isla Cerritos[11]	18		39	7		7		14		34					Cobos 1998

Table 20.2 continued

Obsidian procurement patterns for Early Postclassic (A.D. 1000/1050–1250/1300) Mesoamerica and Sapoa/Ometepe-period (A.D. 950–1550) Gran Nicoya

		MEXICAN SOURCES[1]								CENTRAL AMERICAN SOURCES[2]					
REGION/SITE	N	OTU	PAC	PAR	PDO	UCA	ZAC	ZAR	OTHER	CHY	IXT	SMJ	OTHER	UNKNOWN SOURCE	Reference
Izapa[12]	147	1	3			4			1	27	1	50	13		Clark et al. 1989
Las Morenas[12]	4						25					75			Clark et al. 1989
Las Vegas[13]	52		2								23		73	2	Braswell et al. 1995
Moho Caye, Toledo	1										100				Hammond 1976
Pulltrowser Swamp[14]	3									67	33				Dreiss 1988
Río Claro[13]	3												100		Healy et al. 1996
San Gervasio	31			3		3					90	3			
Sula Valley[13]	1												100		Pope 1987
Wild Cane Caye[15]	75					1				8	84	1	6		McKillop 1996
Xelha	17										100				
Zacualpa	4											100			
GRAN NICOYA															
Ayala[16]	127									1	24		76		Braswell 1997
Bahia de Salinas[17]	1												100		Sheets et al. 1990
Caldera[18]	9									11	44		44		
La Pachona[19]	2											50	50		
Los Jocotes[18]	1									100					
Nindiri[18]	9										33		67		Sheets et al. 1990
Rio Sapóa[20]	1												100		Sheets et al. 1990
San Cristobal[21]	3										33		67		Healy et al. 1996
Santa Isabel "A"[22]	2										100				Healy et al. 1996
Tepetate[16]	35									3	66		31		
Vidor[23]	2										50	50			Sheets et al. 1990

Values shown under each source are expressed as percents; ✔ indicates present but no quantitative data available; if no reference is cited, data first appear here.

[1] OTU=Otumba, México; PAC=Pachuca, Hidalgo; PAR=Paredón, Hidalgo; PDO=Pico de Orizaba, Veracruz; UCA=Ucareo-Zinapécuaro-Cruz Negra, Michoacán; ZAC=Zacualtipan, Hidalgo; ZAR=Zaragoza, Puebla.

[2] CHY=El Chayal, Guatemala; IXT=Ixtepeque, Guatemala; SMJ=San Martín Jilotepeque, Guatemala.

Table 20.2 continued

Obsidian procurement patterns for Early Postclassic (A.D. 1000/1050–1250/1300) Mesoamerica and Sapoa/Ometepe-period (A.D. 950–1550) Gran Nicoya

[3] Three additional pieces (two UCA, one OTU) are either Epiclassic or Early Postclassic in date.
[4] Sources with ✔ identified chemically in zone. All appear in trace quantities except Guadelupe Victoria, which drops considerably after the Preclassic period.
[5] Oaxaca; other Mexican source is Guadelupe Victoria, Puebla.
[6] Oaxaca; other Mexican and Central American sources not specified.
[7] Morelos; only 8 “gray” artifacts sourced; values extrapolated from this sample.
[8] Michoacán; other Mexican source is Zináparo-Varal-Prieto.
[9] Other Mexican sources are El Paraiso (1%), Tulancingo (<1%), and Fuentezuelas (<1%).
[10] San Martín Jilotepeque, Guatemala.
[11] Late Jotuta phase (A.D. 1050–1200); assay results extrapolated for unanalyzed “gray” obsidian.
[12] Chiapas; other Central American source is Tajumulco, Guatemala.
[13] Honduras; other Central American source is La Esperanza, Honduras.
[14] Undifferentiated Postclassic.
[15] Undifferentiated Postclassic. Other Central American sources are “Puente Chetunal,” Guatemala (4%), and La Esperanza, Honduras (1%).
[16] Granada, Nicaragua. Other is Güinope, Honduras.
[17] Costa Rica; other Central American source is “Nica-2.”
[18] Masaya, Nicaragua. Other Central American source is Güinope, Honduras.
[19] Chontales, Nicaragua. Other Central American source is Güinope, Honduras.
[20] Costa Rica; other Central American source is Güinope, Honduras.
[21] Managua, Nicaragua. Other Central American sources are La Esperanza (33%) and Güinope (33%), Honduras.
[22] Rivas, Nicaragua.
[23] Costa Rica.

LOWER CENTRAL AMERICAN SPHERE

Until quite recently, little was known about obsidian trade and production in lower Central America (Sheets et al. 1990). The Late Bagaces period (A.D. 600–850/950) is of particular interest. In Late Bagaces times and in the following Sapoá/Ometepe period, at least three waves of immigrants from Mesoamerica arrived in Pacific Nicaragua. The first group to arrive, the Chorotega, originally came from the region around Cholula, settled for a time in Xoconochco, and moved into Pacific Nicaragua about A.D. 800 (Healy 1980). The Nicarao, a Nahua group that also resided for a time in Xoconochco, arrived in the Rivas region around A.D. 1200. Finally, the Subtiaba, originally from the Tlapanec region of Guerrero, also came to Pacific Nicaragua at the end of the Mesoamerican Early Postclassic period (Fowler 1989:33–35).

The Late Bagaces–period inhabitants of Pacific Nicaragua produced neither prismatic blades nor bifaces. Like inhabitants of Caribbean Honduras and other parts of lower Central America, they made crude ad hoc flake and chopper tools out of chert, chalcedony, and obsidian. Most obsidian artifacts dating to this period are casual and bipolar flakes or cores from the Güinope, Honduras, source. Obsidian from Güinope was imported as small nodules and pebbles and worked locally. Drop-off in the quantity and size of Late Bagaces–period obsidian artifacts is monotonic, suggesting that nodules were exchanged in a down-the-line network.

Small quantities of prismatic blades made of Guatemalan obsidian also were traded through this loosely organized exchange network. The majority of these are made of Ixtepeque obsidian and are morphologically similar to prismatic blades found at Quelepa, Honduras (Braswell 1997). Since Delirio Red-on-white ceramics produced at Quelepa have been found at several sites in Nicaragua, it seems likely that the blades entered lower Central America from this community in the southeastern periphery of Mesoamerica. As noted, a single prismatic blade from the Zacualtipan source has been found at a site in Pacific Nicaragua. The lack of prismatic blade technology and the presence of blades imported from Mesoamerica is an important parallel with the northwest Mexican sphere.

EARLY POSTCLASSIC OBSIDIAN EXCHANGE SPHERES (A.D. 1000/1050–1250/1300)

During the two and a half centuries of the Early Postclassic period (A.D. 1000/1050–1250/1300), regional and interregional obsidian procurement strategies transformed as new centers of political power emerged in Mesoamerica. In the northwest, significant changes in the sources exploited by exchange spheres occurred (table 20.2), although the borders of these spheres shifted very little (figure 20.3). In southeastern Mesoamerica, changes

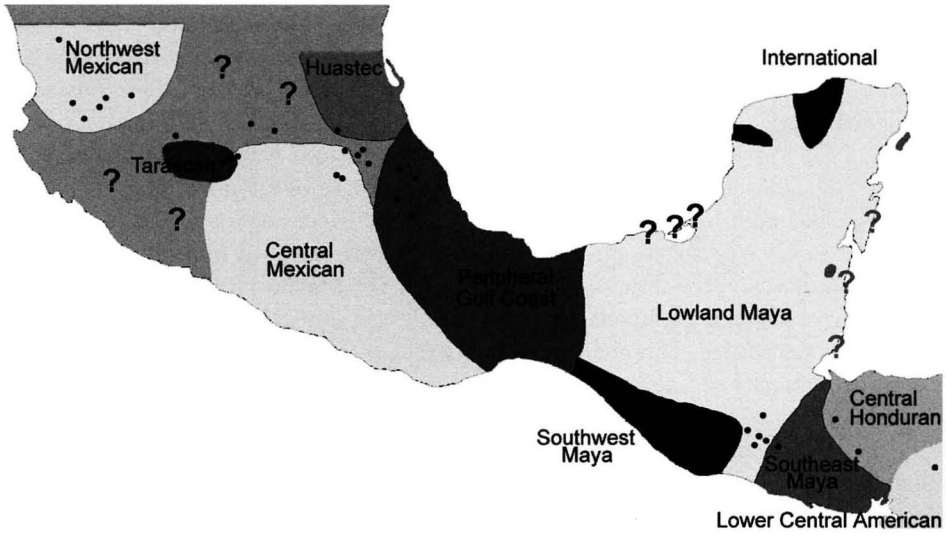


Figure 20.3 Obsidian exchange spheres of the Early Postclassic period (A.D. 1000/1050–1250/1300)

in the location of principal trade routes seem to have played a larger role. Few changes can be seen in several exchange spheres. For this reason, only regions exhibiting new Early Postclassic patterns are discussed.

TARASCAN SPHERE

Obsidian procurement data for the Early Postclassic period come from only two sites in the Tarascan region: Urichu and Xarácuaro. As in the Epiclassic period, material from the Zináparo-Varal-Prieto source complex comprises most of the sample, with lesser amounts coming from Pachuca and the Ucareo source area.

Pollard (chapter 29) divides the centuries I have assigned to the Early Postclassic into two ceramic phases: Early Urichu (A.D. 900–1000/1100) and Late Urichu (A.D. 1000/1100–1300). The Early Urichu sample, corresponding to the Epiclassic–Early Postclassic transition, contains no artifacts from Ucareo, the only portion of the Ucareo-Zinapécuaro–Cruz Negra source complex where high-quality obsidian is found. This phase is contemporary with the Terminal Corral and Early Tollan phases at Tula, when Ucareo obsidian constituted 60–80 percent of the material consumed at the site (Healan 1993:454; Ringle et al. 1998:222). It may be that the lack of Ucareo obsidian in the Tarascan region during the tenth and eleventh centuries was somehow related to heavy exploitation by the central Mexican exchange sphere. Although this hypothesis is quite plausible, only 14 artifacts dating to the Early Urichu phase were assayed. Thus, the lack of Ucareo material in the sample may be a reflection of its small size. Furthermore, some obsidian from the central Mexican exchange system did enter the Tarascan region during the Early Urichu phase. Two obsidian blades in the analyzed sample come from the Pachuca source, located east of Tula.

Ten pieces dating to the Late Urichu phase also were sourced. Two of these, one from each site, are assigned to the Ucareo portion of the greater Ucareo-Zinapécuaro–Cruz Negra source complex. If there was a barrier to trade across the Tarascan–central Mexican frontier during the tenth or eleventh centuries, it disappeared in the second half of the Early Postclassic period.

CENTRAL MEXICAN SPHERE

Two regional capitals emerged in central Mexico during the Early Postclassic period: Tula and Cholula.[4] The economic and political growth of these cities had important ramifications for the sources of obsidian that circulated in both the central Mexican and peripheral Gulf coast exchange spheres. At the beginning of the Early Postclassic, extraction and production at the Pachuca source increased dramatically. The vast majority of obsidian consumed at Tollan-phase Tula came from this source (Healan 1993). Diehl (1981:290) and Spence and Parsons (1972:29) have proposed that the Pachuca source came under the direct political control of Tula at this time. Although this remains a possibility, it may be that the growing demand for obsidian at Tula precipitated an increase in production at the source. Recent surveys around the mines themselves demonstrate a Toltec presence at Pachuca, but the vast majority of recovered ceramics date to the Late Postclassic period (Cruz Antillón 1994; Pastrana 1990, 1998).

Early Postclassic occupants of sites in Morelos (including Teopanzalco, Tepozteco, Tetla, and Yautepec) also received most of their obsidian from the Pachuca source (Smith et al. 1984; Smith et al. 1996). The sole exception is Xochicalco, where more than half of the Early Postclassic sample comes from Ucareo. But given the

strong Epiclassic occupation of the site, this may be a result of stratigraphic mixing. Alternatively, Postclassic inhabitants of Xochicalco may have scavenged obsidian blades from Epiclassic contexts.

PERIPHERAL GULF COAST SPHERE

A similar shift of the principal exploited source occurred in the peripheral Gulf coast exchange sphere during the Early Postclassic period. In this case, the shift was away from Zaragoza, the primary source of the Epiclassic, to a reliance on the Pico de Orizaba source. This change was due in part to the decline of the city of Cantona. A second cause may have been the development of new mining technologies. During earlier periods, only the superficial layers of the obsidian flows at Pico de Orizaba were exploited. These layers yield small, irregular slabs of raw material that are not well suited for the prismatic blade industry (Daneels and Pastrana 1988:108). In the Postclassic period, however, shaft-mining techniques introduced from central Mexico allowed access to high-quality obsidian (Anick Daneels, personal communication, 1996).

A third cause for the shift to Pico de Orizaba obsidian may have been the rise of Cholula, the south pole of Early Postclassic central Mexico. Pico de Orizaba and Zaragoza, the two sources of high-quality obsidian closest to Cholula, are about 110 km away. When production at Zaragoza declined as a result of the abandonment of Cantona, increasing demand at Cholula probably served to intensify production at Pico de Orizaba. Unfortunately, no Postclassic obsidian artifacts from Cholula have been attributed to geological sources, so this remains a conjecture.

Who was mining obsidian at Pico de Orizaba? The source does not seem to have been under the direct control of any large site during the Early Postclassic period. Daneels (1997:249) hypothesizes that the Cotaxtla region, immediately east of Pico de Orizaba, was settled in the Early Postclassic by Nahua immigrants from Tlaxcala. Postclassic ceramics from the Cotaxtla zone include characteristic Mixteca-Puebla wares, as well as other types known from the altiplano (Daneels 1997:244–245). The presence of these ceramics near Pico de Orizaba supports the hypothesis that Postclassic exploitation of the source can be linked to Cholula.

Data from the Mixtequilla region provide some of the strongest evidence for a shift to Pico de Orizaba obsidian before the end of the Early Postclassic period (Heller and Stark 1998). Here, in contexts dating to A.D. 1200–1350 (and perhaps earlier), fully 87 percent of all obsidian artifacts are assigned to the Pico de Orizaba source. Data from the Valley of Oaxaca (Elam 1993; Winter 1989) and the southern isthmus (Zeitlin 1982) also demonstrate continued participation in the peripheral Gulf coast exchange sphere.

SOUTHWEST MAYA SPHERE

Few Early Postclassic sites in the southwest Maya exchange sphere have received significant investigation, despite the fact that Tohil Plumbate, one of the most widely traded ceramic wares in Mesoamerica, originated in the western half of this zone.

In the Xoconochco region, sites like Izapa and Las Morenas continued to receive most of their obsidian from San Martín Jilotepeque, El Chayal, and Tajumulco. At Izapa, significant quantities of obsidian from Ucareo, Pachuca, and Otumba also are represented in the collection. This suggests economic relations with sites in the central Mexican, but not the peripheral Gulf coast, exchange sphere. Perhaps, then, most Plumbate entered northwestern Mesoamerica before A.D. 1200 through Pacific and overland, rather than Gulf coast, trade routes.

SOUTHEAST MAYA SPHERE

The most notable change in obsidian procurement strategies in the Maya region during the Early Postclassic period was the expansion of the southeast Maya exchange sphere. Sotuta-Hocaba contexts at Chichén Itzá, dating to about A.D. 1050, contain the greatest proportions of Ixtepeque obsidian found at the site. At Isla Cerritos, however, no Ixtepeque obsidian has been found in Early Postclassic contexts, but the sample size (N = 18) is small. Still, it seems likely that this site continued to participate in the international exchange sphere after its inland capital was abandoned. Other coastal sites such as Xelha, San Gervasio, Wild Cane Caye (McKillop 1996), and Moho Caye (Hammond 1976) received most of their obsidian from Ixtepeque. What little data we have for inland sites in the Maya lowlands also support an Early Postclassic expansion of the southeast Maya exchange sphere (e.g., Braswell 2000b; Rice et al. 1985).

Who extracted obsidian from Volcán de Ixtepeque during the Postclassic? The nearest important Classic and Postclassic polities were centered at Copán, Chalchuapa, and Cihuatan, respectively 72, 81, and 75 km from the source. Copán was abandoned shortly after A.D. 820 and was briefly and lightly reoccupied about A.D. 950. Inhabitants of that site could not have supervised production at Ixtepeque during the Early Postclassic period, particularly after about A.D. 1050/1100, when Copán was again abandoned. Both Tazumal (in the Chalchuapa zone) and Cihuatan were extensively occupied during the Postclassic period, but no Pipil ceramics have been found near the source. Thus, extraction and production at Ixtepeque were likely managed by local inhabitants of the southeastern Guatemalan highlands.

LOWER CENTRAL AMERICAN SPHERE

The last six centuries of prehistoric Nicaragua are divided into two periods: Sapoá and Ometepe. In practice,

Table 20.3
Obsidian procurement patterns for Late Postclassic (A.D. 1250/1300–1520) Mesoamerica

		MEXICAN SOURCES[1]										CENTRAL AMERICAN SOURCES[2]					
REGION/SITE	N	OTU	PAC	PAR	PDO	TUL	UCA	ZAC	ZAR	ZNP	OTHER	CHY	IXT	SMJ	OTHER	UNKNOWN SOURCE	Reference
NORTHWESTERN MESOAMERICA																	
Acámbaro[3]	8						75									25	Pollard &Vogel 1994
Apatzingan[4]	17		41				6			53							Hester et al. 1973
Cerro Portezuelo	3	33	67														Sidrys 1977b
Coatlan Viejo	—		98														Mason 1980
Copuju[5]	5						20			80							Pollard (this volume)
El Ciruelo A[6]	2613		97	<1			2										Smith et al. 1984
Milpillas[7]	39						10			79	10						Darras 1998
Mixtequilla Zone[8]	409	✔	33	✔	45			✔	22								Heller & Stark 1998
Olintepec[9]	65	68	32														Smith et al. 1984
Otumba[10]																	
Batch 1	—	97	3														Glascock et al. 1999
Batch 2	—	10	90														Glascock et al. 1999
Batch 3	—	39	61														Glascock et al. 1999
Batch 4	—	99	1														Glascock et al. 1999
Batch 5	—	25	75														Glascock et al. 1999
Batch 6	—	67	33														Glascock et al. 1999
Batch 7	—	16	75	2		4					1					4	Glascock et al. 1999
Pareo[6]	10						50			50							Pollard (this volume)
Quiahuitzlan[11]	56		2		21				71		2					4	Jack et al. 1972
Southern Isthmus[12]	—	10	45		45												Zeitlin 1982
Tamazulapan[13]	—		~50														Byland 1980
Tamohi[14]	5							100									
Taximaroa[3]	7		14				86										Pollard &Vogel 1994
Teotihuacan[15]	3672	19	81														Spence 1985

Table 20.3 continued
Obsidian procurement patterns for Late Postclassic (A.D. 1250/1300–1520) Mesoamerica

		MEXICAN SOURCES[1]										CENTRAL AMERICAN SOURCES[2]					
REGION/SITE	N	OTU	PAC	PAR	PDO	TUL	UCA	ZAC	ZAR	ZNP	OTHER	CHY	IXT	SMJ	OTHER	UNKNOWN SOURCE	Reference
Tepeapulco[16]																	
Batch 1	—		35	63		2											Glascock et al. 1999
Batch 2	—	<1	94	5							1						Glascock et al. 1999
Batch 3	—		56	44													Glascock et al. 1999
Batch 4	—	<1	90	9							1						Glascock et al. 1999
Tuzantla[3]	14					100											Pollard &Vogel 1994
Tzintzuntzan[17]	3						67									33	Hester et al. 1973
	381		5			<1	82		1	6						6	Pollard (this volume)
Urichu[5]	48		8				44			40	4					4	Pollard (this volume)
Uruapan[18]	77		6				3			42	29					21	Esparza López 1999
Villa Morelos[19]	100	1	1				96		2								Hester et al. 1973
Xaracuaro[5]	19						16			79	5						Pollard (this volume)
Xochicalco[6]	292	4	82				11									4	Smith et al. 1984
Yautepec[20]	4596	1	93	3		1	1		<1		1					<1	Smith et al. 1996
Zempoala	39		22		44				33								Jack et al. 1972
Zirizicuaro[3]	6						83			17							Pollard &Vogel 1994
Zitacuaro[3]	2						100										Pollard &Vogel 1994
SOUTHEASTERN MESOAMERICA																	
Acapetahua[21]	176		18		27			1	1			13	2	30	7	1	Clark et al. 1989
Aldea Chimuch[22]	12											50		50			
ALO:018[22]	2													100			
ALO:050[22]	2											50		50			
Cary Caye, Toledo	1											100					McKinnon et al. 1989
Caserio El Hato[22]	4											25		25	50		
Casa Roja[22]	3											33		67			
Caye Coco	1466						<1					30	68	1			Mazeau 2000
Cerritos Tecpan[23]	5													100			

Table 20.3 continued

Obsidian procurement patterns for Late Postclassic (A.D. 1250/1300–1520) Mesoamerica

		MEXICAN SOURCES[1]										CENTRAL AMERICAN SOURCES[2]					
REGION/SITE	N	OTU	PAC	PAR	PDO	TUL	UCA	ZAC	ZAR	ZNP	OTHER	CHY	IXT	SMJ	OTHER	UNKNOWN SOURCE	Reference
Cerros	3											33	67				Nelson 1985
Chan Chen	7											29	71				Neivens et al. 1983
Chitaqtzaq[22]	1140											51	2	46	1		
Chiche[24]	2													100			
Chutixtiox[24]	4													100			
Corozal Beach	7												100				Neivens et al. 1983
El Aguacate[21]	155		39		18							9	27	4	3		Clark et al. 1989
El Rincon 3[23]	12													100			Braswell 1996
Finca Argelia[22]	3											100					
Finca El Pilar[22]	52											69		31			
Finca Magnolia[23]	27													100			Braswell 1996
Funk Caye, Toledo	1											100					McKinnon et al. 1989
Iximche[23]	16											19		75	6		
La Cuchilla[23]	1													100			Braswell 1996
Laguna de On[25]	658											27	67	3		3	Mazeau 2000
La Palma[21]	121		32		12							32	17	5	1		Clark et al. 1989
Las Brujas[26]	140		29		26						1	21	6	17			Maguire 2001
Las Carretas 1[23]	61													100			Braswell 1996
Las Gradas[21]	17		24		47							6		12	12		Maguire 2001
Las Morenas[21]	297		10		40		<1		<1			13	10	24	1		Clark et al. 1989
Las Piedritas[21]	224		26		46							9	8	11			Maguire 2001
La Union 2[23]	34													100			Braswell 1996
Mayapan[27]	1241		<1	<1	<1				<1			11	98	<1		<1	
Media Cuesta[28]	72											8	46	3	43		
"Mixco" Viejo[23]	62											39	61				
Ocelocalco[21]	28		57									29		4	11		Clark et al. 1989
Patchchacan	9											55	33			11	Neivens et al. 1983

Table 20.3 continued

Obsidian procurement patterns for Late Postclassic (A.D. 1250/1300–1520) Mesoamerica

		MEXICAN SOURCES[1]										CENTRAL AMERICAN SOURCES[2]					
REGION/SITE	N	OTU	PAC	PAR	PDO	TUL	UCA	ZAC	ZAR	ZNP	OTHER	CHY	IXT	SMJ	OTHER	UNKNOWN SOURCE	Reference
Pericon 2[23]	3													100			Braswell 1996
Pueblo Viejo[23]	167											3		97			Braswell 1996
Pblo. Viejo Tecpan[23]	13											38		62			
Q'umarkaj[24]	4											50	50				
San Gervasio	37						3						97				
Santa Rita Corozal	11		18		9							27	45				Neivens et al. 1983
Sarteneja	39		8										92				Neivens et al. 1983
Talpetate 4[23]	4													100			Braswell 1996
Tipu[29]	171		1									11	79	5		4	Baxter 1984
Topoxte	47											38	45	17			Braswell 2000b
Xelha	29											10	90				
Xesuj 1[23]	3													100			Braswell 1996
Xesuj 2[23]	4													100			Braswell 1996
Xesuj 3[23]	3													100			Braswell 1996
Xoconochco Bajo[21]	39		5		21							15	5	36	18		Maguire 2001
Xoconochco Viejo[21]	47		36		6							19	4	23	11		Maguire 2001

Maguire 2001

Note: Values shown under each source are expressed as percents; ✔ indicates present but no quantitative data available; if no reference is cited, data first appear here.

[1] OTU=Otumba, México; PAC=Pachuca, Hidalgo; PAR=Paredón, Hidalgo; PDO=Pico de Orizaba, Veracruz; TUL=Tulancingo, Hidalgo; UCA=Ucareo-Zinapécuaro-Cruz Negra, Michoacán; ZAC=Zacualtipan, Hidalgo; ZAR=Zaragoza, Puebla; ZNP=Zináparo-Varal-Prieto, Michoacan.

[2] CHY=El Chayal, Guatemala; IXT=Ixtepeque, Guatemala; SMJ=San Martín Jilotepeque, Guatemala.

[3] Frontier sites of the Tarascan empire; see chapter 11 for details.

[4] Michoacán. Pieces originally assigned to Guadalupe Victoria are probably from ZNP.

[5] Michoacán; other Mexican source (if indicated) is Pénjamo, Guanajuato.

[6] Morelos; results of assayed "gray" obsidian extrapolated for entire collection.

[7] Zacapú Basin, Michoacán. Other Mexican source is Pénjamo, Guanajuato. Sample analyzed by NAA. Additionally, 2,709 artifacts were visually sorted into black (87%, assumed to be from Zináparo-Varal-Prieto) and green obsidian (13%, assumed to be Pachuca). Given the easy confusion between PAC and Pénjamo obsidian and UCA and ZNP material, it is likely that the black and green visual categories include some UCA and Pénjamo.

[8] Sources with ✔ identified chemically in zone. All appear in trace quantities except Guadelupe Victoria, which drops considerably after the Preclassic period.

[9] Morelos, only two (of 44) gray artifacts sourced; context mixed with Epiclassic lithics.

Table 20.3 continued

Obsidian procurement patterns for Late Postclassic (A.D. 1250/1300–1520) Mesoamerica

[10] Batch 1 (25 assayed "gray" artifacts) comes from a core-blade workshop; Batch 2 (22 "gray" artifacts) is from excavations in an elite residence; Batch 3 (25 "gray" samples) is from the surface of a rural site near Otumba; Batch 4 (25 "gray" artifacts) from a biface workshop; Batch 5 (25 "gray") is from surface contexts around three houses; Batch 6 (20 "gray") is from the surface of a single house; and Batch 7 (50 "gray" artifacts is from a lapidary workshop. In all cases, assay results extrapolated for entire collection. Other Mexican source is Tepalzingo, Hidalgo; unknown source is probably located near Pachuca.

[11] Other Mexican source is Altotonga, Veracruz.

[12] Oaxaca.

[13] Mixteca Alta, Oaxaca. From area identified as prismatic blade workshop.

[14] San Luis Potosí, also known as Tamuin.

[15] From Aztec-period workshops; bifaces, some of which are Classic in date, are excluded. All "gray" obsidian assumed to be from OTU.

[16] Batches 1 and 3 consist of random samples from prismatic blade workshop; 29 "gray" artifacts from Batch 1, and 25 from Batch 3 were assayed, and results extrapolated for the entire collections. Batches 2 and 4 consists of all "gray" obsidian from several surface collections; 29 gray artifacts from Batch 2, and 25 from Batch 4 were assayed, and results extrapolated for entire collection. Other Mexican sources are Malpaís, Hidalgo (Batch 2 and .4% of Batch 4) and El Paraiso, Querétaro (.4% of Batch 4).

[17] Pieces assigned to PAC are high-quality green obsidian that appear to have been incorrectly assigned to the Jalisco sources; pieces assigned to ZAR originally sourced only to "Puebla."

[18] Upper Río Marques region, Michoacán. Other Mexican sources include Tequila-La Primavera, Jalisco (27%) and Pénjamo, Guanajuato (1%). Only flakes were sourced, skewing data away from Ucareo, the primary source used for blades. Sourced artifacts are of uncertain chronological placement.

[19] Michoacán; site is probably Postclassic in date; two samples originally assigned to Altotonga, Veracruz, and ZAR probably come from ZNP.

[20] Atlan-Santiago phases (A.D. 1300 to Early Colonial period); results of assay of "gray" artifacts extrapolated to entire collection. Other Mexican sources are El Paraiso (.8%) and Fuentezuelas (.4%), Querétaro.

[21] Chiapas; other Central American source is Tajumulco, Guatemala.

[22] Sacatepequez, Guatemala; other Guatemalan source is San Bartolomé Milpas Altas.

[23] Chimaltenango, Guatemala; other Guatemalan source is San Bartolomé Milpas Altas.

[24] Quiche, Guatemala.

[25] Belize; probably contains some earlier materials.

[26] Chiapas; other Central American source is Guatemalan, but particular source unclear.

[27] All pieces from Str. 163.

[28] Santa Rosa, Guatemala; other Guatemalan source is Media Cuesta (Laguna de Ayarza), probable Xinca site.

[29] Unknown source may be SMJ.

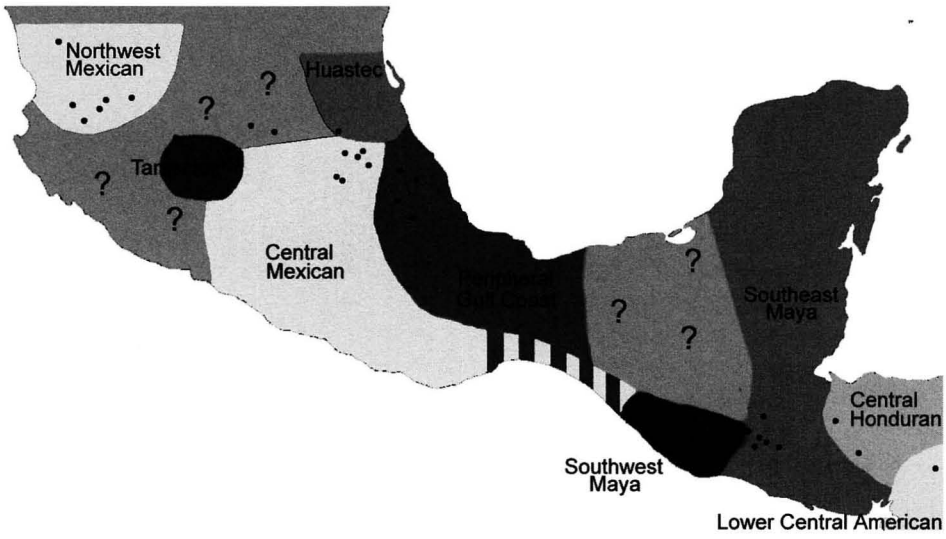


Figure 20.4 Obsidian exchange spheres of the Late Postclassic period (A.D. 1250/1300–1520)

it has proven difficult to distinguish two distinct and sequential occupations corresponding to these periods. At least some of the proposed differences in the Sapoá and Ometepe ceramic complexes reflect regional variation rather than temporal distinctions. For this reason, both periods are discussed together.

During Sapoá/Ometepe times, the proportion of Ixtepeque material in obsidian assemblages grew to more than double that of the earlier Late Bagaces period. This is related to a more than tenfold increase in the quantity of blades. Prismatic blade manufacture, although uncommon in Pacific Nicaragua, is demonstrated for two sites in the departments of Masaya and Rivas. Thus, while all Bagaces blades were imported as finished artifacts, at least some Sapoá/Ometepe blades were locally produced.[5] Moreover, the spatial pattern of obsidian in the department of Granada reveals a significant change in distribution. During the Bagaces period, obsidian artifacts were used at only the highest-ranked sites in the settlement hierarchy. In contrast, obsidian flakes and blades in Sapoá/Ometepe times were used by consumers at more modest villages and hamlets (Salgado González 1996).

LATE POSTCLASSIC OBSIDIAN EXCHANGE SPHERES (A.D. 1250/1300–1520)

The Late Postclassic was a period of remarkable integration. Although many Early Postclassic obsidian procurement and exchange spheres continued to operate, particularly near the sources, there were fewer barriers to trade in many regions (table 20.3 and figure 20.4). In particular, the division between the peripheral Gulf coast, central Mexican, and southwest Maya exchange spheres became less tangible.

TARASCAN SPHERE

The Late Postclassic period saw a major territorial expansion of the Tarascan empire. Ceramics dating to this period from the Ucareo region are related to types from the Tarascan heartland (Hernández and Healan 1999). It seems likely, then, that this source complex came under direct territorial control of the Tarascan empire during the final centuries of Mesoamerican prehistory. The Pénjamo, Guanajuato, source also was incorporated into the Tarascan empire during the Late Postclassic period.

Obsidian procurement data for the center of the Tarascan region come from five sites, including the imperial capital of Tzintzuntzan. Although each site received most of its obsidian from the Ucareo or Zináparo source complexes, the relative quantities of material from each source differ among and within sites.

In particular, fully 76 percent of the obsidian at Tzintzuntzan came from the Ucareo source (and another 6 percent from the Zinapécuaro portion of the system). Residents of two locations at Urichu also received most of their obsidian from Ucareo, but those living in a third section of the site did not. Inhabitants of Xarácuaro, Copujo, and Pareo had only limited access to obsidian from Ucareo.[6] In general, the quantity of Ucareo obsidian in each collection is inversely proportional to the amount of material from the Varal portion of the Zináparo source complex. Possible explanations for this pattern are discussed below.

Collections from peripheral regions of the empire also have been studied (e.g., Darras 1998; Esparza López 1999; Hester et al. 1973). Pollard (chapter 29) summarizes data from the Zacapu Basin (Darras 1998) and from a survey along the upper Río Marques, near Uruapán, Michoacán (Esparza López 1999). In both regions, obsidian from the Zináparo source complex is predomi-

nant, although a surprising amount of material from Pénjamo, Guanajuato, was identified in the Zacapu Basin. In the Río Marques region, 27 percent of the analyzed obsidian came from the La Joya-Teuchitlan–La Primavera source area in Jalisco. It seems as though consumers from the Río Marques region supplemented obsidian procured from sources within the empire with material from outside of the Tarascan zone. Thus, the northwestern political frontier of the empire was not a sharp economic boundary (chapter 13). Collections from Villa Morelos and Apatzingan, located southeast and southwest of the Pátzcuaro Basin, were assayed more than 25 years ago by Hester et al. (1973). These collections are not well dated, but probably should be assigned to the Postclassic period. Nearly all obsidian from Villa Morelos comes from the Ucareo complex. Most material from Apatzingan was assigned originally to the Guadalupe Victoria, Puebla, source, but these assignments are implausible. X-ray fluorescence data for strontium, zirconium, and rubidium concentrations do not allow Zináparo-Varal-Prieto obsidian to be distinguished from material from several sources in Puebla (Michael Glascock, personal communication, 1999). Since the Zináparo complex is much closer to Apatzingan than to Guadalupe Victoria, I assume that the assignments reported by Hester et al. (1973: table 1) are inaccurate. A similar inaccuracy seems to exist in the identification of "Puebla" source obsidian at Tzintzuntzan (see table 29.4). Table 20.3 corrects the apparent errors in these data.

Data also are available for five Late Postclassic sites (Acámbaro, Taximaroa, Tuzantla, Zirizicuaro, and Zitacuaro) located near the Tarascan-Aztec frontier. Nearly 90 percent of the artifacts from these sites are attributed to the Ucareo source complex (Pollard and Vogel 1994). This proportion is even greater than that found at the capital of Tzintzuntzan. The abundance of Ucareo obsidian and lack of Zináparo-complex material may be related to distance; these sites are closer to Ucareo than to the latter source area.

CENTRAL MEXICAN SPHERE

Late Postclassic source attribution data are available for eight cities and smaller centers in central Mexico. These are El Ciruelo A, Olintepec, Xochicalco (Smith et al. 1984), Otumba, Tepeapulco (Glascock et al. 1999), Yautepec (Smith et al. 1996), Coatlan Viejo (Mason 1980), and Teotihuacan (Spence 1985). For the last two sites, only the relative proportions of Pachuca and "gray" (i.e., not green) obsidian are reported. In the case of Teotihuacan, we probably are safe in assuming that nearly all gray obsidian comes from the Otumba source. Material from Otumba and Tepeapulco has been analyzed in batches corresponding to a variety of residential and workshop contexts (Glascock et al. 1999). These collections provide an important glimpse into procurement and production strategies at the sub-site level of analysis. The implications of these data are discussed below in another section.

Most central Mexican collections, not surprisingly, are dominated by prismatic blades from the Pachuca, Hidalgo, source. As mentioned, evidence for intensive shaft mining at this source dates to the Aztec period (Cruz Antillón 1994; Pastrana 1990, 1998), and there is little doubt that extraction and core preparation of obsidian were orchestrated by inhabitants of Pachuca, an administered center within the Acolhua state.

After Pachuca, Otumba is the second most common source for obsidian at sites in the Late Postclassic central Mexican exchange sphere. Obsidian from the Paredón source also was exploited, but its distribution largely was limited to the Tepeapulco region. Trace amounts from other sources within the northeast corner of the exchange sphere also are found, as are a few artifacts made of obsidian from El Paraíso and Fuentezuelas, Querétaro—two peripheral sources that were beyond the frontier of the Aztec empire. Finally, a few artifacts from Xochicalco have been sourced to Ucareo (Smith et al. 1984), but I suspect that these pieces either come from temporally mixed contexts or represent scavenged blades produced in earlier periods.

Within the Aztec empire, evidence for the importation of obsidian from sources in the peripheral Gulf coast sphere is limited to two prismatic blades from Zaragoza found at Yautepec. In fact, more obsidian from this source has been found at Tzintzuntzan and Villa Morelos in the Tarascan empire. The Aztecs, then, did not import obsidian from their eastern rivals.

Beyond the Aztec political frontier, however, the boundary between the central Mexican and peripheral Gulf coast obsidian exchange spheres is less evident. In the southern Isthmus of Tehuantepec, 45 percent of the Late Postclassic obsidian came from Pico de Orizaba, and 55 percent came from sources within the central Mexican sphere (Zeitlin 1982). At Tamazulapan, in the Mixteca Alta, about half the obsidian found in a prismatic blade workshop came from Pachuca (Byland 1980). Given the relative proportions of Pachuca and Otumba obsidian in the central Mexican heartland, it is probable that most of the gray obsidian at Tamazulapan comes from other sources, some in the peripheral Gulf coast sphere.

PERIPHERAL GULF COAST SPHERE

The principal source for obsidian traded within the peripheral Gulf coast exchange sphere during the Late Postclassic period was Pico de Orizaba, but significant quantities of obsidian from Zaragoza and some Altotonga material also were exchanged. There are

indications that the Totonacs eventually came to consume most of the obsidian extracted from the Zaragoza source. Although relatively small quantities of Zaragoza obsidian are found in Late Postclassic contexts in the Mixtequilla zone (Heller and Stark 1998), most of the obsidian artifacts from Quiahuiztlan come from Zaragoza, as do a third of those in the assayed collection from Cempoalla (Jack et al. 1972).

Despite the prevalence of obsidian from Pico de Orizaba and Zaragoza in Late Postclassic collections from sites along the Gulf coast, significant amounts of green obsidian from Pachuca entered the exchange sphere. Thus, the boundary between the central Mexican and the peripheral Gulf coast spheres was more permeable than in earlier periods. In the Mixtequilla region, for example, a third of all Late Postclassic obsidian artifacts are attributed to Pachuca. Although the data are limited, it appears that the relative amount of Pachuca obsidian circulating in the peripheral Gulf coast sphere was greatest at the southern extremes of the exchange zone.

SOUTHWEST MAYA SPHERE

During the Late Postclassic period, the southwest Maya obsidian procurement sphere contracted, and the boundary between it and the two Mexican spheres to the west became diffuse. At the 10 Late Postclassic sites in Xoconochco for which we have data, 26–72 percent of the obsidian artifacts come from Mexican sources, predominantly Pico de Orizaba and Pachuca (Clark et al. 1989). The proportions of these two sources at each site differ. At Acapetahua, Las Morenas, Las Gradas, Las Piedritas, and Xoconochco Bajo, there is more obsidian from Pico de Orizaba. But at El Aguacate, Las Brujas, La Palma, Ocelocalco, and Xoconochco Viejo, Pachuca is the most common source.

Obsidian from four Guatemalan sources—El Chayal, San Martín Jilotepeque, Ixtepeque, and Tajumulco—also are found at these 10 sites. An interesting pattern emerges when we compare the quantities of obsidian from these sources to the Mexican obsidian present in the same collections. In general, sites that received most of their obsidian from Pachuca also acquired the bulk of their Guatemalan material from El Chayal and Ixtepeque. In contrast, sites with greater amounts of Pico de Orizaba obsidian tended to get most of their Guatemalan material from San Martín Jilotepeque.[7] Thus, at least two distinct local procurement networks operated within Xoconochco during the Late Postclassic period. I suspect that these two networks are temporally distinct, representing an early facet of the Late Postclassic (with more Pico de Orizaba and San Martín Jilotepeque obsidian) and a late facet of the Late Postclassic (with greater quantities of Pachuca, El Chayal, and Ixtepeque obsidian). Recent excavations and the careful analysis of stratigraphy lend credence to this hypothesis (Susan Maguire, personal communication, 2001). It seems likely that the increase in the use of Pachuca obsidian was due to the Aztec arrival in Xoconochco at the end of the fifteenth century. The Aztec incursion, which has been difficult to detect in the ceramics of Xoconochco, may be discernable through analysis of obsidian exchange patterns.

Mexican obsidian is extremely rare in the Late Postclassic central highlands of Guatemala, and Pachuca is the only source that has been noted. With the exception of Saq Ulew (Woodbury and Trik 1953:229–231), the westernmost excavated Postclassic center, I know of no exotic obsidian at any major highland site.

Obsidian procurement patterns at Media Cuesta, a small site in the eastern highlands of Guatemala, are worth discussing for three reasons. First, the site is on the boundary between the southeast and southwest Maya exchange spheres, a fact reflected in the presence of obsidian from all three major Guatemalan sources in its Late Postclassic assemblage (table 20.3). Second, the site is only a few hundred meters from a small obsidian source known as Laguna de Ayarza or Media Cuesta (Braswell and Glascock 1998: figure 5). Despite the proximity of the outcrops, more than half of the obsidian used at the site was imported from more-distant sources. Media Cuesta obsidian is of sufficient quality for biface and casual flake production, but is not well suited for making blades. Third, two interesting polychrome paintings in the Postclassic international style are found above the lake 1 km west of the site. Finally, there is good reason to think that Media Cuesta was a Xinca, rather than Maya, site. Several indigenous place names in the region are derived from Xinca, and the few remaining Xinca speakers live in the same department. Thus, the stability of the boundary between the southwest and southeast Maya exchange spheres in this part of Guatemala might have been related to the presence of remnant Xinca populations.

SOUTHEAST MAYA SPHERE

Source provenance data are available for 14 Late Postclassic sites in the southeast Maya exchange sphere. In all but two collections (from Funk Caye and Pachchacan, Belize), the predominant source is Ixtepeque. Because these two sites are represented by a total of 10 artifacts, they do not seem to constitute significant exceptions.

Despite the paucity of data on Late Postclassic procurement patterns in the Maya lowlands, several facts are worthy of note. First, with the possible exception of Tikal, the density of obsidian artifacts at Mayapán is greater than that of any other lowland Maya site. The 1,241 artifacts for which source assignments are presented in table 20.3 come from only one building: a low range structure near the Castillo. Recent excavations in several buildings throughout Mayapán suggest that

Structure 163 is not anomalous (Peraza Lope et al. 1996). The quantity of obsidian at Mayapán and its general paucity elsewhere in the Late Postclassic Maya lowlands suggest that circum-peninsular trade was tightly regulated by this polity.

Second, obsidian from El Chayal, San Martín Jilotepeque, and several Mexican sources also reached the Maya lowlands during the Late Postclassic period. Most Mexican obsidian can be sourced either to Pico de Orizaba or the Pachuca source, but trace quantities from Paredón, Ucareo, and perhaps Zaragoza also have been noted. As in the Epiclassic period, obsidian from both the central Mexican and peripheral Gulf coast exchange spheres entered the Maya lowlands.

Third, in the southern lowlands, the quantity of obsidian seems to be greatest at sites near the coast or on major rivers. Again, this supports a model of circum-peninsular, rather than overland, trade routes.

DISCUSSION

Many aspects of the procurement data presented here are relevant to the emergence of transnational economies in ancient Mesoamerica. In this final section, I discuss several issues germane to Postclassic economies that these data elucidate.

LOCATION OF SOURCES ON ECONOMIC AND POLITICAL FRONTIERS

Figures 20.2 to 20.4 suggest that most sources were peripheral, rather than central, to the exchange spheres in which artifacts ascribed to those sources circulated. In particular, the directed rather than radial pattern of distribution is striking. That is to say, instead of exhibiting a pattern of concentric decrement as distance from source increases, obsidian from a particular source is often absent from sites to one side of that source.

With the exceptions of Cantona and Zaragoza, and perhaps Tula and Pachuca, there are few indications that source areas were directly controlled by major polities during the Epiclassic and Early Postclassic periods. Epiclassic ceramics from the Ucareo source complex are local and show no particular affinities with pottery from Tula or sites in the Pátzcuaro Basin. Early Postclassic sites near Pico de Orizaba are small, and there is no nearby central place. In the Maya region, there is no evidence suggesting that Copán, Chalchuapa, or Cihuatan controlled Ixtepeque, despite the fact that this was the source of the most widely distributed obsidian in Postclassic southeastern Mesoamerica. Nor is there compelling evidence that Kaminaljuyú ever exerted direct control over the El Chayal source. Few important centers were located around the San Martín Jilotepeque source during the Classic and Early Postclassic periods, and during the Late Postclassic both Iximche' and Saqik'ajol Nimakaqapek ("Mixco" Viejo) were positioned equidistant from the source (Braswell 1996).

The peripheral or interstitial locations of obsidian sources, the directional pattern of distribution, and the lack of clear controlling central places all suggest that obsidian extraction and circulation were governed more by demand than by central planning. Rather than interpreting these patterns as indicating colonialist exploitation of hinterland resources, it may be that local populations residing near obsidian quarries manipulated their economic relations with more-powerful and populace regions to maintain political autonomy. One such strategy is tribute (when viewed from the perspective of the center) or gift giving (when viewed from the position of the periphery). If centers received enough obsidian from regions beyond their political control, it may not have been worth the military effort to incorporate small frontier communities with access to important resources.

INCREASED PRODUCTION AND EXCHANGE

There is strong evidence that extraction and production levels increased at most obsidian sources during the Postclassic period. At the Choatalum quarry of the San Martín Jilotepeque, Guatemala, source, topsoil was stripped away to afford easy access to obsidian-bearing deposits (Braswell 1996:239–242). During the last 500 years before the conquest, approximately 3000 m^3 of lithic debitage—weighing nearly 3,000,000 kg—accumulated on the quarry floor (Braswell 1996:648). In central Mexico, evidence for increased production levels is even greater. New technologies, such as shaft and pit mining, were introduced during the Postclassic period (e.g., Charlton 1969a; Cobean 1991; Cruz Antillón and Pastrana 1994; Holmes 1900; Pastrana 1990, 1998; Stocker and Cobean 1984). Although it can be quite difficult to date quarry and mine features, most of the ceramic materials recovered from the major source areas of Pachuca and Otumba date to the Aztec period (e.g., López Aguilar and Nieto Calleja 1989; López Aguilar et al. 1989). Thus, it seems likely that extraction levels at those sources reached their peak during the Late Postclassic.

Recent research at the Ucareo, Michoacán, source has demonstrated the practice of large-scale "trench quarrying," but the chronology of such quarries is not yet clear (Healan 1997:90–92). Nonetheless, occupation of the Ucareo Valley was insubstantial until the end of the Late Classic period, so it is likely that trench quarries date to the Epiclassic or Postclassic periods (Healan 1997:93–98). There also is evidence for increased production at the Zináparo, Michoacán, source area during the Late Postclassic (Darras 1998).

Archaeological reports typically do not contain enough information to calculate consumption levels of obsidian artifacts. The problem is compounded by

different recovery techniques. For example, some archaeologists working in the Maya region do not sift excavated soils for small artifacts, so fragments of obsidian blades and flakes often are under-represented in collections. Still, there is some evidence that the intensity of obsidian exchange and consumption increased during the Postclassic period. Carlos Peraza Lope has directed three field seasons of consolidation-oriented excavations at Mayapán. Bárbara Escamilla Ojeda, a student working on the project, currently is analyzing some 14,000 obsidian artifacts recovered from the site. This quantity, although small for a site in central Mexico or highland Guatemala, is much more than the total number of obsidian artifacts that have been reported for *all* other sites in the northern lowlands. Most of this material comes from Ixtepeque, the most distant obsidian source in the Maya region. Ixtepeque obsidian also became important in the K'iche'an highlands of Guatemala during the Postclassic period, suggesting the formation of new trade ties with the southeast Maya sphere. Finally, the presence of Mexican-source obsidian in significant quantities at Postclassic sites in Xoconochco, where little exotic material was present during earlier periods, is further evidence for an increase in long-distance obsidian exchange.

Population levels increased dramatically in many regions of Mesoamerica during the Late Postclassic period. Thus, one source of the increase in demand for obsidian was greater population. Another source seems to have been the proliferation and increased wealth of affluent production zones far from core areas. Residents of Xoconochco, for example, may have imported more exotic obsidian during the Postclassic period because they were exporting more cacao. Similarly, inhabitants of the Balsas-Tepalcatepec drainage (including the upper Río Marques sites discussed by Pollard in chapter 29) may have been able to import more Zináparo obsidian because they were mining for metal ores. Thus, as the demand for goods from affluent production zones increased in the core, wealth and the demand for core goods increased in affluent production zones. In some cases, interlocking central-place systems developed, and commodities from different affluent production zones were exchanged without direct administration by the core.

ELITE CONTROL VERSUS MARKET EXCHANGE

Were intrasite and intraregional variations in procurement strategies the result of elite control or market exchange? At the beginning of this chapter, I stated that obsidian was a primarily utilitarian rather than prestige good. Given the central role ascribed to preciosities in many discussions of the application of world-systems theory to preindustrial economies, it is important to examine the social value of obsidian in ancient Mesoamerica.

Obsidian may have served as a precious commodity in two contexts. First, in regions of Mesoamerica where access to material or skilled artisans was unusually low, imported obsidian could have been manipulated as a scarce quantity. The Pacific coast of Oaxaca and Guerrero, the Maya lowlands, and lower Central America all are regions where scarcity might have caused obsidian to become a preciosity. It is only in this third region, however, that there is clear evidence for differential access to material during the periods that concern us.

Salgado González (1996) describes the Late Bagaces settlement hierarchy of Granada, Nicaragua, as consisting of only two levels: nucleated and dispersed villages. The distribution of obsidian and imported ceramics (such as Delirio Red-on-white, Uluá polychromes, and Gallo Polychrome: Jaguar variety) was limited to nucleated villages, which Salgado González argues were the centers of incipient complex polities. She suggests that the emerging elite of Granada monopolized the exchange of items received through long-distance trade, which helped stimulate political elaboration.

In regions where access to obsidian was more common, material from a distant source may have become a precious good because of its rarity and distinctive characteristics. Obsidian from the Pachuca source, for example, could have been a preciosity in the Maya region because of its green color. During the Terminal Classic period, however, there is little reason to suspect that access to Pachuca obsidian was limited to elites. Studies conducted in the southern Maya lowlands have not revealed a strong correlation between access to Pachuca obsidian and status (Stiver et al. 1994; Kindon and Connell 1999). Recent research has revealed significant quantities of both Pachuca and Ucareo obsidian throughout all Ejar-phase contexts at Copán. There is no evidence that the elite living in the epicenter of Chichén Itzá had greater access to exotic Mexican obsidian than did people living in more-humble and peripheral residential groups. During the time periods in question, within- and between-site analyses in the Maya region do not suggest that access to exotic obsidian from distant sources varied with economic status. One possibility, then, is that exotic obsidian was not a prestige item. If access to all obsidian was related only to need, and not restricted by controlling elites, then this pattern also is consistent with Hirth's (1998) model of marketplace exchange. Elsewhere (Braswell 2000a), I have argued that data from the northern lowlands are consistent with the emergence of partially and fully commercialized market economies during the Terminal Classic period.

Some evidence for differential access to exotic materials, and hence for redistributive and uncommercialized economies, can be seen in the Tarascan region, where most imported green obsidian is found in elite burials. Furthermore, the proportion of exotic obsidian in a col-

lection, the number of remote sources represented, and the distance to those exotic sources all are greater for Tzintzuntzan than for the other Late Postclassic sites in the Pátzcuaro Basin. Residents of the imperial capital therefore had more access to obsidian brought to the region by long-distance traders than did the occupants of the outlying centers. This may be due in part to the higher status of the residents of Tzintzuntzan and the limited redistribution of obsidian by elites. But it also may reflect the role of the capital as a node of long-distance exchange, and the inefficiency of the local market system. Most likely, the procurement strategies of the Tarascan core were complex, consisting of both market exchange and the privileged provisioning of high-status individuals residing in the capital (chapter 29).

The distribution of Ucareo obsidian within the Late Postclassic Pátzcuaro Basin seems to suggest elite control of the exchange of material from that source. The pattern is complicated by the fact that most prismatic blades consumed in the Tarascan empire were made of Ucareo obsidian, but material from the Zináparo source area was used commonly to make ad hoc flake tools. Thus it is not clear if the Tarascan dynasty controlled the exchange of Ucareo obsidian or access to prismatic blade technology. Ucareo is more distant than the Zináparo source complex, a factor that would have been incorporated into its cost in the marketplace. Why trade for costly imported obsidian when cheaper material suitable for the dominant lithic industries is plentiful?

Recent data from Late Postclassic Tepeapulco (Glascock et al. 1999) appear to suggest the practice of marketplace exchange. Two collections from a variety of rural sites near Tepeapulco suggest an even distribution of obsidian from different sources, with Pachuca supplying 94 percent and 90 percent of the material in each sample (table 20.3: Batches 2 and 4). Collections from two prismatic blade workshops exhibit procurement patterns different from those of rural residential contexts, and also are distinct from each other (table 20.3: Batches 1 and 3). One workshop received 63 percent of its material from the Paredón source, and the other acquired 56 percent of its obsidian from Pachuca. Thus, although the prismatic blade workshops each had different procurement patterns, perhaps representing distinct dyadic relations with individuals who had access to the quarries, marketplace exchange appears to have homogenized the acquisition patterns of prismatic blade consumers. But why do households in Tepeapulco have radically different consumption patterns than the two sampled workshops?

The most complex local procurement pattern has been observed at sites around the city-state of Otumba (Glascock et al. 1999). Prismatic blade and biface workshops in that area exhibit similar procurement strategies: nearly all obsidian consumed in two workshops comes from the Otumba source (table 20.3: Batches 1 and 4). But collections from three residential zones display distinct procurement strategies. Nearly all the obsidian consumed at an elite household comes from the Pachuca source (table 20.3: Batch 2), a pattern similar to most sites in the Aztec empire. In contrast, a collection from three rural households reveals a somewhat greater reliance on Otumba obsidian (table 20.3: Batch 3), and a sample from a single house is dominated by obsidian from the Otumba source (table 20.3: Batch 6).

According to Hirth's (1998) models, this pattern is most consistent with elite control and redistribution, with Pachuca as the more-valuable obsidian. It does not suggest direct procurement from local workshops, because almost all obsidian from both the prismatic blade and biface workshop comes from the Otumba source. Thus, either the sampled workshops are anomalous, or distribution and consumption patterns are more complex than can be explained by Hirth's three models.

Most sites in the Aztec empire exhibit the same basic procurement strategy: 90–98 percent of all obsidian comes from Pachuca. This remarkably consistent pattern suggests the existence of a very large regional market system. It is likely that the source was controlled directly by the administered center of Pachuca, and indirectly by the Acolhua state, so we may assume that the proposed regional exchange system was heavily influenced by the economic concerns of Texcoco. Residents of the two sampled regions of Tepeapulco received almost all their obsidian from Pachuca, even though local workshops procured much of their raw material from Paredón. Thus, the hypothesized regional market system was sufficiently pervasive to overwhelm local production systems at Tepeapulco: a case of Winn Dixie versus the local roadside produce cart.

At Otumba, it seems that elites participated fully in the regional market system. In contrast, the occupants of rural households and non-elite portions of the city-state received the bulk of their obsidian tools from local producers exploiting the Otumba source. Hence, the local economy of Otumba was not as dominated by the regional market system as was that of Tepeapulco. The fact that local producers at both of these smaller city-states exploited distinct sources suggests that their two economies were not well articulated, at least as far as obsidian exchange is concerned (Glascock et al. 1999). In contrast, the distribution of Aztec-period ceramics is much more homogeneous, implying that the exchange of pottery was more strongly governed by the regional market system than was the obsidian trade.

Local variation in Epiclassic/Terminal Classic and Postclassic obsidian procurement patterns can be interpreted in a number of different ways. In Late Bagaces (analogous to the Terminal Classic) period Nicaragua, obsidian was a prestige good limited to and manipulated

by local elites. This may be an example, therefore, of macroregional interaction stimulating local economic and political development. The Late Postclassic Tarascan case suggests a mixed system: Ucareo obsidian or core-blade technology was the domain of the elite, but material from the Zináparo source complex circulated in a regional market system. At Epiclassic Xochicalco, according to Hirth (1998), obsidian consumption patterns indicate the existence of a single market. Finally, the Late Postclassic city-states of the Aztec empire appear to have participated in both local market systems and a powerful regional market.

IDEOLOGY AND INTERNATIONAL INTEGRATION

The Postclassic Mesoamerican world not only was articulated by economic interdependence, but also was integrated by shared ideological principles (chapter 22). The two, in fact, are rarely separable. Regional cults or world religions that mandate pilgrimages may stimulate the growth of enormous international exchange networks; it is no accident that the hajj and global trade routes coincide. I close this chapter by observing that the two periods of greatest pan-Mesoamerican economic integration, as reflected in obsidian exchange spheres, seem to coincide with the spread of world religions in Mesoamerica.

The first period of economic integration that can be discerned from obsidian procurement data was the Epiclassic/Terminal Classic. At that time, Maya sites participating in the international exchange sphere received much of their obsidian from a wide variety of sources in highland Mexico. Ringle et al. (1998) have linked the broad distribution of the material traits collectively referred to as "Toltec" to the expansion of a cult centered on Quetzalcoatl/Kukulkan. They propose that sites exhibiting these characteristics formed a network of pilgrimage shrines spreading from Xochicalco, Teotenango, Cholula, Tula, and El Tajín in northwestern Mesoamerica, to Uxmal and Chichén Itzá in the northern Maya lowlands. An important aspect of their argument is that the cult of Quetzalcoatl/Kukulkan dates to the Epiclassic, rather than Early Postclassic period. The establishment of these pilgrimage centers corresponds to the period of economic integration reflected in the international obsidian exchange sphere. Since sites from both the central Mexican and peripheral Gulf coast exchange spheres were major centers in this pilgrimage network, it is not surprising that the Mexican sources represented at sites in the international exchange sphere reflect connections with both regions of northwestern Mesoamerica.

The second period of economic integration corresponds with the Late Postclassic and the expansion of the Postclassic international style and the Late Postclassic international symbol set. These were brought into southeastern Mesoamerica and lower Central America along established Pacific and Gulf coast trade routes. The Pacific expansion can be linked to movements of Mesoamerican peoples, particularly the Pipil, Nicarao, and ultimately, the Aztecs. The appearance of round structures, twin pyramids, *tzompantlis* (skull racks), and the cult of Xipe Totec in Central America are tied to this migration.

Although there is very little evidence for the trade of Mexican obsidian in the Guatemalan highlands during the Late Postclassic period, ceramics and murals of the Postclassic international style, elite cremation, and numerous architectural features from northwestern Mesoamerica appear at sites like Iximche' and Q'umarkaj. The Nahuaization of K'iche'an culture, it appears, is related to the expansion of economic ties with both the Gulf coast and central Mexico (chapter 36). Ethnohistorians and archaeologists alike have struggled to discover the source and origin of these traits. Obsidian procurement data suggest that they are related, in part, to Late Postclassic economic integration along the Pacific coast.