8

Shell Ornament Production and Routes of Exchange

Marine shell was highly valued in prehispanic Mesoamerica and was fashioned into a variety of ornaments with great symbolic importance. Shells were traded widely and were often deposited in high-status contexts (e.g., Borhegyi 1966; Coe 1959; Feinman 2001; Inomata and Emery 2014; Kidder 1947; Kolb 1987; Miller 1986; Moholy-Nagy 1985, 1994a, 1994b, 2008; Velázquez Castro and Melgar Tísoc 2021). One of those special contexts is Monte Albán's spectacular Tomb 7 in the landlocked Valley of Oaxaca (Caso 1932, 1969). The tomb is famous for its Late Postclassic assemblage of gold and jade objects, yet among the more than 500 exotic ornaments in the tomb were necklaces made of hundreds of shell beads, especially red ones crafted from the spiny oyster (*Spondylus*). Other necklaces made of small whole shells were used to adorn breast pieces of jaguar skin. There were ornamental shell bracelets, earspools, small mother of pearl plaques (primarily *Pinctada mazatlanica*) that were used in mosaics, and perforated shells that served as eyes in mosaics of turquoise. A conch-shell trumpet was one of the offerings left above the crypt after a reopening of the tomb (Marcus 1983b), which was originally constructed late in the Classic period.

Earlier during the Classic period, when the South Platform on Monte Albán's Main Plaza was dedicated, stone boxes with almost identical offerings were placed beneath at least three of the building's corners; each box contained a necklace of 7 jade beads, but the principal components were marine shells—5 large and 5 small spiny oysters (*Spondylus*) and 10 tent olive (*Oliva*) shells (Acosta 1958–59, 27). At Teotihuacan, in Central Mexico, Pacific Coast *Spondylus* shells were frequently deposited in caches and offerings (Kolb 1987, 90–91; Séjourné 1966, lámina 47), including Classic period offerings of spiny oysters and jade beads similar to those on the South Platform at Monte Albán (Marcus 1983c, 2009a, 97). Finished shell objects reported from other excavated contexts in the Valley of Oaxaca were also found principally in dedicatory offerings and funerary contexts (e.g., Bernal 1953; Bernal and Gamio 1974; Flannery 1983c; Gallegos Ruiz 1978; Paddock 1955). At El Palmillo, a child buried on a lower terrace was interred with an artificial, ceramic snail shell (Feinman and Nicholas 2009). These finds attest to the symbolic importance that the prehispanic inhabitants of the Valley of Oaxaca, and Mesoamerica more generally, gave to shell. *Spondylus* was especially valued; unworked shells have been found in dedicatory contexts not only in Oaxaca and Central Mexico but also across Mesoamerica (e.g., Coe 1959; Moholy-Nagy 1994a, 1994b; Turner 2022, 270). In addition to being a valued commodity, at Spanish contact, shell was one of several media that was, at certain times and places, used as currency in Mesoamerica and elsewhere in the Americas (Boekelman 1935; Gamble 2020; Paris 2021; Tozzer 1941). *Spondylus* was especially valued as a currency among the Maya (Freidel et al. 2016, 18). Shell and other materials appear to have taken on monetary functions in marketplace exchanges, at least among the Maya, as early as the Classic period (Baron 2018; Freidel et al. 2002, 2016; Paris 2021, 11).

Marine shell has generally and traditionally been recovered by Mesoamerican archaeologists as whole pieces or finished ornaments from special contexts. In a large-scale study, Lourdes Suárez Díez (1977, 1981) analyzed more than 20,000 shell objects recovered from salvage excavations of burials at 19 sites along the Balsas River in Guerrero and developed a detailed typology of prehispanic shell objects, including preferred species, and the techniques used in their manufacture. These are important volumes on prehispanic shell from Mesoamerica, but the shells in the analysis were found in dispersed funerary contexts and none were from a clear production context. At the time we began our study in Ejutla, relatively little was known about the range of prehispanic Mesoamerican marine shell ornaments that were produced, the species used to make specific ornaments, or the scale and context of the production activities. Who were the artisans, where did they work, what range of items did they make, and who were the intended consumers of their products?

Marine shell was imported and worked into ornaments in the Valley of Oaxaca as early as the Early Formative period (Flannery and Marcus 2005, 78–81; Flannery and Winter 1976; Pires-Ferreira 1975, 1976; Winter 1972). In the 1970s, Kent Flannery and Joyce Marcus documented shell working at San José Mogote, one of six Formative period villages that were excavated as part of Flannery's Prehistory and Human Ecology of the Valley of Oaxaca research program. San José Mogote was only one of two villages (the other is Tierras Largas) where extensively excavated houses contained areas of 1–2 m^2 littered with flint chips, chert knives and drills, fragments of cut and discarded shell, and shell ornament fragments that were broken in the process of manufacture, in addition to complete ornaments (Flannery and Winter 1976, 39). Shell working was most evident in two houses at San José Mogote (see Flannery and Marcus 2005, 184–95, 314–34). Only intact shell ornaments were recovered from the other Formative villages (Pires-Ferreira 1976, 315). Most of the shell was from the Pacific Coast, but a significant minority was imported from Atlantic drainage, freshwater riverine contexts. Pacific Coast pearl oyster (*Pinctada mazatlanica*) and spiny oyster (*Spondylus*) were the most frequently worked species (Flannery and Marcus 2005, 78; Pires-Ferreira 1978). The most common shell ornaments were shell pendants, both perforated whole shells and thin pieces carved into a variety of forms, and flat disk beads.

Shell-working contexts are rare elsewhere in the Valley of Oaxaca, both during the Formative period and in later times. In the 1960s and 1970s (Brockington 1973, 15; Markman 1981, 32), possible shell working was observed at Miahuatlán near the southern edge of the Central Valleys of Oaxaca. And during the survey of Monte Albán, several areas of possible shell working were noted on the surface of two site subdivisions (or sectors) near the Main Plaza where a relatively high proportion of terraces had evidence of craft production (Blanton 1978, 83). Although *Pinctada* and *Spondylus* also were important for ornamentation at Monte Albán, there was a relatively greater abundance of various bead forms and mosaics at the hilltop center than at San José Mogote. But no intensive studies of shell-working areas at Monte Albán or Miahuatlán have been completed, which has limited our understanding of how the context and nature of shell ornament manufacture and exchange in the Classic (and Postclassic) periods may have differed from the earlier Formative. Was later shell working carried out in domestic contexts, as at San José Mogote? In the Maya area, for example at the Classic period sites of Aguateca and Tikal, in Guatemala, elite households engaged in shell ornament production (Emery and Aoyama 2007; Inomata and Emery 2014, 156; Moholy-Nagy 1994a, 1994b, 104). Our discovery and excavation of a prehispanic shell-working area in a residential context at Ejutla provided a production context for the Valley of Oaxaca, which has allowed us the opportunity to start to address these questions.

In this chapter, we present the material evidence of shell working at Ejutla, which corresponds to key criteria laid out by Suárez Díez (1986, 121): presence of raw material (complete shells, fragments, tiny debris), tools used to work the shell, and both unfinished and finished ornaments. We present the nature of the assemblage and the shell taxa that were crafted into ornaments, the ornaments that were made, including preferred species, and the technology and tools that were used to work the shell. Microdebitage and soil chemistry analyses provided additional empirical support that helps tie shell working to the excavated house.

At the time that we were researching at Ejutla, we were invited by the principal investigators to analyze thousands of pieces of shell from a series of excavations at Monte Albán. These projects were directed over a number of field seasons by Marcus Winter and by Ernesto González Licón under the auspices of the Instituto Nacional de Antropología e Historia (Feinman and Nicholas 1995a, 1995b; González Licón 2003; Winter 1994; Winter et al. 1995). Most of the shell came from nonproduction contexts, where ornaments were more prevalent, but one area on the west side of the North Platform stood out for its high proportion of worked shell and lower number of finished ornaments. We end this discussion of shell with a broad comparison of the full shell assemblages at Ejutla and Monte Albán and a more focused comparison of the two shell-working areas. We later also received permission to source obsidian from the same projects at Monte Albán. We end this chapter with a comparison of the obsidian and shell assemblages together, in conjunction with spatial modeling of travel routes (White and Barber 2012) and more recent sourcing of mica at Monte Albán and Teotihuacan (Manzanilla et al. 2017), as they collectively provide an additional vantage on exchange and how these nonlocal goods arrived in Ejutla and beyond.

8.1. The Ejutla Shell Assemblage

We recovered more than 25,000 pieces (~34 kg) of broken and worked shell during our investigations in the eastern sector of the Ejutla site, 77% of which came from a dense midden within a few meters of the north side of the excavated house (Table 8.1). Levels of both 5 and 10 cm in many of the units (2 × 2 m) in the midden contained hundreds of pieces of shell debris mixed with cut fragments and unfinished ornaments (Figure 8.1). Shell was also recovered in the house, with lower amounts in smaller midden deposits immediately surrounding the house, in fill below the house, and in the pit kilns. Approximately 5% was recovered from the surface of fields south of the house, where we suspect there were other households in a neighborhood of craftworkers, including those who worked marine shell into ornaments.

The largest component of the shell assemblage (61.1%) is broken shell and other small debris without clear evidence of working (Figure 8.2, Figure 8.3). Although no complete shells of large, unworked marine species were recovered, a wide range of shell body parts (see Morris 1966, 261–65) were present in the debris, including gastropod spires (>400) and columellas (>3400), bivalve hinges (>2300),

Table 8.1. The shell assemblage at Ejutla by class.

Shell category	Bivalve	Gastropod	Unidentified	Total
broken shell	6666	6337	2319	15322
worked shell	7315	1021	263	8599
whole shell (unmodified)	19	50	1	70
unfinished ornament	593	221	73	887
finished ornament	108	68	18	194
Total	14701	7697	2674	25072

Figure 8.1. All cut marine shell debris collected from level 3 in 16n26e (top) and level 3 in 16n24e (bottom).

and large wall (>1200) and margin (>400) fragments from both bivalves and gastropods (Appendix 5a). Large gastropods and nacreous mother of pearl almost evenly dominated the broken shell assemblage (Figure 8.4a). Since no parts of the well-represented shell species are systematically missing from our collections (Figure 8.5), we suspect that most of the shell was transported to Ejutla as whole (or nearly whole) shells rather than as finished pieces and blanks and that primary breakage and working of the shell occurred on site. Some of the pieces of broken shell are large enough to be raw material for future use. But the lack of large whole shells or even many large pieces of broken shell in our collections would seem to indicate that the Ejutla craftworkers made judicious use of this exotic raw material in manufacturing ornaments for exchange.

Approximately one-third (34.3%) of the assemblage consists of shell fragments with clear evidence of modification or working (Appendix 5b, Figure 8.6). Most prevalent are pieces of shell with one (>2600) or two or more smooth cut edges (>3500), unwanted pieces of shell cut away with a stone tool during the crafting of an ornament. Additional pieces of debris have one (>200) or two edges (>100) that had been cut with a perishable material, most likely string or cord, while others were cut more roughly. The edge of string-cut pieces tend to have a smooth even edge compared to the rougher surfaces cut with stone tools. Some shell fragments have abraded surfaces (>400) but lack other evidence of working. These pieces were all cut away from a shell during the process of creating ornaments or are the byproducts of bead or bracelet manufacture (Suárez 1981, lámina 36). Still others bear surficial cut marks (>100) (Figure 8.7). Another indicator of shell working is the presence of production failures, including roughed-out blanks (>1000) that were never finished, ornaments that failed early in the process, and beads with misdrilled perforations (Figure 8.8). In contrast to the unworked shell, the cut shell

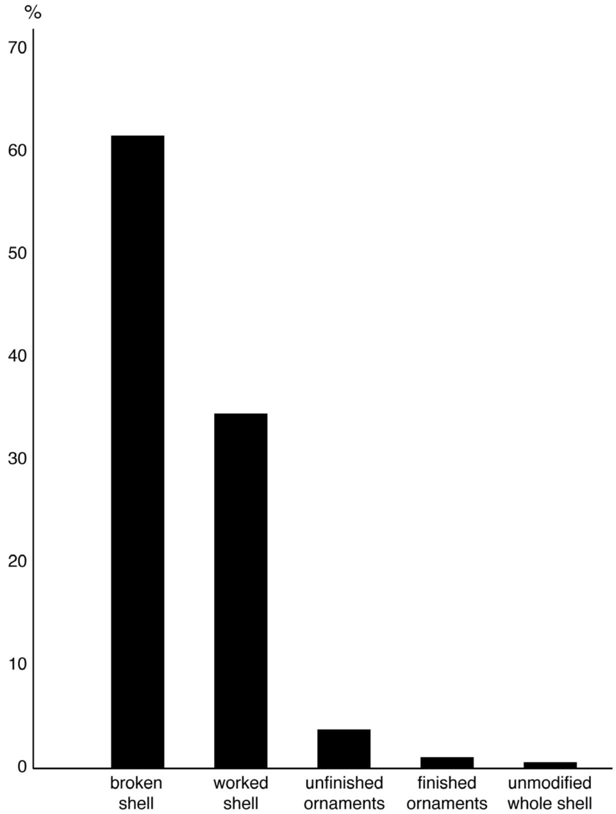

Figure 8.2. Percentage of broad shell categories in the Ejutla assemblage.

debris is heavily dominated by nacreous mother of pearl (see Figure 8.4b), and an additional 4.3 kg of nacreous chipping debris and tiny flakes that were too small to be counted were weighed by context instead.

Ornaments and blanks (pieces formed as intermediate stages in the process of bead or pendant manufacture, Figure 8.9) are less abundant, only 4.6% of the shell assemblage. They include small angular plaques (*placas*), disks, beads, pendants, bracelets, and unperforated but whole small marine shells. Most of the ornaments are unfinished; less than 1% of the recovered shell are finished ornaments. Based on the very low proportion of finished ornaments compared to the volume of shell debris from the excavations, it seems highly improbable that all ornaments crafted in Ejutla were consumed by the residents of the excavated house or even locally. Few finished ornaments were found in the house (<20), and there was only one tiny bead in the subfloor tomb (see Figure 5.6).

Published quantitative data for comparison are few, but for Tikal, Moholy-Nagy (1985, 148–150, 1994a, 1994b) reported a much larger proportion (35–45%) of finished and largely finished artifacts in the shell assemblage. At Aguateca (Guatemala), ornaments account for more than 60% of reported nonfood shell (Inomata and Emery 2014, 141–42). At Ceibal in Guatemala (Sharpe 2019), the Classic period shell assemblage is heavily dominated by ornaments (87%), most from burials. We found similar

Figure 8.3. Small broken pieces of shell with no evidence of working.

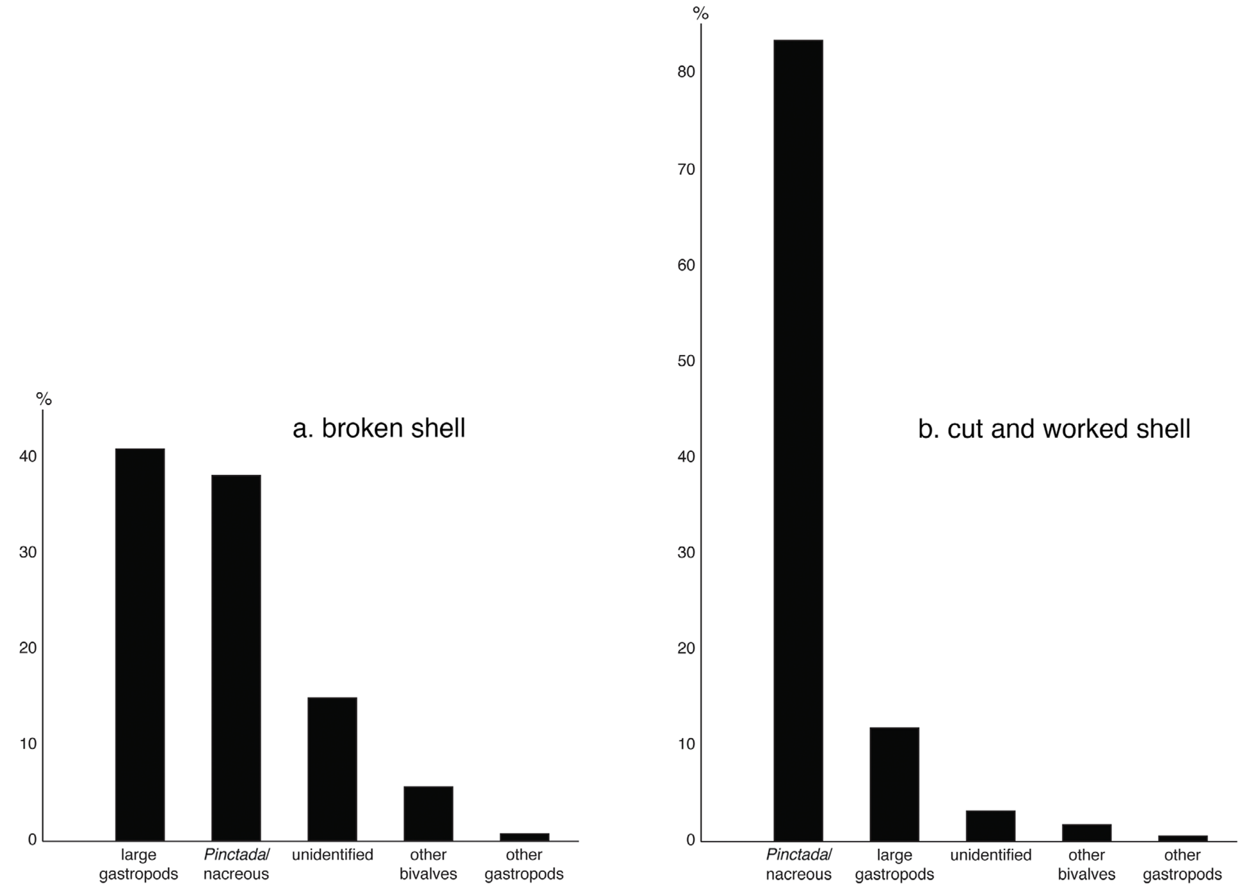

Figure 8.4. Graphs of (a) broken shell and (b) worked shell by major shell category.

Figure 8.5. Large broken and cut pieces of shell include *Strombus* columellas (top left), spires (top right), and margins (bottom left), and *Pinctada* margins and hinges (bottom right).

Figure 8.6. Cut and worked pieces from large gastropods.

Figure 8.7. Shell fragments with surficial cut marks.

Figure 8.8. Ornament failures include broken beads (top) and unfinished shell placas (bottom).

patterns in the marine shell we analyzed at Monte Albán, where ornaments comprise at least 40% of all analyzed shell in most contexts. However, in one context (discussed in section 8.6) the patterns are more similar to Ejutla in that only 11% of the shell are finished or unfinished ornaments and 45% are worked debris/discarded fragments. At El Palmillo, Lambityeco, and the Mitla Fortress in Tlacolula, ornaments account for 60–80%. Other analyzed contexts in highland Mesoamerica include the Xalla complex at Teotihuacan (Velázquez Castro et al. 2019), where finished and unfinished ornaments are 30% of the shell assemblage**.**

8.2. Shell Species at Ejutla

Shell varieties recovered in the Ejutla investigations are almost entirely native to the Pacific Coast (Keen 1971; Morris 1966; Olsson 1961), 100 km away across high mountains. The few Atlantic species (Morris 1973) that were identified in the Ejutla assemblage (*Cypraea cinerea* and *Marginella apicina*) are represented by only a few specimens (<0.03%). In all, we identified more than 90 different taxa from 25 bivalve and 37 gastropod genera (Table 8.2); however, only 7 genera account for more than 98% of the identifiable shell (Table 8.3). Four

Figure 8.9. Shell ornament blanks for beads and pendants.

Table 8.2. Shell species at Ejutla.

Bivalves		
Genus	**Species**	**Common name**
Anadara	*cepoides*	ark shell
Anadara	*esmeralda*	ark shell
Anadara	*formosa*	ark shell
Anadara	*grandis* ?	ark shell
Anadara	*multicostata*	ark shell
Anomia	*adamas* (?)	jingle shell
Arca	*pacifica*	ark shell
Barbatia	*alternata*	ark shell
Chama	*buddiana*	jewel box
Chama	*echinata* (*C. coralloides*)	jewel box
Chama	*frondosa* (?)	jewel box
Chione	sp.	Venus clam
Codakia	sp.	lucine
Donax	sp.	bean clam
Glycymeris	*bicolor* (?)	bitterweet shell
Glycymeris	*gigantea*	bitterweet shell
Glycymeris	*maculata* (?)	bitterweet shell
Glycymeris	*multicostata* (?)	bitterweet shell
Heterodonax	*bimaculata* (?)	false donax
Lucina	*approximata*	lucine
Lucina	*mazatlanica*	lucine

Bivalves		
Genus	**Species**	**Common name**
Ostrea	*angelica*	oyster
Ostrea	*corteziensis*	oyster
Ostrea	*fisheri*	fisher's oyster
Ostrea	*iridescens*	oyster
Pecten	*vogdesi* (?)	scallop
Periglypta	*multicostata*	Venus clam
Pinctada	*mazatlanica*	pearly oyster
Pitar	sp.	Venus clam
Protothaca	sp.	Venus clam
Pteria	*sterna* (?)	winged oyster
Semele	sp.	semele
Solamen (*Megacrenella*)	*columbianum* (?)	mussel
Spondylus	*calcifer* (*S. limbatus*)	spiny oyster
Spondylus	*princeps* (*S. crassisquama*)	spiny oyster
Tellina	*virgo* (?)	tellin
Tivela	*planulata*	Venus clam
Trachycardium	*consors*	cockle shell
Trachycardium	*pristipleura*	cockle shell
Trachycardium	*senticosum*	cockle shell

Bivalves		
Genus	**Species**	**Common name**
Acmaea	*discors*	small limpet
Acmaea	*fascicularis*	small limpet
Acmaea	*limatula*	small limpet
Acmaea	*mitella* (?)	small limpet
Acmaea	*pediculus*	small limpet
Acmaea	*pelta*	small limpet
Agaronia	*testacea*	olive shell
Astraea	*olivacea*	olive turban
Astraea	*unguis*	turban
Calliostoma	*leanum* (?)	pearly top shell
Cancellaria	*urceolata*	nutmeg
Cassis	*centiquadrata*	helmet
Cerithidea	*albonodosa*	horn shell
Cerithidea	*mazatlanica*	horn shell
Cerithidea	*valida* (?)	horn shell
Cerithium	sp.	horn shell
Conus	sp.	cone shell
Cypraea	*arabicula*	cowrie
Cypraea	*cinerea*	cowrie
Ficus	*ventricosa*	fig shell
Fissurella	*gemmata*	keyhole limpet
Fissurella	*rubropicta*	keyhole limpet
Fissurella	*volcano* (?)	keyhole limpet
Haliotis	*fulgens*	green abalone
Haliotis	*rufrescens*	red abalone
Janthina	*globosa*	violet snail
Jenneria	*pustulata*	sea button
Lamellaria	*inflata*	wide-mouth snail
Littorina	*conspersa*	periwinkle
Malea	*ringens*	cask shell
Marginella	*apicina* (?)	marginella
Mitra (?)	sp.	miter
Mitrella	*lalage* (?)	dove shell
Morum	*tuberculosum*	helmet
Nassarius	*bailyi*	dog whelk
Natica	*elenae*	moon shell
Oliva	*porphyria*	olive shell
Olivella	*alba* (?)	olive shell
Olivella	*semistriata* (?)	olive shell
Olivella	*tergina*	olive shell
Patella	*mexicana* (*Ancistromesus mexicanus*)	giant limpet
Persicula	*frumentum*	marginella
Petaloconchus (?)	sp.	worm shell
Polinices	sp.	moon shell
Purpura	*columellaris* (?)	dye shell
Pyrene	*major*	dove shell
Strombus	*galeatus*	conch shell
Strombus	*gracilior*	conch shell
Strombus	*peruvianus*	conch shell
Tegula	*mariana* (?)	pearly top shell
Thais	*speciosa*	dogwinkle
Thais	*triangularis*	dogwinkle
Trivia	*sanguinea*	sea button
Turritella	*leucostoma*	turret

Table 8.3. Quantity of each shell genus identified at Ejutla.

Class	Genus	Quantity
Bivalve	*Anadara*	89
Bivalve	*Anomia*	1
Bivalve	*Arca*	3
Bivalve	*Barbatia*	1
Bivalve	*Chama*	394
Bivalve	*Chione*	2
Bivalve	*Codakia*	1
Bivalve	*Donax*	1
Bivalve	*Dosinia*	1
Bivalve	*Glycymeris*	9
Bivalve	*Heterodonax*	1
Bivalve	*Lucina*	3
Bivalve	*Ostrea*	14
Bivalve	*Pecten*	3
Bivalve	*Periglypta*	2
Bivalve	*Pinctada*/nacreous	13638
Bivalve	*Pitar*	4
Bivalve	*Protothaca*	1
Bivalve	*Pteria*	1
Bivalve	*Semele*	1
Bivalve	*Solamen* (*Megacrenella*)	1
Bivalve	*Spondylus*	182
Bivalve	*Tellina*	2
Bivalve	*Tivela*	1
Bivalve	*Trachycardium*	8
Gastropod	*Acmaea*	45
Gastropod	*Agaronia*	4
Gastropod	*Astraea*	8
Gastropod	*Callistoma*	1
Gastropod	*Cancellaria*	2
Gastropod	*Cassis*	11
Gastropod	*Cerithidea*	11
Gastropod	*Cerithium*	1
Gastropod	*Conus*	2

(*Continued*)

Class	Genus	Quantity
Gastropod	*Cypraea*	5
Gastropod	*Ficus*	33
Gastropod	*Fissurella*	5
Gastropod	*Haliotis*	15
Gastropod	*Janthina*	1
Gastropod	*Jenneria*	4
Gastropod	*Lamellaria*	1
Gastropod	*Littorina*	2
Gastropod	*Malea*	6
Gastropod	*Marginella*	5
Gastropod	*Mitra* (?)	1
Gastropod	*Mitrella*	1
Gastropod	*Morum*	1
Gastropod	*Nassarius*	1
Gastropod	*Natica*	2
Gastropod	*Oliva*	36
Gastropod	*Olivella*	7
Gastropod	*Patella*	443
Gastropod	*Persicula*	1
Gastropod	*Petaloconchus* (?)	7
Gastropod	*Polinices*	1
Gastropod	*Purpura*	1
Gastropod	*Pyrene*	1
Gastropod	*Strombus*	207
Gastropod	*Tegula*	1
Gastropod	*Thais*	13
Gastropod	*Trivia*	3
Gastropod	*Turritella*	2

of these genera are bivalves (pelecypods): nacreous pearl oysters (*Pinctada*), jewel boxes (*Chama*), spiny oysters (*Spondylus*), and ark shells (*Anadara*); three are snails (gastropods): giant limpets (*Patella*), conch shells (*Strombus*), and small limpets (*Acmaea*). All are marine bivalves and gastropods that were frequently cut and shaped to make ornaments in prehispanic highland Mesoamerica (and generally were not used for food) (e.g., Kolb 1987; Pires-Ferreira 1978; Starbuck 1975; Suárez 1981). Most of these species are relatively easy to procure along the Pacific Coast of Oaxaca; for example, *Strombus* and *Pinctada* are found in shallow water and the intertidal zone (Keen 1971), but *Spondylus* could be significantly more difficult to procure from depths up to 30 m (García-Domínguez et al. 2021, 17).

Pinctada mazatlanica (mother of pearl) is by far the most abundant species at Ejutla (Figure 8.10, see also Figure 8.5). Its large size and shiny nacreous interior made it a prized raw material for ornamentation. Although unmistakable features are removed from many fragments and the most finished nacreous ornaments, their assignment to *Pinctada* is based on the thickness of the shell pieces and the almost complete absence of other nacreous shells identified to genus (15 fragments total of *Ostrea* sp. and *Pteria* sp. and none of the freshwater mussel, *Margaritifera* sp.). The breaking and working of the thousands of *Pinctada* shells we identified in the collections would have resulted in large quantities of mother of pearl ornaments and prodigious amounts of nacreous debris. In all, *Pinctada* comprises 61% of all shell at Ejutla by weight (~16.4 kg), and minute pieces of chipping debris (not included in shell totals) are 25% of that weight. More than half of the ornaments, especially small placas, disks (and disk beads), and bracelets, were made from *Pinctada*.

Chama and *Spondylus* were prized for their red and purple colorations. Though less abundant than *Pinctada*, *Chama* sp., especially *C. echinata* (spiny jewel box), and *Spondylus* sp. (spiny oyster), both *S. princeps* and *S. calcifer*, are common at Ejutla (Figure 8.11, Figure 8.12, see also ornament blanks in Figure 8.9). Dozens of ornaments were crafted from each genus, most often small beads and pendants. The nomenclature of these three species was revised in the late 2000s to *Spondylus crassisquama* (syn: *S. princeps*), *S. limbatus* (syn: *S. calcifer*), and *Chama coralloides* (syn: *C. echinata*) (García-Domínguez et al. 2021; Lodeiros et al. 2016). Keen (1971) was our principal source to speciate *Chama* and *Spondylus* shells during our analyses in the 1990s, and we retain those designations here. Although ark shells are among the more common genera (~90 or more specimens), we recovered only one unfinished whole shell ornament of *Anadara* sp. Other identified genera of bivalves are represented by 10 or fewer specimens each (Figure 8.13, see Table 8.3).

Of the 37 gastropod genera identified at Ejutla, only the two large ones mentioned above are represented in any substantial quantities. Most ornaments of *Patella mexicana* (giant limpet, syn: *Ancistromesus mexicanus*) are bracelet fragments (Figure 8.14). Although smaller matte white beads and blanks cannot be identified to species, many are from unidentified gastropods, including several large beads identified as likely *Strombus* sp., especially *S. galeatus* (conch shell) (see Figure 8.9 top left). Most of the other identified taxa are small gastropods that are present in low quantities, including olive shells (*Agaronia*, *Oliva*, *Olivella*), nutmegs (*Cancellaria*), horn shells (*Cerithidea*), cowries (*Cypraea*), small limpets (*Acmaea*), keyhole limpets (*Fissurella*), sea buttons (*Jenneria*), periwinkles (*Littorina*), marginellas (*Marginella*), nerites (*Nerita*), dye shells (*Thais*), and turret shells (*Turritella*) (Figure 8.15). These shells generally are whole (or almost whole), and many had been perforated for stringing.

8.3. Shell Ornaments

Based on the amount of production debris and the high proportion of unfinished ornaments in the shell assemblage, the Ejutla craftworkers made the full range of ornaments that we recovered on site, most frequently small

Figure 8.10. Broken and worked fragments of *Pinctada mazatlanica*.

placas, disks, and beads, but also pendants and bracelets (Table 8.4, Appendix 6). Most of the ornaments are cut and shaped pieces in which the original form of the shell has been obliterated or small gastropods perforated for stringing; engraving or other decoration on finished shell ornaments was rare. As the artisans crafted the ornaments, they generally had a clear preference for certain taxa (Figure 8.16), and even for which taxa to use to create different kinds of ornaments (see Table 8.4). The tailoring of specific materials to particular end products reflects intentionality and planning at levels that traditionally would not have been expected in a domestic context but do match expectations for practiced artisans crafting goods for exchange beyond their own household or local community.

The most abundant shell ornaments are small angular placas of nacreous pearl oyster that have been cut and

Figure 8.11. ***Chama*** **shells; three shells on right are interior (top) and exterior (bottom).**

Figure 8.12. ***Spondylus*** **shells; three shells on bottom are interior (left) and exterior (right).**

Figure 8.13. Other bivalve species, *Anadara* (top) and *Glycymeris* (bottom).

Figure 8.14. Unfinished ornaments and fragments of *Patella mexicana*.

abraded on all sides. Approximately 92% were cut from large *Pinctada* shells, mostly as triangles and rectangles but also in a variety of other shapes including trapezoids, squares, diamonds, crescents, and pentagons (Table 8.5; Figure 8.17). One unusual placa is in the form of the number 7. Although the size of the placas varies from small 5.0 × 6.0 × 0.5 mm squares to large rectangles that are 36.4 × 16.4 × 5.2 mm, most of the nacreous placas are between 10 and 25 mm long and 1–4 mm thick. We considered fewer than 20% of the placas to be finished (i.e., all four edges had been abraded smooth), but, depending on their size, some may have been blanks intended to be

Figure 8.15. Small gastropods, including horn shells, marginellas, olive shells, and turret shells (top two rows), sea buttons and cowrie shells (middle two rows), and small limpets (center right and bottom two rows).

tabular beads or pendants that had not yet been perforated. Other finished nacreous pieces could have been crafted for mosaic inlays (Caso 1965, 906; Ekholm 1942, 111; Kidder 1947, 65; Lowe and Agrinier 1960, 42; Suárez 1981, 39), sewn on cloth (Kidder 1947, 65; Mahler 1965, 584; Mester 1985), or used as incrustations in the teeth of ceramic figurines and urns (see Romero 1958).

The remaining placas (8%) were cut from the walls of large gastropods or unidentified shell, and are generally smaller than the nacreous placas. Some are small rectangles and trapezoids, but two-thirds are small, low triangles, mostly 10–20 mm at the base and 7.3–11.5 mm tall (Figure 8.18). The small triangles are more standardized than most other placas, apparently cut to a template (Figure 8.18 bottom). Their intended use is not clear. Several larger ornamental pieces of *Spondylus* that we coded as blanks likely are unfinished placas (see Figures 8.9 and 8.12), similar in form to those reported from El Perú-Waka in Guatemala (Navarro-Farr et al. 2021, figure 7e) and Mayapan (Pollock et al. 1962, figure 43b–d) and what have been called spangles at Tikal (Moholy-Nagy 2008, figure 148a) and elsewhere (Kidder et al. 1946, 151, figure 461a–d), all of which were perforated and may have been sewn together (Coe 1959, 59, figure 54; Moholy-Nagy 2008, 58; Navarro-Farr et al. 2021, 196), as in a reconstructed garment at Tula (Velázquez Castro et al. 2021, figures 8 and 15).

Thin circular shell disks are the second most abundant ornaments. Like the placas, most (77%) of the disks were crafted from nacreous pieces of *Pinctada*. Except for two

Table 8.4. Shell ornaments by genus at Ejutla.

Genus	Bead	Bracelet	Disk	Pectoral	Pendant	Placa	Unknown	Unmodified whole shell	Total
Bivalves	**42**	**16**	**214**	**–**	**48**	**372**	**8**	**19**	**719**
Anadara	–	–	–	–	–	–	–	1	1
Anomia	–	–	–	–	1	–	–	–	1
Chama	14	–	1	–	4	–	–	4	23
Chione	–	–	–	–	–	–	–	1	1
Glycymeris	–	–	–	–	–	–	–	6	6
Heterodonax	–	–	–	–	–	–	–	1	1
Lucina	–	–	–	–	–	–	–	3	3
nacreous/*Pinctada*	21	3	123	–	10	198	2	–	357
Ostrea	–	–	–	–	–	–	–	1	1
pelecypod UID	1	2	–	–	2	–	–	1	6
Pinctada	–	11	89	–	8	173	1	–	282
Solamen	–	–	–	–	–	–	–	1	1
Spondylus	6	–	1	–	23	1	5	–	36
Gastropods	**114**	**11**	**48**	**1**	**50**	**24**	**44**	**50**	**342**
Acmaea	–	–	–	–	1	–	–	8	9
Agaronia	–	–	–	–	1	–	–	–	1
Astraea	–	–	–	–	–	–	–	1	1
Cerithidea	–	–	–	–	1	–	–	9	10
Cerithium	–	–	–	–	–	–	–	1	1
Cypraea	–	–	–	–	–	–	–	2	2
Ficus	–	–	–	–	1	1	2	–	4
gastropod UID	63	1	40	–	29	17	29	2	181
Haliotis	–	–	–	–	–	2		–	2
Janthina	–	–	–	–	–	–	–	1	1
Jenneria	–	–	–	–	2	–	–	1	3
Lamellaria	–	–	–	–	–	–	–	1	1
limpet UID	–	–	–	–	–	–	–	3	3
Littorina	–	–	–	–	–	–	–	2	2
Marginella	2	–	–	–	–	–	–	3	5
matte white UID	36	1	8	–	9	3	7	–	64
Mitra(?)	–	–	–	–	–	–	–	1	1
Mitrella	–	–	–	–	–	–	–	1	1
Nassarius	–	–	–	–	–	–	–	1	1
Natica	–	–	–	–	–	–	–	1	1
Oliva	1	–	–	–	4	–	–	–	5
Olivella	–	–	–	–	1	–	–	4	5
Patella	–	9	–	1		–	2	–	12
Pyrene	–	–	–	–	–	–	–	1	1
Strombus	4	–	–	–	1	1	4	–	10
Tegula	–	–	–	–	–	–	–	1	1
Thais	8	–	–	–	–	–	–	3	11
Trivia	–	–	–	–	–	–	–	2	2
Turritella	–	–	–	–	–	–	–	1	1
UID	53	1	13		14	7	1	1	90
Total	209	28	275	1	112	403	53	70	1151

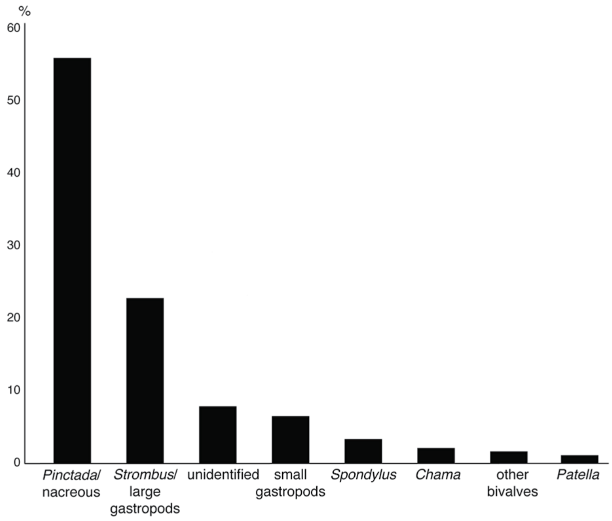

Figure 8.16. Graph of principal genera used to make shell ornaments (includes finished and unfinished ornaments).

colorful ones cut from *Chama* and *Spondylus* shells, the rest are matte white cut from unidentified gastropods. The disks are unperforated and largely unfinished. Most (84%) of the disks have abraded or roughly cut/chipped edges, while a smaller subset of disks (16%) are perfectly circular, cut with a hollow tubular drill (see section 8.4 on shell-working techniques). The two methods were used on both bivalves and gastropods, but to craft different kinds of disks. The abraded disks of *Pinctada* are generally larger and thinner than those made from gastropods (Figure 8.19, Figure 8.20). The *Pinctada* disks have an average diameter of 15.6 mm (most fall between 10 and 20 mm) and are 2.7 mm thick (ranging between 1 and 5 mm), similar to the dimensions of the placas; they may have been intended to be finished into thin beads and pendants or mosaic pieces, or sewn on clothing. The gastropod disks average 9.9 mm in diameter (most are 8–12 mm) and are 3.7 mm thick (most between 2 and 6 mm); these smaller matte white disks appear to be beads in the making that were discarded prior to final smoothing and perforation.

The drill-cut disks of all shell types are more regular in size, between 10 and 13 mm in diameter (average 11.5 mm for *Pinctada* and 11.4 mm for gastropods) (Figure 8.21). As with the abraded disks, the gastropod drill-cut disks tend to be thicker than nacreous ones (3.3 mm vs. 2.4 mm). Some of these disks have been further processed by abrading the outer edge completely smooth. These disks may have been intended to be beads, although the *Pinctada* ones also could have been used in ways similar to the nacreous placas once they were finished.

Table 8.5. Types of shell ornaments at Ejutla by class.

Ornament category	Bivalves	Gastropods	UID	Total
Bead	**42**	**114**	**53**	**209**
cubical	–	12	2	14
cylindrical	5	25	11	41
disk bead	28	18	12	58
flat square	–	8	2	10
irregular	2	8	13	23
miniature	5	3	6	14
spherical	–	15	4	19
tubular	2	14	2	18
whole shell bead	–	10	–	10
unknown	–	1	1	2
Bracelet	**16**	**11**	**1**	**28**
Disk	**214**	**48**	**13**	**275**
abraded disk	175	35	11	221
circular disk (with lip)	32	10	2	44
circular disk (no lip)	6	2	–	8
unknown	1	1	–	2
Pectoral	**–**	**1**	**–**	**1**
Pendant	**48**	**50**	**14**	**112**
circular	7	–	1	8
comb shape	–	–	1	1
cubical	–	2	–	2
diamond	–	2	–	2
flower	–	1	–	1
hourglass	–	–	1	1

Ornament category	Bivalves	Gastropods	UID	Total
incisor shape	1	–	–	1
lunate	–	1	–	1
monkey face	–	1	–	1
oval	2	1	2	5
tabular irregular	10	4	2	16
tabular needle	–	1	–	1
tabular rectangular	18	16	3	37
tabular trapezoid	1	6	2	9
tabular triangular	3	2	–	5
teardrop	2	5	1	8
whole shell	3	8	–	11
unknown	1	–	1	2
Placa	**372**	**24**	**7**	**403**
circular	5	–	–	5
crescent	2	–	1	3
diamond	10	–	–	10
irregular	34	–	2	36
lunate	10	–	–	10
number 7	1	–	–	1
pentagonal	8	–	–	8
rectangular	105	4	–	109
spade-like	1	–	–	1
square	29	–	–	29
stepped edges	–	1	–	1
teardrop	2	–	–	2
trapezoid	28	2	–	30
triangular	131	17	3	151
unknown	6	–	1	7
Unknown ornament	**8**	**44**	**1**	**53**
circular	–	1	–	1
cubical	4	12	–	16
lunate	–	2	–	2
star shape	1	–	–	1
tabular diamond	–	1	–	1
tabular hexagon	1	–	–	1
tabular irregular	1	5	–	6
tabular rectangular	–	15	–	15
tabular triangular	–	4	–	4
tubular	–	1	–	1
unclear	1	3	1	5
Unmodifed whole shell	**19**	**50**	**1**	**70**
Total	**719**	**342**	**90**	**1151**

The Ejutla artisans also made a variety of beads and pendants. Both are perforated for stringing, either grouped into a necklace or as single adornments. We consider ornaments with one central perforation to be beads, while ornaments with one or more perforations near one end of the ornament are pendants (Moholy-Nagy 2008, 40, 47; Suárez 1977, 23, 30). Not surprisingly, there is greater size and form variation in the pendants, while beads in general are smaller than most pendants.

In her analysis of shell from Tikal, Hattula Moholy-Nagy (1989, 141) drew a distinction between 'natural' and

Figure 8.17. Finished (top) and unfinished (bottom) *Pinctada* placas.

'formed' beads (see also Yerkes 1993, 238). The original form of the shell is still identifiable in natural beads, while it has been obliterated in formed beads. Formed beads require considerably more time and skill than natural ones, which only require a drilled or tapped-out hole for suspension (Moholy-Nagy 1994b, 96–97; Suárez 1981, lámina 3b). Most of the shell beads in Ejutla generally fit Moholy-Nagy's second category and include disk, cylindrical, spherical, square, and tubular beads (see Table 8.5; see also Kidder 1947, 62–63; Suárez 1977, 92–98). In contrast to the placas and disks, which were primarily crafted from bivalves, most of the formed beads in Ejutla were made from unidentified shell and gastropods, only a few of which could be identified to genus, all *Strombus*. Approximately 20% were made from bivalves, primarily *Chama*, *Spondyus*, and nacreous shell, most likely *Pinctada*. Gastropods were also used to make a wider range of bead forms than bivalves were. Beads in Ejutla lacked surface carving.

Disk beads with a central perforation are the most abundant form of bead in Ejutla (as they are elsewhere in Mesoamerica—e.g., Kidder 1947, 61; Willey 1972, 223), at least in part due to the nature of shell, which is more conducive to making disks than making larger, thicker beads (Garber 1989, 64). Although this form was made almost equally from gastropods and bivalves, all beads of *Pinctada* are disk beads (Figure 8.22). Like the unperforated shell disks, most of the disk beads have abraded edges, but a small number of the nacreous beads were cut with a tubular drill, with edges then abraded smooth. The drill-cut disk beads have the same diameter

Figure 8.18. Placas, mostly triangular, cut from gastropods. Top left set of shells shows the interior side of the shell (above) and the cut made on the exterior side of the shell (below). In the lower set of shells, the form and size of a finished triangular placa fits a cut triangular piece on a large gastropod.

Figure 8.19. Abraded *Pinctada* disks.

Figure 8.20. Abraded gastropod disks.

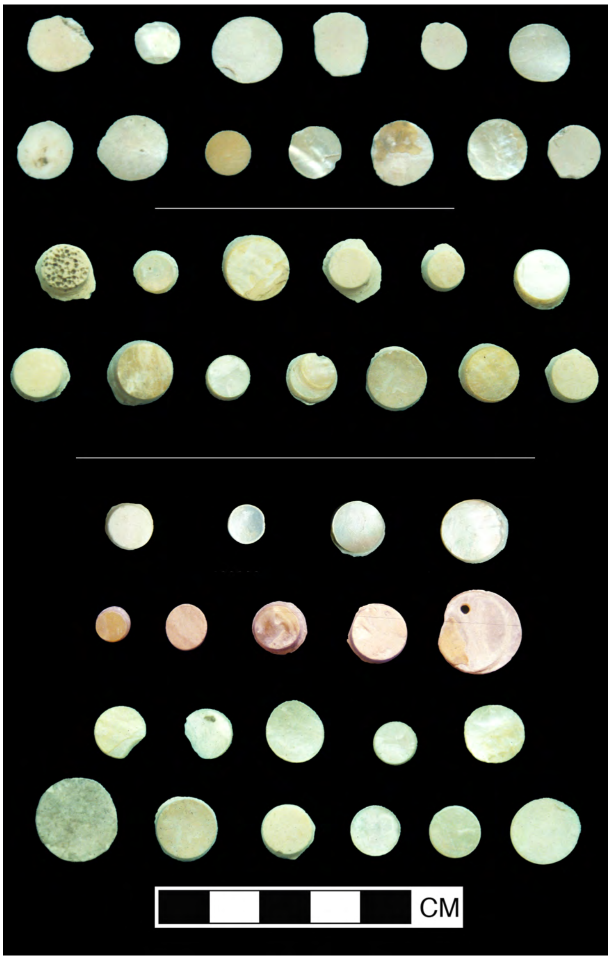

Figure 8.21. Shell disks cut with a hollow tubular drill. The top two sets of discs are the same objects, showing the interior side of the shell (top) and the exterior side cut side (center).

Figure 8.22. Shell disk beads.

as the unperforated disks, but in general are thinner; some are barely 0.1 mm thick. The abraded disk beads also tend to be thinner and smaller than many of the unperforated abraded disks, so not all of the abraded disks may have been intended to be finished into beads. Approximately two-thirds of the disk beads have biconical perforations (63%), while in more than a third the perforations are conical (37%).

The other bead forms—small cylindrical, spherical, square or cubical, miniature, and tubular—were made mostly from gastropods, although a dozen were crafted from *Chama* and *Spondylus* (Figure 8.23, Figure 8.24). The cylindrical beads are typically 4.5–9.0 mm in diameter and 2–5 mm thick, with flattened ends. Spherical beads are rounder (generally 4.5–8.0 mm thick) and a bit larger (mostly 5–9 mm in diameter), but some are as large as 18 mm in diameter. Square and cubical beads range from ~6.5 × 7 × 2.5 mm to as large as 16 × 17 × 8 mm, although most are ~9–11 mm square and 3.5–5 mm tall. Miniature beads have diameters of ~5 mm or smaller and are only 2–2.5 mm thick. Tubular beads generally have diameters of 4–5 mm and range between 7.5 and 30 mm tall; taller unfinished ones may have been intended to be cut into several shorter cylindrical beads. Compared to the disk beads, these other bead forms were primarily perforated biconically. Overall, the Ejutla artisans made more cylindrical beads than other forms. Many unfinished beads had been partially or completely perforated but had not undergone final abrading and smoothing.

A small subset of beads are natural beads, all made from small gastropods, mostly small dogwinkles (*Thais triangularis)*, all with irregular perforations, but also a few marginellas (*Marginella apicina)* (Figure 8.25). Several unperforated *T. triangularis* and *M. apicina* shells in the shell assemblage may have been intended to be perforated and used as beads.

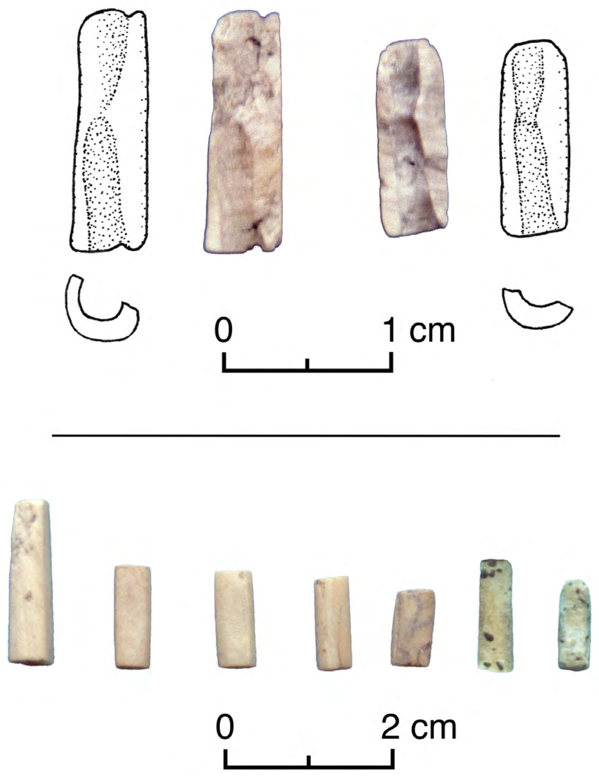

Figure 8.24. Tubular shell beads; the two beads at top are drawn at 200% to show the biconical perforations; they are the two beads on the right in the row of beads at bottom.

The pendants are more variable than beads in form and size and, in contrast to beads, were more evenly crafted from gastropods and large bivalves. Like beads, pendants can also be formed or natural (Moholy-Nagy 1994b, 96). The

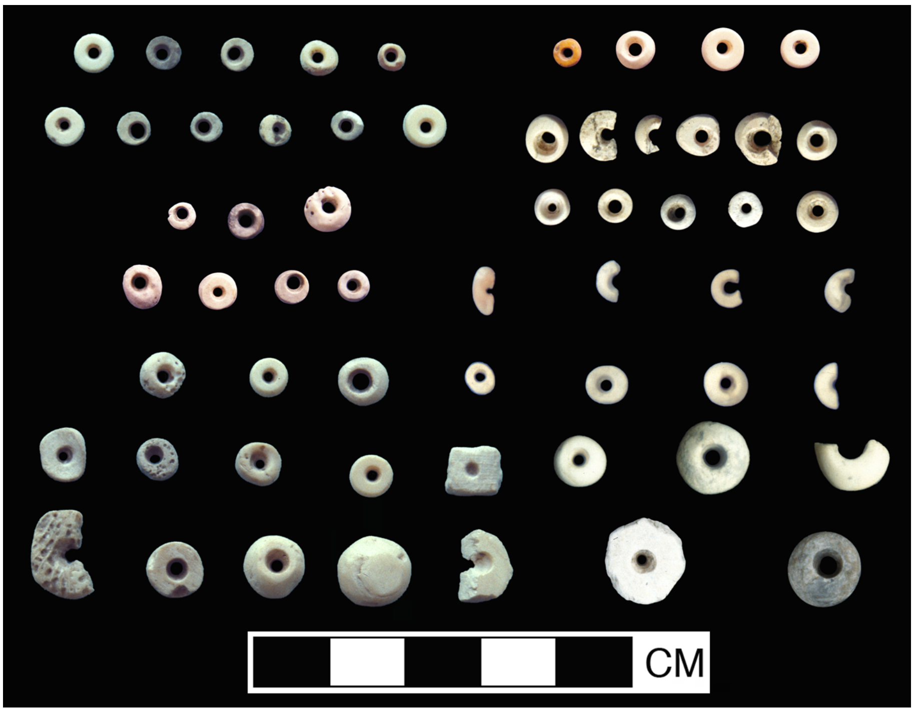

Figure 8.23. Small shell beads at Ejutla are mostly cylindrical or spherical; several in bottom two rows are unfinished.

Figure 8.25. Whole shell beads and pendants; top left are the dorsal (above) and ventral (below) sides of perforated *Thais* shells.

Ejutla craftworkers created more formed (90%) pendants than natural, approximately half of which were too processed to identify the taxa at all or to classify beyond unknown gastropod (Figure 8.26). The most frequently identified taxa are spiny oyster (*Spondylus princeps* and *S. calcifer*) (see also Moholy-Nagy 1989, 141) and nacreous mother of pearl (*Pinctada mazatlanica*). The pendants were made into a variety of tabular forms including circles, ovals, rectangles, triangles, squares, and trapezoids, but rectangular pendants are most common. The more finished formed pendants range from ~10 to 30 mm in length, although several unperforated pendant blanks are as long as 40–70 mm. Some of the larger abraded shell disks may be unfinished pendants that were never perforated. Perforations for stringing the ornaments are both conical and biconical, with pendants ~2.5 mm thick or less primarily perforated from one side (conical) and those thicker than 2.5 mm perforated biconically.

Most whole shell pendants are small gastropods (8), including *Jenneria pustulata*, *Oliva porphyria*, *Olivella* sp., *Agaronia testacea*, *Cerithidea albonodosa*, and *Acmaea* sp. (see Figure 8.25). Most *O. porphyria* shells were perforated with cord and abrasive, and as is typical for ornaments made from *Oliva* shells (Suárez 1977, 33–34), the spires had been cut away. The other gastropods have irregular perforations. But several small bivalves also are largely whole; several *Chama* pendants were less processed so that more of the original shape of the shell was retained, and one small jingle shell (*Anomia* sp.) was perforated and turned into a pendant with no additional processing. The *Chama* pendants have conical perforations, while the *Anomia* shell has an irregular perforation. An additional 70 small whole shells are unmodified but include most of the species that were used to make whole shell pendants (and beads). Additional whole shell bivalves represented by more than one specimen include *Glycymeris* and *Lucina*. Unmodified whole shell gastropods include *Cypraea*, *Littorina*, *Olivella*, and *Trivia sanguinea* (see Figure 8.15). We suspect that these shells were curated as raw material that had not yet been perforated for stringing.

Only two ornaments in the Ejutla shell assemblage, both pendants, have carved designs on the surface of the shell (Figure 8.27). One is a small head cut from the wall of a large gastropod with what appears to be the face of a monkey in profile. The ornament broke across a conical perforation in the neck. Although representations vary, monkey profiles have been carved onto bracelets (Spinden 1911, 37–38) and (from our perspective) other ornaments (Coe 1959, figure 51a). The other carved ornament was cut from the spire of a small olive shell (Olividae). The very tip of the spire was cut off and abraded smooth, and four notches were carved into the edge of the spire. The top volutions of the spire had been carved to accentuate the

Figure 8.26. Formed shell pendants.

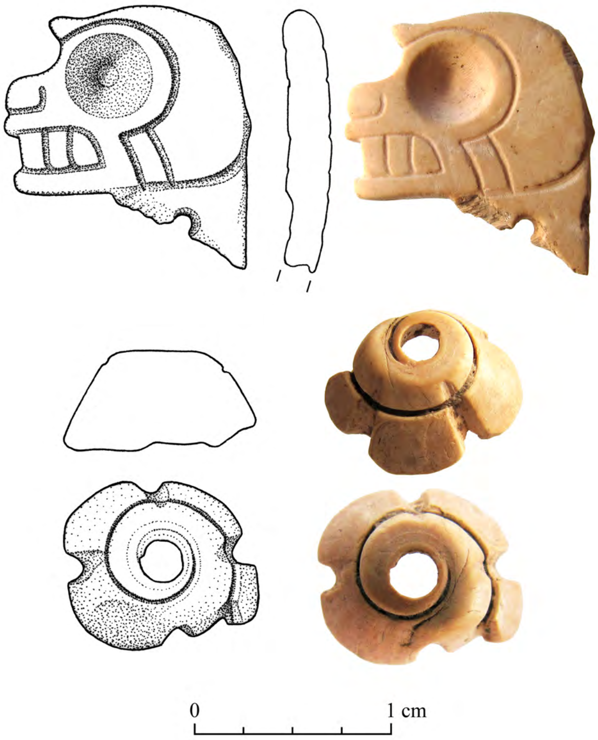

Figure 8.27. Two carved shell ornaments, a monkey pendant and a representation of a flower.

spiral, and the finished ornament reminds us of a flower, or rosette. These two finished ornaments were found on the house floor. Because they are the only two carved shell ornaments in the Ejutla shell assemblage, we suspect that these finely carved ornaments were largely crafted for exchange.

The Ejutla craftworkers also made bracelets, almost entirely from *Patella americana* and *Pinctada mazatlanica* (Figure 8.28). All of the bracelets are very partial, so we do not know how large they were, but the width of the recovered bracelet fragments have a bimodal distribution, so two different kinds of bracelets were made. Most of the *Patella* bracelets are smaller, between 5 and 7.5 mm wide; only a few are between 10 and 13 mm wide. *Pinctada* bracelets are evenly divided between two size modes, smaller ones 4–6.5 mm wide, and larger ones 10.5–23 mm wide.

By far the largest ornament is a *Patella mexicana* pectoral measuring 182 × 152 mm, in which the top of the shell has been cut out (Figure 8.29). The remaining margin of the shell is ~15–20 mm wide. The exterior margin and the cut edge were abraded smooth, but there is no other decoration on the ornament. The ornament is a perfect match (in form and size) to what were called 'horse collar' ornaments at Kaminaljuyu (Kidder et al. 1946, 149, figure 162e, h) and is

Figure 8.28. Bracelets of *Patella* (top and third row left) and *Pinctada* (other five in center two rows and bottom).

very similar to a large oval-shaped pectoral ornament from Tula that was made from a large marine limpet (Carter and Lukach 2023, figure 7). Horse collar ornaments are also reported from Tikal (Moholy-Nagy 2008, 46, figure 181a) and Uaxactun (Kidder 1947, 63, figure 52); similar ornaments made from large *Patella* shells have also been called *brazaletes* (Suárez 1977, 47, láminas 48 and 49).

8.4. Shell-Working Techniques and Tools

A range of techniques and materials were used prehispanically to work shell into ornaments (Suárez 1977, 1981; see also Emery and Aoyama 2007; Melgar Tísoc et al. 2010; Moholy-Nagy 2008, 6; Velázquez Castro et al. 2019). We begin with a general discussion of shell-working practices in Mesoamerica before turning to the techniques and tools evidenced in the Ejutla shell assemblage. An initial step is percussion (Suárez 1981, 11–12), the striking of the shell with a hard object in which the body of the shell changes form to separate the various parts of the shell, such as the spire of gastropods (Suárez 1981, lámina 3a); this action breaks the shell into irregular pieces, some of which could be worked into ornaments and many others that are waste and discarded. The hard object may be stone, antler, or another shell. Large hammerstones were often used for the initial fragmentation of the shells (e.g., Kozuch 2022; Mayo and Cooke 2005, 294, figures 11 and 12). The percussion can also be indirect, using an intermediary tool, such as a chisel or wedge, between the striking tool and the shell (Suárez 1981, lámina 3b); this technique is effective in species with a laminar structure, such as mother of pearl, to obtain nacreous sheets of varying thickness, which are an excellent raw material for ornaments. Rough shaping of pieces can also be accomplished by pressure flaking with a harder rock or heat-hardened deer antler (Foreman 1978, 18, figure 3; Suárez 1981, 12).

Most processing of the shell into ornaments involves abrasion using a variety of tools and abrasive agents, such as fine sand or volcanic ash, and water (Suárez 1981, 12–13; see also Melgar Tísoc et al. 2018, 103). The edges of a broken piece of shell can be abraded against stones of varying coarseness to smooth them into a range of circular

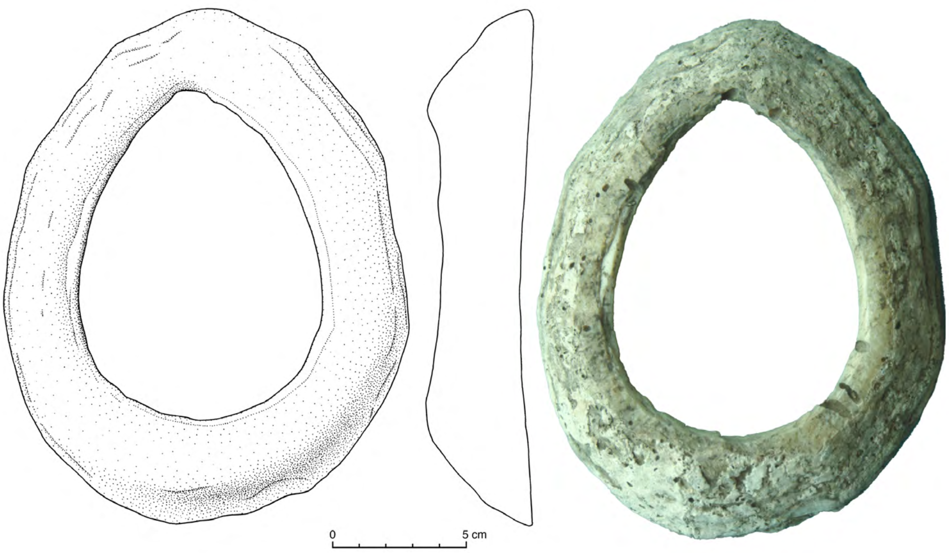

Figure 8.29. Pectoral cut from a large *Patella mexicana* shell.

and quadrangular forms (Melgar Tísoc et al. 2010, 2018; Suárez 1977, lámina 6b and c; 1981, lámina 55a)—even a smooth rock can be used for abrasion by covering it with a slurry of sand/dirt (Foreman 1978, 21), or the shell can be cut with materials of greater or lesser hardness by adding an abrasive to create friction as the tool is moved back and forth across the shell, and water for lubrication. For example, shells commonly used for ornaments, like *Spondylus princeps*, have a hardness around 3 on the Mohs scale, compared to 1 for talc, 7 for rock crystal, and 10 for diamonds (Foreman 1978, 18). The shell can be cut with thin, knifelike stone tools (Suárez 1981, lámina 4a), including obsidian blades and chert flakes (Emery and Aoyama 2007; Lewenstein 1987, 113; Martínez López and Markens 2004; Melgar Tísoc and Solís Ciriaco 2021; Melgar Tísoc et al. 2010, 2018; Velázquez Castro et al. 2019). Taut strips of perishable materials—vegetal, cordage, leather—can be used with abrasives at various stages of manufacture. These include cutting through the columella and body of gastropods or slicing off the top of large pelecypods (Moholy-Nagy 2008, 6; Suárez 1981, lámina 4b). Likewise, cord or string can serve to cut quadrangular pendants and mosaic pieces and in the near-final stages of cutting bead blanks into cylindrical beads (Suárez 1981, láminas 9 and 14). The vegetal material can also be used with water and abrasive to saw notches in a stone to hold a piece of shell for further processing (Foreman 1978, 18). Hollow tubular drills (Foshag 1957, 54–55; Holmes 1919, 350–51), most likely segments of cane (Caso 1965, 905; Kozuch 2022), can be used to extract small circular disks for crafting into thin disk beads and other ornamental pieces.

Various tools and methods were used to perforate shell ornaments, including small stone drills, hollow drills, pressure applied with a hard object, and indirect percussion (Suárez 1981, 13–15) (see chapter 9). Drills, whether solid or hollow, require abrasives and water, as the abrasive material is the chief agent (Rau 1869, 393; Suárez 1981, 13). Small solid stone drills, often of chert (Martínez López and Markens 2004; Melgar Tísoc et al. 2010, 2018; Yerkes 1983, 1989, 1993), were used to perforate formed beads and pendants, either before or after the ornament was otherwise finished (Suárez 1981, lámina 14). The perforation can be cut from one side (conical) or both sides (biconical) (Suárez 1981, lámina 5), depending, in part, on the kind of shell and the thickness of the ornament. Perforations on thicker beads, for example, are almost exclusively biconical, while the perforation of thinner beads and most pendants is more variable. Larger perforators could be handheld, while smaller microdrills were hafted to a cane stalk or wooden stick; with a bead blank placed on a secure anvil or in a notch carved into stone, the drill can be rotated using a bow drill or by rolling the drill shaft rapidly back and forth between the palms (Foreman 1978, 19, figures 6 and 7; Kozuch 2022; Yerkes 1993, 235, figure 4). String can be used to ream out perforations made with solid drills (Moholy-Nagy 2008, 6, figure 126c).

Some gastropod pendants, such as *Oliva* sp., were perforated near the base of the shell with a back and forth cutting motion (Suárez 1981, 14–15), using either a sharp stone tool or string and abrasive (see Figure 8.25). Even bone (and antler), also 3 on the Mohs scale, can be used to perforate shell; in experiments, it took approximately 35 minutes to perforate a 1.3 mm thick disk of clam shell using a handheld porcupine quill in conjunction with abrasives (Foreman 1978, 18). Pressure and indirect percussion were also used on small thin-walled gastropods to punch a hole for stringing, either as beads or as pendants (Suárez 1981, 35, láminas 3b and 24a). In contrast to the other methods, pressure and percussion produce irregular perforations. While carving on shell ornaments is not common, a pointed stone tool can be used for thicker carvings, and sharp objects like long thorns can be used for thinner, fine lines (Suárez 1981, láminas 6c and 28b).

Through a systematic examination of the shell assemblage and other artifactual debris at Ejutla, we documented the methods and tools that the Ejiutla artisans used for working shell into ornaments, although none of the perishable materials used to work shell—cane drills, cordage, and possibly thorns—were preserved. We found that the same tools and methods were used on a range of shell taxa, both bivalves and gastropods, but that the different properties of shell taxa were a factor in what kind of ornaments were made and how the shells were initially processed. For example, most of the shell ornaments at Ejutla were made from nacreous pearl oyster, primarily *Pinctada mazatlanica*, and from large gastropods that include *Strombus* sp. and *Patella mexicana*. In analyzing these two classes of shell, we noted that a much larger proportion of nacreous shell fragments have cut edges or other evidence of working (52% of nacreous shell) compared to large gastropods (only 12%), even though the number of ornaments that were made from each class of shell is comparable (4.7% of all nacreous shell and approximately 3.5% of large gastropods). In general, the most abundant non-nacreous bivalves (*Spondylus* and *Chama*) were processed into ornaments in ways more similar to the large gastropods. Most of the whole shell beads and pendants made from small gastropods generally were minimally processed beyond perforation. We begin with the methods and tools the Ejutla craftworkers used to craft ornaments from nacreous shell.

The laminar nacreous surface of pearl oysters easily flakes off into thin sheets, so striking a mother of pearl shell with a hard object can shatter it and produce many unworkable small pieces. Instead, the presence of *Pinctada* hinges with string-cut edges indicates the use of cordage with abrasive and water in the initial processing of pearl oysters to remove unwanted parts of the shell. Cordage and sharp stone tools were also employed to cut small tabular pieces from the wall of the shell that were then crafted into placas, the ornaments most often made from *Pinctada*. Many pieces of discarded nacreous shell and roughed-out blanks have at least one edge that was cut with string or have incomplete string cuts across the surface, and more than half (54%) of the placas, both finished and unfinished, have string-cut edges. Cutting shell with cordage often leaves a slight lip on the opposite edge, as the shell snaps just before the cut is completed. The lip on most of the tabular placas is on the interior, nacreous side of the shell, showing that the string cuts were usually initiated from the exterior. In many cases, part of the exterior surface, the periostracum, is still attached to the unfinished ornament. Some of the nicest finished placas appear to have been cut with string on one or more edges and then abraded smooth, removing remnants of the lip (see Figure 8.17). Final abrasion of the edges removes indications of the method of cutting, so it is not always possible to determine without finding pieces of debris with string-cut edges and marks.

Thousands of discarded nacreous fragments in the shell assemblage have one or two edges that were cut with a sharp stone tool; some of these cut edges were curved or slightly irregular and not as smooth as those cut with string. These characteristics are visible in many placas (~46%), which in addition to string-cut tabular forms also include crescents, circular forms, teardrops, and two singular forms, one shaped like a spade and another shaped like a thick number 7. Most of the nacreous pendants were crafted in the same manner. In close subsurface association with the shell debris, we found thousands of heavily worn obsidian blades (see Table 5.5). These spent blades would have been effectively dulled by repeatedly cutting and working the hard, abrasive shell (Lewenstein 1987; Parry 1987). Hundreds of chert blades, knives, and bifaces found in these same contexts may also have been used to cut the shell (e.g., Melgar Tísoc et al. 2010, 2018). There was no status distinction in the use of chert or obsidian tools (contra Melgar Tísoc et al. 2018), as the craftworkers of this middle-status household used both obsidian and chert tools to work shell into a range of ornaments, from simple shell disks and placas to the two carved shell pendants in the house.

The other common ornaments made from nacreous shells—small thin disks and disk beads—were crafted in two ways. Approximately 15% were cut with a hollow tubular drill, most likely cane, which is readily available along the banks of the Ejutla River and nearby tributaries. Like the placas cut with string, the shell was drilled from the exterior, with a slight lip often remaining on the interior, nacreous side of the disk (see Figure 8.21). The lip was abraded away on more finished disks and on disks that were perforated for stringing. The diameter of the drilled disks is fairly uniform, an average of 11 mm. A larger proportion of the shell disks (>80%) were formed by abrading small pieces of shell against another hard surface to create a smooth rounded edge. Many stone abraders of basalt and other materials found with the shell have visible striations as a result of abrading a hard material such as shell (see Figure 5.39). The abraded disks are more variable in size, less uniformly circular, and generally not as finely finished as the disks cut with a tubular drill.

In contrast to nacreous shell, a first step in processing large gastropods was striking them with a hard object, breaking them into numerous fragments with jagged edges, including body whorls, outer margins, spire fragments, and large columella pieces and bases (see Figure 8.5). Some of the spires were intact, broken just below the last suture of the spire. Hammerstones and river cobbles that are abundant at Ejutla would have been effective at breaking up large shells and creating large quantities of broken shell. Another abundant tool are large utilized basalt flakes and bifaces (see Figure 5.35), some heavily battered, that also may have been used to knock off the spires from large gastropods. While abundant at Ejutla, large basalt flakes are rare at the other Classic period sites—El Palmillo, the Mitla Fortress, and Lambityeco—where there is no excavated evidence of shell working. The fragments chosen for ornamentation could then be roughly shaped by simple flaking or chipping into disk-like forms that were then abraded and polished into finished ornaments (Foreman 1978, 18).

The Ejutla craftworkers also used perishable materials to cut pieces from large gastropods for making ornaments. String with abrasive and water was used to cut through columellas and the thick outer margins to obtain larger ornament blanks**.** String was also used to cut smaller fragments from the walls of the shell that were then crafted into small placas, mostly low triangles (see Figure 8.18). From shell remnants it is clear that the base of the triangle was cut first, and then the two sides. Although hollow tubular drills were used more often on nacreous shell, the craftworkers also used them to cut small flat disks from the wall of the large gastropods (see Figure 8.21). Most of these disks were not finished, still having a sharp lip on the bottom side. Given the smaller size of the unperforated gastropod disks (compared to most nacreous disks) and their shape and their lack of nacre, the unfinished disks appear to be an intermediate step in the production of beads rather than inlay like some of the nacreous disks.

Most of the formed beads at Ejutla were made from large gastropods. Thinner beads were made by abrading the edge of broken body fragments into roughly circular forms. Working fragments of large, non-nacreous bivalves (especially *Spondylus* and *Chama*) followed a similar path (e.g., Suárez 1981, lámina 14). Making larger cylindrical and spherical beads was more labor intensive than the production of whole shell beads or pendants (mostly small gastropods) or thin disk beads (more often crafted from nacreous shell) (e.g., Garber 1989; see also Kozuch 2022). For larger cylindrical and spherical beads, segments were cut from the columella or the thick outer margin, using either string or a sharp stone tool, such as an obsidian blade. The cut pieces were then shaped and smoothed into the desired shape through abrasion against a hard object, such as the river cobbles and ground stone slabs bearing linear marks from abrasion wear that we found in the midden and in association with the structure (see chapter 9). There also were hundreds of abraders and polishing or burnishing stones and pebbles, of basalt and quartz, especially, that could have been used to finish shaping and then polishing the ornaments.

Perforation can take place before or after a bead is abraded and polished into final form, and we found many finely smoothed beads that had yet to be perforated and rough unfinished beads with complete and partial perforations (see Figure 8.9). But in general, the larger and thicker beads tended to be perforated prior to final shaping and polishing, while the smaller and flatter beads were perforated at the end of the manufacturing process (see also Kozuch 2022). Most of the beads (and pendants) were perforated with small stone drills and perforators. During the excavations we recovered hundreds of solid chert microdrills (see Figure 5.34), but also a few of obsidian and quartz, which have been linked to the perforation of beads and pendants elsewhere in Oaxaca (Martínez López and Markens 2004, Parry 1987; see also Melgar Tísoc et al. 2010, 2018) and in other parts of the Americas (e.g., Mester 1985, 107; Yerkes 1989, 115). High quantities of tiny bifacial thinning flakes found in association with the shell and stone tools evidence frequent sharpening of the tools as they were used to perforate the shell ornaments. Other thin pendants, mostly *Pinctada*, have small smoothed drilled perforations that appear to have been cut with a narrow tubular drill (~5 mm). Half a dozen small flat stones with circular lines or pitting may have been drilling platforms (see chapter 9). Other evidence of shell working was recovered from the floor of the structure.

8.5. The Residence and Shell Working

The shell debris and the tools to work the shell were heavily concentrated in the dense midden just to the north of structure, likely deposited there from a nearby household (our excavated house) in the immediate vicinity (e.g., Bayham 1996; Beck 2003; Beck and Hill 2004; Blinman 1989). Overall quantities of artifacts were much lower in the house, which is not unexpected, since house and patio floors, worldwide, were often swept clean, removing or displacing macroartifacts (e.g., Hutson and Terry 2006; Kenoyer et al. 1991; Vidale et al. 1993). But small pieces of microdebitage are harder to remove, even if mats are placed in the work area to collect debris as it is produced (e.g., Clark 1989). Here we look at both to tie shell working (and the creation of the dense midden) to the residents of the excavated house.

Inside the limits of the house, we found a number of tools that have been tied to shell working, including 2 chert perforators (1 is a microdrill), half a dozen small obsidian perforators (1 is a microdrill), and over 100 heavily used obsidian blades. Although other tools, like hammerstones and abraders, were present in the house, they cannot be tied so closely to shell working alone, yet 1 abrader, several small cobbles, and several flat stones that appear to be work platforms have abrasion wear consistent with smoothing a hard material like shell. In addition, 2 small flat stones have circular drilling marks from repeated use as drilling platforms (see chapter 9).

The more than 18,000 pieces of shell in the midden dwarf the hundreds (~400) of pieces of shell on the house floor. Ornaments were also overwhelmingly recovered from the midden instead of other contexts, but not to the same degree, so that the proportion of ornaments, especially finished ones, was higher in the house than in the midden, which helps tie shell working and consumption of at least some shell ornaments to the house. Approximately 4.6% of the shell in the house are finished ornaments, compared to 0.7% in the midden. In addition, unperforated small whole shells were proportionally 10 times more common in the house than the midden (6 to 22) or other contexts; they may have been stored in the house prior to perforation into ornaments. Only in the house did finished ornaments outnumber unfinished ones (by 2 to 1). In all other excavated contexts, unfinished ornaments greatly outnumbered finished ones, especially in the midden, where they were five times more abundant.

Most of the ornaments in the house are beads, including 6 perforated *Thais* shells that were found together, likely part of a necklace (see Figure 8.25 top left). Out of the 20 finished ornaments in the house, only 2 are *Pinctada*, 1 pendant and 1 placa. This is a much lower proportion of *Pinctada* than in all the ornaments in the midden (77/130). Because nacreous debris in the house indicates that the residents of the house did make nacreous ornaments, it appears that they consumed many fewer of the nacreous ornaments they made compared to those made from large and small gastropods.

Chemical and microartifactual analyses also tie shell working to the house (Middleton 1998, 2004). Samples for microdebitage analysis were collected from all floor units, and control samples were selected from midden, fill, and off-site contexts. The heavy fraction of the samples was sorted by size, with a focus on the materials recovered with 1/16 in.–1 mm mesh (in the sand size range), as materials of this size interval are the most difficult to remove once they have fallen to the floor and are most likely to be in primary context (e.g., Miller Rosen 1989).

The microdebitage analysis produced distribution patterns that do not conform to that of the macroartifacts (Middleton 1998, 213–15), which were present in much higher quantities in the midden than in the house. In contrast, the control samples from the midden, fill, and off-site contexts yielded no 1 mm microdebitage (Middleton 1998, 213–15). The highest amounts of microdebitage were from floor levels, and then the exterior midden adjacent to the house. These samples contained micro flecks of shell and small chert flakes in the 1.0 mm range, some even smaller, the byproduct of tool use or maintenance (Fladmark 1982). In addition to the chert flakes and shell flecks, tiny flakes of obsidian, greenstone, mica, onyx, and basalt were recovered in these samples. By weight and quantity (per liter of soil), the density of these microartifacts generally exceeds the figures reported by Widmer (1991) for a suggested lapidary and shell-working area at Teotihuacan (Feinman et al. 1993). The recovery of these microartifacts in the heavy fraction from floor deposits provides additional support for the argument that these materials were worked inside the excavated house (Feinman et al. 1993; Middleton 1998, 213–14). Although larger artifacts of most of these materials were not particularly abundant in the collections associated specifically with the structure, all were present in the dense midden. For comparison, similar samples taken from a deposit associated with ceramic firing contained many small fired concretions and a greater quantity of small bone fragments than found within the house, but only a single obsidian flake and no shell (Feinman et al. 1993, 38–39).

Chemical analysis (ICP) of soil samples taken systematically from the house floor also supports shell working in the house (Middleton 1998, 238–40; 2004; Middleton and Price 1996). Marine shell is composed of calcium carbonate, which is subject to chemical degradation and dissolution in the soil. Some techniques used in shell working produce very fine debris that cannot be recovered by standard microdebitage techniques, so chemical residues help pinpoint shell working. Bone also degrades into the soil, contributing both calcium and phosphorus, but the Ca:P ratio can help separate calcium added by shell and calcium added by bone. The ratio is highest where Ca is high relative to P (more shell) and lowest where P is highest relative to Ca (more bone). At Ejutla, high concentrations of Ca and P in the midden are attributable to the presences of both shell and bone in those deposits. The highest Ca:P ratios were within the house, with the distribution matching the general pattern of marine shell microdebitage (Middleton 1998, 240). These two independent analyses provide additional evidence that the residents of the excavated structure engaged in crafting shell ornaments.

8.6. Monte Albán Shell and Comparisons with Ejutla

Between 1992 and 1997 we analyzed thousands of pieces of shell from excavations at Monte Albán directed by Marcus Winter and by Ernesto González Licón (Feinman and Nicholas 1995a, 1995b; Appendix 7). Most of the shell (n = 3351) is from contexts that were excavated during the Proyecto Especial Monte Albán 1992–94 (Winter 1994). These contexts are concentrated on the Main Plaza and the North Platform and include one area where there is good evidence of shell working (see also Martínez López and Markens 2004). A small amount (n = 82) is from burials and tombs that were excavated on several terraces in a residential area approximately 1 km northwest of the Main Plaza during the Proyecto Monte Albán 1972–73 (Winter et al. 1995). The rest of the analyzed pieces (n = 386) are from one context on the North Platform and from houses and mortuary contexts that were exposed during the Proyecto Salvamento Carretera de Acceso a Monte Albán 1991, directed by González Licón (2003).

There are many similarities between the shell assemblages at Monte Albán and Ejutla. The same broad categories of worked and unworked shell that we documented at Ejutla are present at Monte Albán (Table 8.6). At both sites, most of the shell is from the Pacific Ocean; a few *Marginella apicina* shells at both sites and one *Cypraea cinerea* at Ejutla are from the Atlantic**,** Table 8.7). This preponderance is not unexpected given that the shortest routes (by foot) from the Pacific Coast into the center of the valley and Monte Albán pass through Ejutla (White and Barber 2012). The most abundant taxon is *Pinctada mazatlanica*, accounting for 55–60% of all shell in the analyzed collections (Table 8.8, Figure 8.30), and nacreous mother of pearl also accounts for ~50–60% of all ornaments at both sites and 40–45% of the finished ornaments. But there are differences in which nacreous ornaments were finished. Placas, the most common ornament at Ejutla, are also prevalent at Monte Albán (Figure 8.31), but nacreous beads and pendants are considerably more abundant at Monte Albán (Figure 8.32) than at Ejutla (Table 8.9, see Table 8.4 for Ejutla), and unperforated shell disks like those at Ejutla are present in much lower quantities at Monte Albán. We suspect that at least some of these unfinished disks are blanks for disk beads, and once perforated, they would look like the perforated nacreous disk beads at Ejutla (some of which are also present at Monte Albán). Other common bivalves are *Spondylus* sp. and *Chama* sp., both of which were used for ornamentation in prehispanic Mesoamerica, prized for their colorful shells (Moholy-Nagy 1994a; Velázquez Castro and Melgar Tísoc 2021). There are low numbers of beads, pendants, and placas of both genera at both sites (Figure 8.33). Most other bivalves are present in very low numbers and often with no evidence of working.

The pattern for gastropods is different (see Table 8.8). Although many of the same taxa are present, large gastropods, including *Strombus* sp. and *Patella mexicana*, are much more abundant at Ejutla (30% of the assemblage) than at Monte Albán (5.5%). At both sites, bracelets are the most common ornament made from *Patella*, while beads were often made from large gastropods. It was not possible to positively identify the taxa of many finished matte white beads, but even given the possibility that they were made from large gastropods, the proportions rise to 40% at Ejutla and only to 13% at Monte Albán. In contrast, whereas many different small gastropods are found at bth sites, they are much more common at Monte Albán (491 vs. 178 at Ejutla), especially as perforated whole shell beads and pendants (258 at Monte Albán vs. 21 at Ejutla). Among the most common at Monte Albán are olive shells (*Oliva* sp., *Olivella* sp., *Agaronia* sp.) and turret shells (*Turritella* sp.), which often were perforated for stringing as beads and pendants. Of these, only *Oliva* is present at Ejutla in any quantity above a half dozen. Other small gastropods are present in very low numbers at both sites, but most are proportionately much more common at Monte Albán, given the much greater quantities of shell overall at Ejutla (see Tables 8.3 and 8.8), such as cone shells (*Conus* sp.), cowrie shells (*Cypraea* sp.), marginellas (*Marginella* sp., *Persicula* sp.), dove shells (*Mitrella* sp., *Pyrene* sp.), dogwinkles

Table 8.6. The shell assemblage at Monte Albán by class.

All analyzed collections at Monte Albán					
Shell category	**Bivalve**	**Gastropod**	**Scaphopod**	**Unidentified**	**Total**
broken shell	1143	229	–	53	1425
worked shell	936	62	–	4	1002
whole shell (unmodified)	81	90	–	2	173
unfinished ornament	221	51	–	5	277
finished ornament	418	295	1	228	942
total	2799	727	1	292	3819
Non-shell-working areas					
Shell category	**Bivalve**	**Gastropod**	**Scaphopod**	**Unidentified**	**Total**
broken shell	487	194	–	47	728
worked shell	196	49	–	4	249
whole shell (unmodified)	80	83	–	2	165
unfinished ornament	133	46	–	5	184
finished ornament	355	269	1	227	852
total	1251	641	1	285	2178
Shell-working area on the west side of the North Platform					
Shell category	**Bivalve**	**Gastropod**	**Scaphopod**	**Unidentified**	**Total**
broken shell	656	35	–	6	697
worked shell	740	13	–	–	753
whole shell (unmodified)	1	7	–	–	8
unfinished ornament	88	5	–	–	93
finished ornament	63	26	–	1	90
total	1548	86	–	7	1641

Table 8.7. Shell species at Monte Albán.

Bivalves		
Genus	**Species**	**Common name**
Anadara	*mazatlanica* (?)	ark shell
Arca	*pacifica*	ark shell
Barbatia (?)	sp.	ark shell
Chama	*buddiana*	jewel box
Chama	*echinata* (*C. coralloides*)	jewel box
Chama	*frondosa* (?)	jewel box
Chama	*squamuligera* (?)	jewel box
Choromytilus	*palliopunctatus* (?)	mussel
Donax	*navicula* (?)	bean clam
Donax	*transversus* (?)	bean clam
Dosinia (?)	sp.	Venus clam
Glycymeris	*gigantea*	bitterweet shell
Lophocardium (?)	sp.	?
Lucina	sp.	lucine
Macoma	*siliqua* (?)	macoma
Mactrellona	*clisia*	surf clam
Margaritifera (?)	sp.	freshwater mussel
Ostrea	*conchaphila*	oyster
Ostrea	*fisheri*	fisher's oyster
Ostrea	*iridesens*	oyster
Ostrea	*palmula*	oyster
Periglypta	*multicostata*	Venus clam
Pinctada	*mazatlanica*	pearly oyster
Pitar	*frizzelli*	pearly oyster
Pitar	*lupanaria* (?)	Venus clam
Pitar	*tortuosus* (?)	Venus clam
Polymesoda (?)	sp.	marsh clam
Protothaca	sp.	Venus clam
Pteria	*sterna* (?)	winged oyster
Sanguinolaria	sp.	gari shell
Spondylus	*calcifer* (*S. limbatus*)	spiny oyster
Spondylus	*princeps* (*S. crassisquama*)	spiny oyster
Tagelus (?)	sp.	gari shell
Tellina	sp.	tellin
Tivela	*delessertii* (?)	Venus clam

(*Continued*)

Tivela	*planulata*	Venus clam
Trachycardium	*consors*	cockle shell
Ventricolaria	*isocardia* (?)	Venus clam
Gastropods		
Genus	**Species**	**Common name**
Acmaea	*discors*	small limpet
Acmaea	*fascicularis*	small limpet
Acmaea	*pediculus*	small limpet
Agaronia	*propatula*	olive shell
Agaronia	*testacea*	olive shell
Anachis	*scalarina*	dove shell
Astraea	*olivacea*	olive turban
Astraea	*unguis*	turban
Cassis	*madagascarensis*	helmet
Cassis	*tenius* (?)	helmet
Cassis	*tuberosa* (?)	helmet
Cerithidea	*albonodosa*	horn shell
Cerithidea	*montagnei* (?)	horn shell
Cerithium	*stercusmuscarum*	horn shell
Conus	*fergusoni*	cone shell
Conus	*nux* (?)	cone shell
Conus	*purpurascens* (?)	cone shell
Conus	*regularis*	cone shell
Conus	*virgatus* (?)	cone shell
Conus	*princeps*	cone shell
Crepidula	*aculeata*	prickly slipper shell
Crucibulum	*scutellatum*	cup and saucer limpet
Cymatium	*lignarium*	triton
Cymatium	*wiegmanni*	triton
Cypraea	*arabicula*	cowrie
Cypraea	*cervinetta*	cowrie
Diodora	*inaequalis*	keyhole limpet
Engina	*pulchra*	small whelk
Ficus	sp.	fig shell
Fissurella	*gemmata*	keyhole limpet
Fissurella	*longifissa* (?)	keyhole limpet
Fissurella	*rugosa* (?)	keyhole limpet
Fossarus	sp.	fossarus
Fusinus	sp.	spindle shell
Haliotis	*fulgens*	green abalone
Haliotis	*rufrescens*	red abalone
Hexaplex (?)	sp.	rock shell
Janthina	*globosa or prolongata*	violet snail
Jenneria	*pustulata*	sea button
Lamellaria	*inflata*	wide-mouth snail
Latirus	*ceratus*	tulip shell
Latirus	*socorroensis*	tulip shell
Littorina	*conspersa*	periwinkle
Malea	*ringens*	cask shell
Marginella	*apicina*	marginella
Marginella	*curta*	marginella
Mitrella	*delicata*	dove shell
Mitrella	*lalage*	dove shell
Morum	*tuberculosum*	helmet
Muricanthus	*princeps* (?)	rock shell
Nassarius	*luteostoma* (?)	dog whelk
Natica	*chemnitzi* (?)	moon shell
Natica	*broderipiana* (?)	moon shell
Nerita	*scabricosta*	nerite
Neritina	*meleagris*	nerite
Neritina	*reclivata*	nerite
Oliva	*incrassata*	olive shell
Oliva	*polpasta*	olive shell
Oliva	*porphyria*	olive shell
Oliva	*splendidula* (?)	olive shell
Olivella	*alba* (?)	olive shell
Olivella	*dama*	olive shell
Olivella	*gracilis* (?)	olive shell
Olivella	*morrisoni* (?)	olive shell
Olivella	*volutella* (?)	olive shell
Olivella	*walkeri* (?)	olive shell
Olivella	*zanoeta* (?)	olive shell
Patella	*mexicana* (*Ancistromesus mexicanus*)	giant limpet
Persicula	*imbricata* (?)	marginella
Petaloconchus	*flavescens* (?)	worm shell
Planaxis	*obsoletus*	grooved snail
Pyrene	*fuscata*	dove shell
Pyrene	*lucasana*	dove shell
Pyrene	*major*	dove shell
Siphonaria (?)	sp.	false limpet
Strombus	*galeatus*	conch shell
Strombus	*gracilior*	conch shell
Tegula	sp.	pearly top shell
Terebra (?)	sp.	auger shell
Thais	*biserialis* (?)	dogwinkle
Thais	*speciosa*	dogwinkle
Thais	*triangularis*	dogwinkle
Trivia	*radians* (?)	sea button
Turritella	*leucostoma*	turret
Scaphopods		
Dentalium	*pretiosum* (?)	tusk shell

Table 8.8. Quantity of each shell genus identified at Monte Albán.

Class	Genus	Quantity
Bivalve	*Anadara*	5
Bivalve	*Arca*	1
Bivalve	*Barbatia*	1
Bivalve	*Chama*	289
Bivalve	*Choromytilus*	1
Bivalve	*Donax*	8
Bivalve	*Dosinia* (?)	1
Bivalve	*Glycymeris*	3
Bivalve	*Lophocardium* (?)	1
Bivalve	*Lucina*	1
Bivalve	*Macoma*	1
Bivalve	*Mactrellona*	1
Bivalve	*Margaritifera* (?)	3
Bivalve	*Ostrea*	5
Bivalve	*Periglypta*	1
Bivalve	*Pinctada*/nacreous	2290
Bivalve	*Pitar*	3
Bivalve	*Polymesoda/Cyrenoida*	2
Bivalve	*Protothaca*	1
Bivalve	*Pteria*	3
Bivalve	*Sanguinolaria*	1
Bivalve	*Spondylus*	93
Bivalve	*Tagelus* (?)	1
Bivalve	*Tellina*	4
Bivalve	*Tivela*	3
Bivalve	*Trachycardium*	1
Bivalve	*Ventricolaria*	1
Gastropod	*Acmaea*	12
Gastropod	*Agaronia*	14
Gastropod	*Anachis*	1
Gastropod	*Astraea*	8
Gastropod	*Cassis*	4
Gastropod	*Cerithidea*	7
Gastropod	*Cerithium*	4
Gastropod	*Conus*	13
Gastropod	*Crepidula*	1
Gastropod	*Crucibulum*	5
Gastropod	*Cymatium*	2
Gastropod	*Cypraea*	13
Gastropod	*Diodora*	3
Gastropod	*Engina*	1
Gastropod	*Ficus*	1
Gastropod	*Fissurella*	13
Gastropod	*Fossarus*	1
Gastropod	*Fusinus*	1
Gastropod	*Haliotis*	8
Gastropod	*Hexaplex* (?)	2
Gastropod	*Janthina*	1
Gastropod	*Jenneria*	2
Gastropod	*Lamellaria*	1
Gastropod	*Latirus*	6
Gastropod	*Littorina*	1
Gastropod	*Malea*	4
Gastropod	*Marginella*	33
Gastropod	*Mitrella*	19
Gastropod	*Morum*	6
Gastropod	*Muricanthus*	2
Gastropod	*Nassarius*	2
Gastropod	*Natica*	2
Gastropod	*Nerita*	3
Gastropod	*Neritina*	7
Gastropod	*Oliva*	106
Gastropod	*Olivella*	101
Gastropod	*Patella*	9
Gastropod	*Persicula*	2
Gastropod	*Petaloconchus*	2
Gastropod	*Planaxis*	1
Gastropod	*Pyrene*	9
Gastropod	*Siphonaria* (?)	1
Gastropod	*Strombus*	14
Gastropod	*Tegula*	2
Gastropod	*Terebra* (?)	1
Gastropod	*Thais*	9
Gastropod	*Trivia*	2
Gastropod	*Turritella*	70
Scaphopod	*Dentalium*	1

(*Thais* sp.), horn shells (*Cerithidea* sp., *Cerithium* sp.), sea buttons (*Jenneria* sp., *Trivia* sp.), moon shells (*Natica* sp.), turban shells (*Astraea* sp.), pearly top shells (*Tegula* sp.), nerites (*Nerita* sp., *Neritina* sp.), helmets (*Morum* sp.), periwinkles (*Littorina* sp.), and dog whelks (*Nassarius* sp.). Two small limpets are present at both sites (*Acmaea* sp. and *Fissurella* sp.); others are present only at Monte Albán (*Crucibulum* sp., *Diodora* sp.). Many of these small limpets have natural holes that were enlarged for stringing. For all these genera, the same species often are not present at both sites. These small shells may have been traded to Monte Albán and Ejutla by various routes.

An important difference between the shell assemblages at Ejutla and Monte Albán is the much greater proportion of ornaments at Monte Albán (32% vs. 4.3% at Ejutla) and especially finished ornaments, approximately one-quarter of the assemblage (24.7%) at Monte Albán compared to <1% at Ejutla (see Tables 8.1 and 8.6). The Monte Albán shell ornament assemblage is dominated by beads (47%), pendants (19%), and placas (26%). Most of the beads are

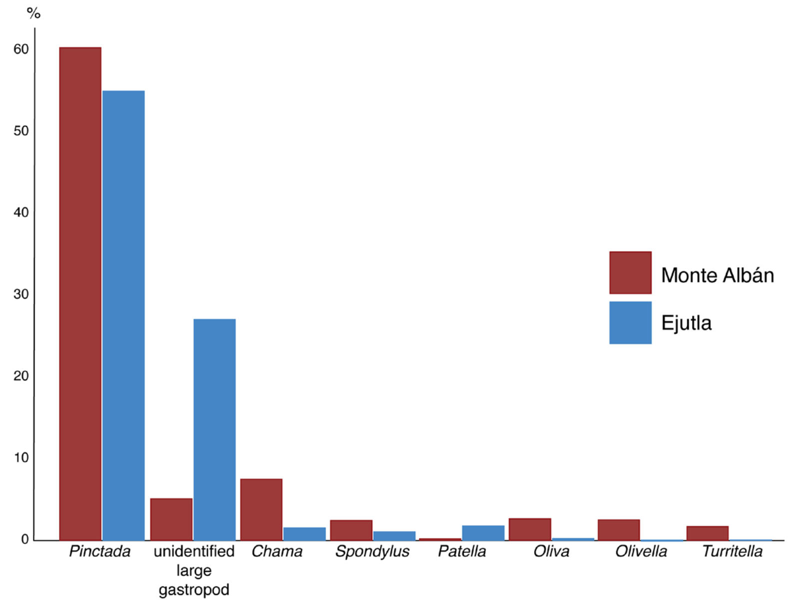

Figure 8.30. Comparison of principal shell genera at Monte Albán and Ejutla by percentage (only includes taxa that are at least 1% at one of the two sites).

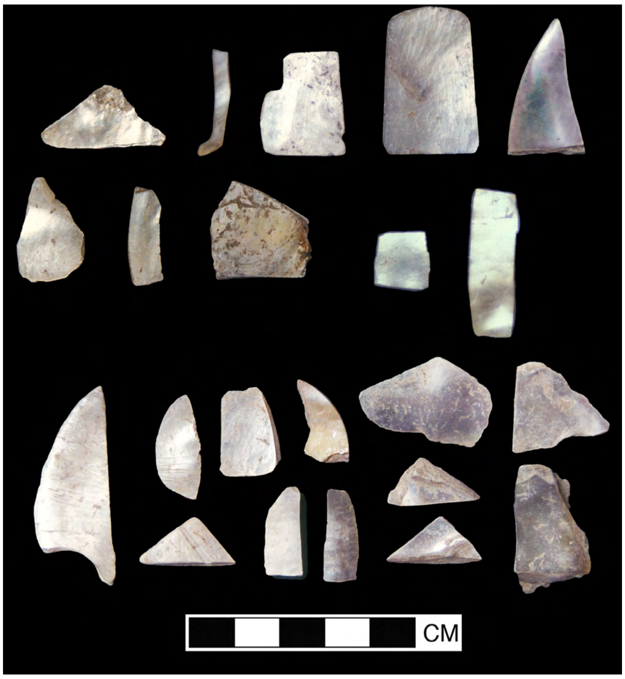

Figure 8.31. Sample of *Pinctada* placas from Monte Albán.

formed thin disk beads (mostly matte white and some *Pinctada*) and larger tabular beads (mostly *Pinctada*) (Figure 8.34), and whole shell beads (small gastropods) (Figure 8.35). Most of the beads are finished. The majority of the pendants are natural small gastropods that have been perforated (see Figure 8.35); the remaining formed pendants have a variety of quadrangular and curvilinear forms, with tabular or rectangular more common than other shapes (see Figure 8.32). Most of the formed pendants were made from *Pinctada*. Over 75% of the pendants are finished, whereas fewer than half of the placas are finished. Most placas were also made of *Pinctada*, in a wide variety of shapes, with triangles, rectangles, trapezoids, diamonds, and crescents the most common (Table 8.10). Some of the placas could be unperforated bead blanks, along with a small number of shell disks, while finished placas and disks could have been used as mosaic inlay.

There is less broken and worked shell at Monte Albán, approximately 63% of the assemblage compared to more than 95% at Ejutla. These differences in quantities of ornaments and shell debris are not surprising given the contexts from which much of the shell was collected at Monte Albán, whereas the shell from Ejutla comes exclusively from a shell-working context. The differences are even greater when we separate out the shell from the Conjunto Plataforma Norte Lado Poniente, an area where shell working occurred, based on the nature of the shell assemblage (see also Martínez López and Markens 2004). That one context alone (n = 1643, wgt. = 2.5 kg) accounts for 43% of all the shell that we analyzed at Monte Albán. For the rest of the shell assemblage at Monte Albán, ornaments account for almost half (48%) of the assemblage, with many more finished ornaments (39%) than unfinished ones (8.4%). These contexts were clearly receiving shell ornaments crafted elsewhere, either on site or from afar, and were not making ornaments in any large numbers.

In many respects, the assemblage from the complex on the west side of the North Platform looks a lot like the assemblage in the domestic shell-working area at Ejutla (see Appendix 7, Figure 8.36). Approximately 11% are ornaments, about half finished and half unfinished. The most common ornaments are placas (>60%). There also are high quantities of worked shell (46%) and unworked broken shell (42%). But shell working in this context was limited almost entirely to nacreous shell, primarily *Pinctada*, which accounts for 92% of the shell here (n =

Figure 8.32. Nacreous beads and pendants from Monte Albán.

1510), plus more than 1000 tiny flakes or chipping debris weighing only 200 g that we do not include in the total count; many of these tiny pieces may have simply flaked off of larger nacreous debris or broken ornaments (compared to Ejutla, where nacreous shell was 61% of all shell, with 4.3 kg of uncounted chipping debris). There are only a few pieces of *Spondylus* (n = 6) and *Chama* (n = 15), mostly broken fragments with no evidence of working and a few ornaments. Gastropods are fairly evenly divided between small snail shells (42 comprising 17 different genera, with more *Olivella* and *Turritella* than the others) and larger gastropods (44, most unidentified but a few *Strombus*), both ~2.5% of the assemblage. The craftworkers may have perforated small snail shells for stringing, but given the very low amounts of modified fragments from large gastropods in this context, there is minimal evidence that the large shells were crafted into ornaments for exchange in this context.

In analyzing the shell from the west side of the North Platform, and the ornaments from the other contexts, we saw the same techniques that the Ejutleño artisans used to craft ornaments (e.g., Feinman and Nicholas 2000), including techniques that Melgar Tísoc et al. (2010, 2018) have documented through experimental analyses at Monte Albán—cutting shell with sharp obsidian and chert blades and flakes, perforating beads and pendants with small chert drills and pointed flakes, and shaping ornaments with basalt abraders. These techniques have been documented elsewhere in Mesoamerica (Emery and Aoyama 2007; Suárez 1977, 1981; Velázquez Castro et al. 2019) and are not unique to Oaxaca, Ejutla, or Monte Albán. While many placas and worked debris have string-cut edges, many others were cut with sharp-edged stone tools. The edges of many placas were abraded very smooth, removing any evidence of whether string or a stone tool was used initially to cut the ornament blank. Regardless of the tools used, many placas are very similar to those we found at Ejutla. There were only a few disks (12) in this context, proportionally many fewer than in Ejutla; most were abraded, but two had been cut with a tubular drill (most likely cane), and several pieces of discarded worked shell have cut marks made with a tubular drill. There were approximately two dozen each of beads and pendants, accounting for ~25% of the ornaments in this context, half of which are small whole gastropods perforated for stringing by abrading (often with string) an opening in the shell wall, or in thinner shells by punching a hole in the shell wall or cutting off the top of the spire. Formed beads were abraded, while pendants were formed by cutting with string or a sharp stone tool, and then abrading the edges smooth. Given the low number of disks, the craftworkers' main focus appears to have been on making tabular pieces that were finished into pendants, beads, or mosaic inlay. Mixed with the shell debris were hundreds of blades and flakes of obsidian, chert, and quartz, and a small number of perforators (Martínez López and Markens 2004, 85). The obsidian blades were well used, like those at Ejutla (see also Lewenstein 1987). The presence of rejuvenation flakes indicates resharpening of blades and perforators as

Table 8.9. Shell ornaments by genus at Monte Albán.

Genus	Bead	Bead/ pendant	Bracelet	Button	Cube	Disk	Earspool	Ornament blank	Pearl	Pectoral	Pendant	Placa	Ring	Trumpet	Unknown ornament	Whole shell	Total
Bivalve	**186**	**3**	**5**	**5**	**1**	**31**	**–**	**11**	**1**	**2**	**108**	**280**	**1**	**–**	**5**	**81**	**720**
Arca	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Chama	1	–	–	–	–	–	–	1	–	–	4	–	–	–	–	64	70
Chama (?)	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1
Choromytilus (?)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Donax	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	2
Glycymeris	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Glycymeris (?)	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Macoma (?)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Margaritifera (?)	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1	2
nacreous/*Pinctada*	71	3	–	4		21	–	3	–	–	54	195	–	–	5	–	356
Ostrea	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	2
pelecypod UID	2	–	–	–	–	1	–	–	1	–	3	–	–	–	–	6	13
Pinctada	96	–	2	1		7	–	2	–	1	16	34	–	–	–	1	160
Pinctada (?)	9	–	–	–	–	2	–	3	–	1	22	32	1	–	–	–	70
Pitar	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Polymesoda (?)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Pteria (?)	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1
Spondylus	3	–	–	–	1	–	–	2	–	–	6	18	–	–	–	–	30
Spondylus (?)	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4
Tivela	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1
Gastropod	**178**	**–**	**3**	**–**	**–**	**4**	**2**	**13**	**–**	**–**	**117**	**23**	**4**	**1**	**1**	**90**	**436**
Acmaea	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	4	5
Acmaea (?)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Agaronia	–	–	–	–	–	–	–	–	–	–	5	–	–	–	–	–	5
Agaronia (?)	1	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	2
Agaronia/Oliva	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1
Agaronia/Olivella	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1
Anachis	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Astraea	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Cerithidea	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	4	6

Genus	Bead	Bead/ pendant	Bracelet	Button	Cube	Disk	Earspool	Ornament blank	Pearl	Pectoral	Pendant	Placa	Ring	Trumpet	Unknown ornament	Whole shell	Total
Cerithidea (?)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Cerithium	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	2	3
Conus	–	–	–	–	–	–	–	–	–	–	6	–	–	–	1	–	7
Crepidula	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Crucibulum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	3
Cypraea	1	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	2
Diodora	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1	2
Diodora (?)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Engina	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1
Ficus	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1
Fissurella	–	–	–	–	–	–	–	–	–	–	4	–	–	–	–	5	9
Fissurella (?)	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1
Fossarus	–	–	–	–	–	–	–	–	–	–	–		–	–	–	1	1
gastropod UID	29	–	–	–	–	2	2	9	–	–	7	19	4	–	–	–	72
Haliotis	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1
Hexaplex (?)	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	1
Jenneria	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1
Lamellaria	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Latirus	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	4	5
Littorina	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Malea (?)	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1
Marginella	29	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	32
Mitrella	14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	15
Mitrella (?)	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Morum	–	–	–	–	–	–	–	–	–	–	5	–	–	–	–	–	5
Nassarius	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	2
Natica (?)	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1
Nerita	–	–	–	–	–	–	–	–	–	–	3	–	–	–	–	–	3
Neritina	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6	7
Oliva	1	–	–	–	–	–	–	–	–	–	56	–	–	–	–	2	59
Oliva (?)	–	–	–	–	–	1	–	–	–	–	4	–	–	–	–	–	5

(*Continued*)

Genus	Bead	Bead/ pendant	Bracelet	Button	Cube	Disk	Earspool	Ornament blank	Pearl	Pectoral	Pendant	Placa	Ring	Trumpet	Unknown ornament	Whole shell	Total
Olivella	85	–	–	–	–	–	–	–	–	–	1	–	–	–	–	5	91
Olivella (?)	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Patella	–	–	1	–	–	–	–	1	–	–	–	–	–	–	–	1	3
Patella (?)	–	–	2	–	–	–	–	1	–	–	–	–	–	–	–	–	3
Persicula	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Planaxis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Pyrene	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	6
Siphonaria (?)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Strombus	–	–	–	–	–	–	–	2	–	–	2	2		1	–	1	8
Tegula (?)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Thais	6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	7
Turritella	–	–	–	–	–	–	–	–	–	–	9	–	–	–	–	33	42
Scaphopod	**1**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**1**
Dentalium	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Unidentified	**213**	**–**	**3**	**–**	**–**	**1**		**1**	**–**	**–**	**6**	**8**	**–**	**–**	**1**	**2**	**235**
Total	**578**	**3**	**11**	**5**	**1**	**36**	**2**	**25**	**1**	**2**	**231**	**311**	**5**	**1**	**7**	**173**	**1392**

Figure 8.33. ***Spondylus*** **placas from Monte Albán.**

Figure 8.34. ***Pinctada*** **disks and tabular beads from Monte Albán.**

Figure 8.35. Whole shell beads and pendants at Monte Albán, small olive and marginella shells (top) and ***Oliva porphyria*** **(bottom).**

Table 8.10. Types of shell ornaments at Monte Albán by class.

Ornament category	Bivalves	Gastropods	Scaphopods	UID	Total
Bead	**186**	**178**	**1**	**213**	**578**
cylindrical	6	2	–	1	9
flat disk	7	18	–	184	209
miniature	3	8	–	17	28
other form	10	2	1	11	24
tabular	159	–	–	–	159
whole shell bead	1	148	–	–	149
Bead/pendant	**3**	**–**	**–**	**–**	**3**
Bracelet	**5**	**3**	**–**	**3**	**11**
Button	**5**	**–**	**–**	**–**	**5**
Cube	**1**	**–**	**–**	**–**	**1**
Disk	**31**	**4**	**–**	**1**	**36**
abraded disk	19	4	–	1	24
tubular cut	12	–	–	–	12
Earspool	**–**	**2**	**–**	**–**	**2**
Ornament blank	**11**	**13**	**–**	**1**	**25**
Pearl	**1**	**–**	**–**	**–**	**1**
Pectoral	**2**	**–**	**–**	**–**	**2**
Pendant	**108**	**117**	**–**	**6**	**231**
anthropo/zoomorphic	15	3	–	2	20
circular	11	–	–	1	12
cruciform	–	–	–	1	1
dagger-shaped	2	–	–	–	2
engraved	5	1	–	–	6
irregular	5	1	–	–	6
J-shaped	2	1	–	–	3
other angular form	2	–	–	–	2
other shape	4	2	–	–	6
rectangular	18	1	–	–	19
ring-shaped	1	1	–	–	2
square	4	–	–	–	4
tabular	19	2	–	2	23
teardrop	1		–	–	1
trapezoidal	6	1	–	–	7
triangular	7	–	–	–	7
whole shell pendant	6	104	–	–	110
Placa	**280**	**23**	**–**	**8**	**311**
anthropo/zoomorphic	7	–	–	1	8
arrow-shaped	8	1	–	–	9
circular	3	1	–	–	4
crescent	13	1	–	–	14
cruciform	1	–	–	–	1
curvilinear	4	2	–	–	6
engraved/incised	4	1	–	–	5
flower	1	1	–	–	2
irregular	25	1	–	3	29
letter-shaped	14	–	–	–	14
notched/serrated	9	1	–	1	11

Ornament category	Bivalves	Gastropods	Scaphopods	UID	Total
other angular	9	1	–	–	10
rectangular	64	4	–	1	69
square	13	–	–	–	13
star-shaped	1	–	–	–	1
tabular	22	4	–	–	26
teardrop	2	–	–	1	3
trapezoidal	12	2	–	–	14
triangular	62	3	–	–	65
unclear form	6	–	–	1	7
Ring	**1**	**4**	**–**	**–**	**5**
Trumpet	**–**	**1**	**–**	**–**	**1**
Unknown ornament	**5**	**1**	**–**	**1**	**7**
Unmodified whole shell	**81**	**90**	**–**	**2**	**173**
Total	**720**	**436**	**1**	**235**	**1392**

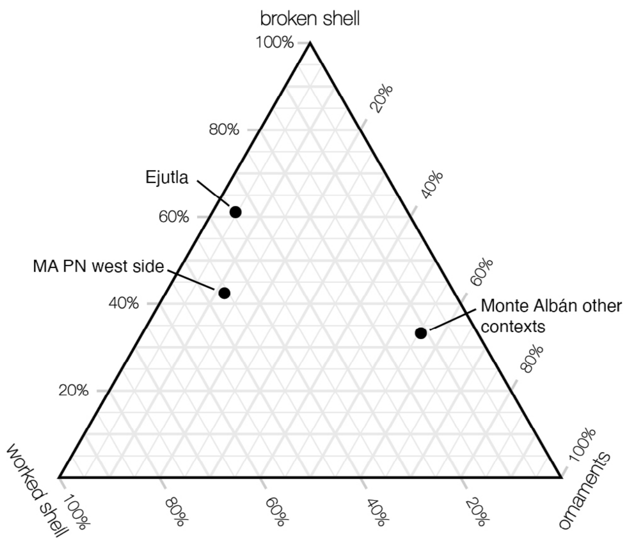

Figure 8.36. Ternary chart showing proportions of ornaments, worked shell, and broken shell at Ejutla, the shell-working area on the west side of the North Platform, and all other contexts at Monte Albán.

they were worn down by working the hard shell. There was much less ground stone, only 17 hammerstones to break up the shells, most of which are chert, and many fewer other forms, such as manos, polishers, anvils, axes, or chisels (Martínez López and Markens 2004, 88–89). It is not clear from the reporting how many, if any, of the other tools are basalt.

Because of the limited evidence that the shell workers in the Conjunto Plataforma Norte Lado Poniente worked shell genera other than *Pinctada* and the high volume of shell ornaments in the collections we analyzed at Monte Albán, we suspect that many of those ornaments were made elsewhere at Monte Albán, or at another shell-working site. There is minimal evidence that shell working was carried out in any of the other archaeological contexts we analyzed, or at least it did not occur at scale. During the survey of Monte Albán, Richard Blanton (1978, 77–79) recorded sparse quantities of shell on ~6% of all terraces spread across Monte Albán; he also identified several possible shell-working areas by denser than usual quantities of shell on the surface, in his words, “that 10 or more pieces could be sighted in a small area immediately and that if a surface collection were to be made hundreds or even thousands of pieces could be picked up.”

All of the terraces with possible shell working are on Monte Albán’s main hill, on several sides of the Main Plaza (Blanton 1978, figure 4.29). All are on residential terraces, several of which are clustered in what appear to be small barrios of artisans who crafted shell ornaments (Figure 8.37). The largest cluster includes five terraces with abundant surface shell off the southwest corner of the Main Plaza. Several other shell-working terraces are below the eastern side of the Main Plaza, and another one is to the north. Although none of these areas have been investigated further, they remain possible sources for the shell ornaments that we analyzed from the contexts on the Main Plaza.

Yet just because shell working occurred in at least one context at Monte Albán, that does not rule out the possibility that shell ornaments crafted elsewhere were traded to Monte Albán. As an example, ceramic production is well documented at Monte Albán (e.g., Markens and Martínez López 2009), yet a compositional analysis of ceramics from across the valley found that a small amount of pottery at Monte Albán was not made at the site itself (Minc et al. 2015). The same pattern was even clearer at El Palmillo, where we found several small ceramic firing features; most of the tested pottery was made from clays near El Palmillo, yet 18% was made from clays in western Tlacolula. Local production of a good does not preclude all residents of a site from obtaining similar classes of that good produced elsewhere.

Given the similarity in the species, the techniques used to work the shell, and the kinds of ornaments in both

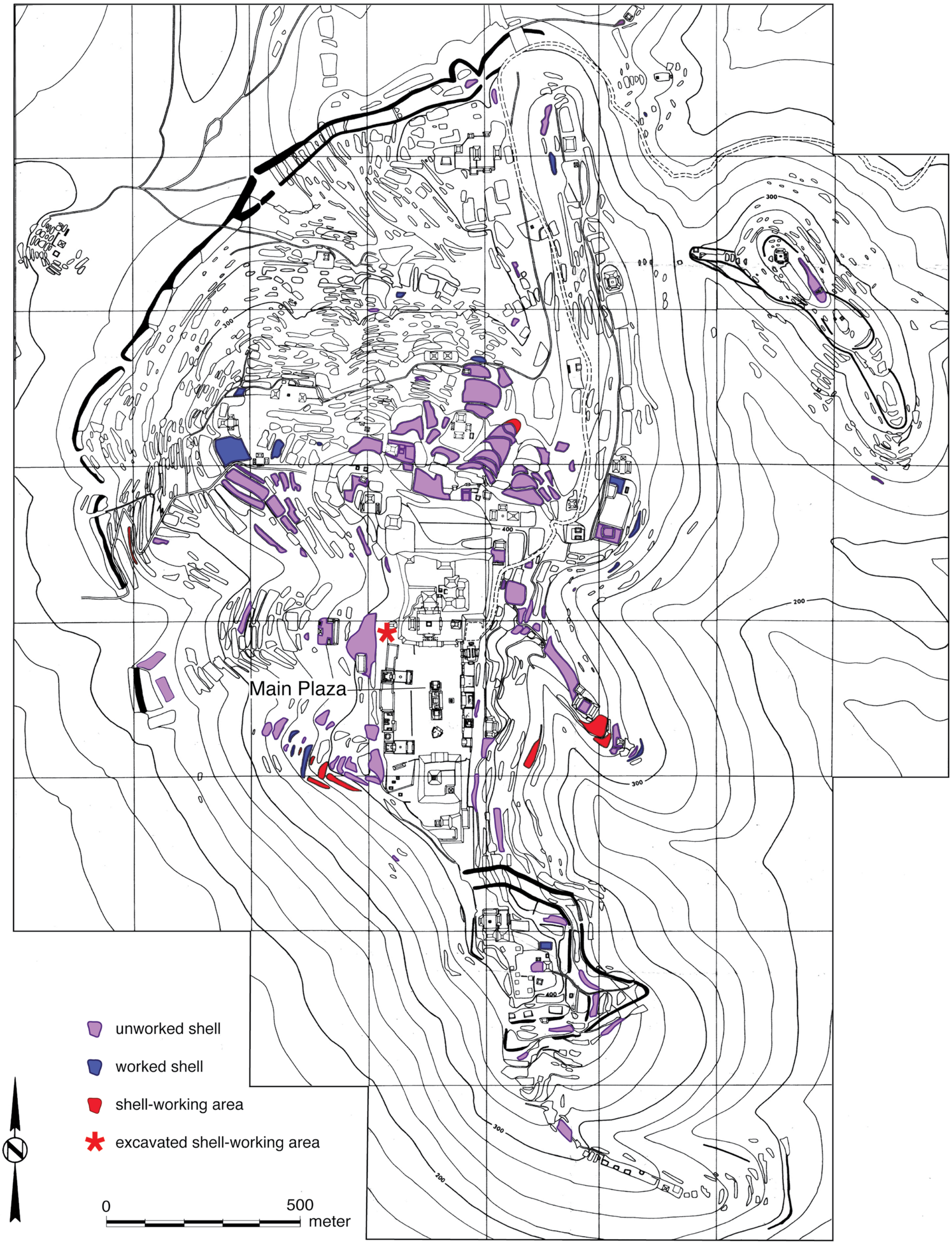

Figure 8.37. Map of Monte Albán, showing location of the Main Plaza, areas where shell and indications of shell working were found during the surface survey of the site (data from Blanton 1978, appendix 1), and the excavated shell-working area on the west side of the North Platform.

contexts, we also cannot rule out that some of the shell at Monte Albán came from Ejutla, including beads or other ornaments made from large gastropods, as well as blanks and unworked shell (e.g., Feinman and Nicholas 1995c, 2000; contra Melgar Tísoc et al. 2010, 2018). The amount of broken gastropod debris at Ejutla far exceeded the number of (even partial) ornaments. These larger and heavier shells may have been more difficult to transport and so were at least initially broken and processed at Ejutla; this would help explain the high amounts of unworked debris from these large shells at Ejutla. At Ejutla, large gastropods account for 30% of the shell assemblage, with only 3.5% finished or unfinished ornaments compared to 20% in the Conjunto Plataforma Norte Lado Poniente. *Spondylus* and *Chama*, both as unworked shells and as ornaments, also may have arrived at Monte Albán by way of Ejutla.

Surveys and excavations in the Valley of Oaxaca have found few sites with high-intensity shell working. Shell was recorded on the surface of only 20 sites during surveys in the Valley of Oaxaca (out of 2700, including Monte Albán; Kowalewski et al. 1989). The relative abundance of surface shell was greater in the southern parts of the central valleys, 21 out of 423 sites in Ejutla (Feinman and Nicholas 1992, 1993) and 8 out 120 sites in the Sola Valley (Balkansky 2002; Nicholas and Feinman 2002). At most sites only one or two pieces of shell were noted.

Only at Monte Albán and Ejutla have dense surface scatters of marine shell been recorded and then (through subsequent excavation and analysis) shell working documented. Although shell ornaments and broken debris are not rare finds in our excavations at El Palmillo, Lambityeco, and the Mitla Fortress (Feinman and Nicholas 2009, 2011b, 2016b) or those of colleagues elsewhere in the valley (Feinman and Nicholas 2007e), the quantities are generally very low, and there is no evidence of shell working at any level of intensity. Shell ornaments generally are more abundant in higher-status contexts but have been found in non-elite houses (Feinman and Nicholas 2009, 2011b) and in child burials (González Licón 2009; Feinman and Nicholas 2007e).

In spite of high-intensity shell ornament production at Ejutla, there was only one bead in the tomb and only a few other finished shell ornaments in the house, including the two carved pendants (see Figure 8.27). This household and the local community were not consuming most of the shell ornaments made by the Ejutla craftworkers, in contrast to artisans at the Xalla palace at Teotihuacan (Velázquez Castro et al. 2019) or the Maya sites of Aguateca and Tikal (Inomata and Emery 2014; Moholy-Nagy 2008) or at Monte Albán, where finished ornaments were a far larger component of shell assemblages. So, for whom were the Ejutla artisans making the ornaments? Consumers at Monte Albán are one reasonable answer. Given that shell ornaments are most frequently found in elite contexts at Monte Albán and other sites in the valley, including El Palmillo, where we excavated low- and high-status houses, it does not seem likely that the large quantity of shell ornaments made in Ejutla were traded only to nearby communities, all of which were much smaller than Ejutla. One could presume that at least some of the ornaments were crafted for higher-status individuals who lived closer to the site's core in the center of the modern town, where we mapped a ceremonial complex of mounds during the regional survey. Nevertheless, although we were able to collect pottery as we investigated the heavily damaged mounds and surrounding areas, we did not recover a single piece of shell, much less any ornaments. Sourcing studies of obsidian and mica help define prehispanic networks and routes that appear to provide some conceivable answers.

8.7. Obsidian and Travel Routes to the Pacific Coast

In 2012 we started sourcing the obsidian from our excavations using portable XRF (X-ray fluorescence), and now we have sourced more than 20,000 pieces of obsidian from more than 50 archaeological sites in the state of Oaxaca (Nicholas et al. 2022). There are no obsidian sources in the entire state of Oaxaca, so all obsidian arrived via long-distance exchange (Figure 8.38). We found that obsidian was moving long distances as early

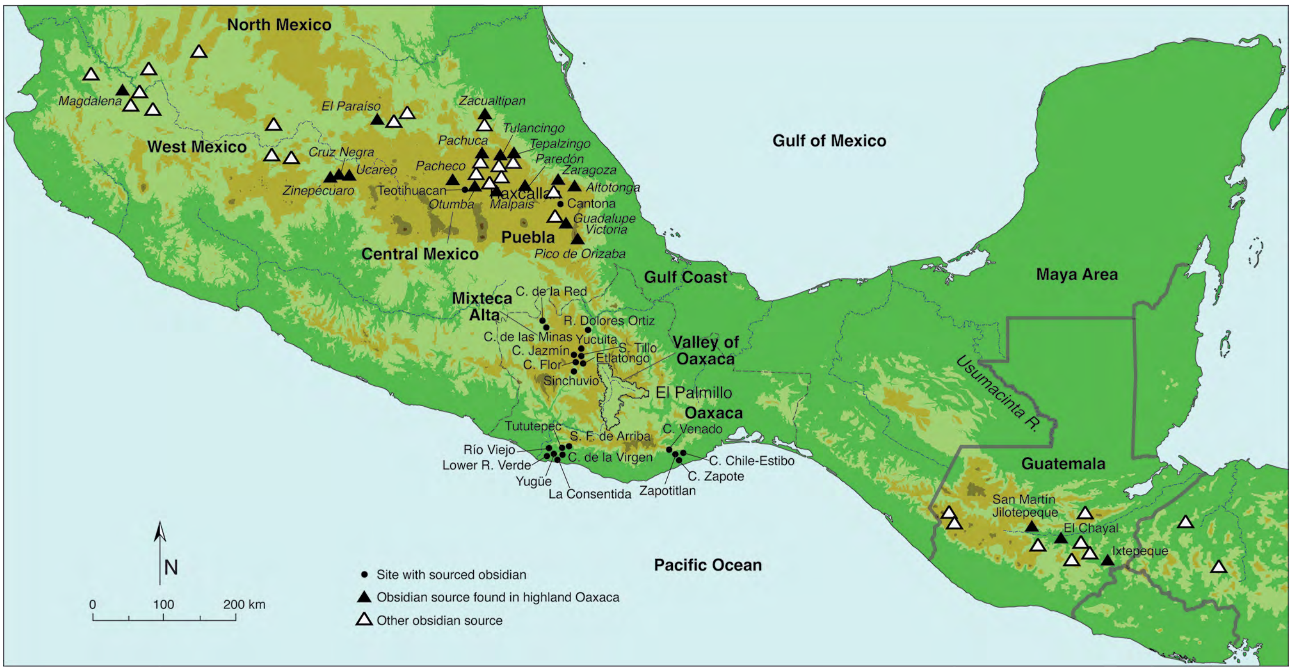

Figure 8.38. Map of Mesoamerican obsidian sources and sites with sourced obsidian (see Figure 8.39 for sites in the Valley of Oaxaca).

as (and likely prior to) the Formative period (Feinman et al. 2022). During the Classic period, when we have the largest sample from sites in Oaxaca, obsidian from a range of sources entered the Valley of Oaxaca along different routes; Pachuca obsidian from Central Mexico entered through the northern arm of the valley, Zaragoza obsidian from Puebla through the eastern arm, and Ucareo obsidian from Michoacan in West Mexico from the south (Figure 8.39; Feinman et al. 2018c; Nicholas et al. 2022). Overall, we identified obsidian from eight different sources in the Ejutla assemblage, so that occupants of this household were linked to a number of different economic networks.

Obsidian from West Mexican sources generally was never as abundant in the Valley of Oaxaca as the Central Mexican or Gulf Coast sources were, yet during the Late Classic period, more than a quarter (28%) of the obsidian at Ejutla was from the Ucareo source in Michoacan, even though Ejutla is more distant from Ucareo (as the crow flies) than are the northern or central parts of the valley, where Ucareo obsidian was much less common (Table 8.11) (Feinman et al. 2018c; Nicholas et al. 2022). The high percentages of Ucareo obsidian associated with Late Classic contexts (Río Viejo, Lower Río Verde) on the southern coast of Oaxaca and in the Mixteca Alta to the west of the Valley of Oaxaca provide evidence of a

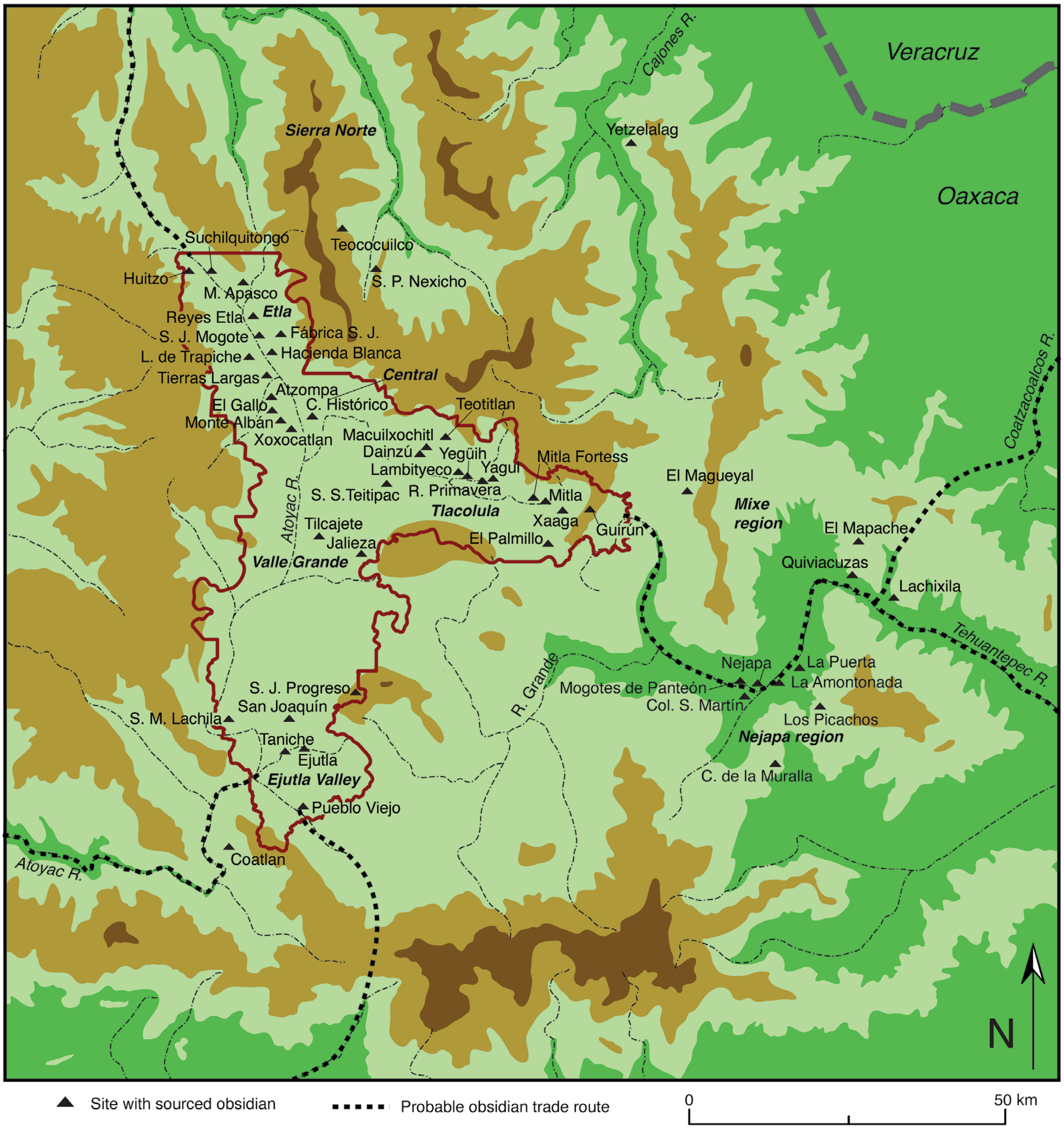

Figure 8.39. Map of highland Oaxaca showing sites with sourced obsidian and the three principal routes into the valley from the north, east, and south.

Table 8.11. Sourced obsidian* at Late Classic period sites in Oaxaca.

Site	Zone	# pieces	# sources	ZP	GP	PV	MH	PP	SH	TH	PH	ZH	OM	UM	CG	IG	SMJ	Unknown
Cerro de las Minas	Mixteca Alta	21	5	10%	14%	–	–	–	24%	–	–	–	19%	33%	–	–	–	–
El Mapache	Mixe	32	4	72%	–	19%	–	–	3%	–	–	–	–	6%	–	–	–	–
Lachixila	Mixe	185	5	90%	–	3%	–	1%	–	–	–	–	1%	5%	–	–	–	–
Quiavicuzas	Mixe	6	2	67%	–	33%	–	–	–	–	–	–	–	–	–	–	–	–
Atzompa	Valley—Central	515	9	66%	7%	3%	–	1%	11%	<1%	–	1%	2%	10%	–	–	–	1%
Ej-Ej-Sj-6	Valley—Ejutla	2	2	50%	–	–	–	–	–	–	–	–	–	50%	–	–	–	–
Ejutla	Valley—Ejutla	1842	8	52%	2%	1%	–	2%	8%	–	–	1%	5%	28%	–	–	–	–
El Gallo (Monte Albán)	Valley—Central	47	6	19%	60%	2%	–	2%	9%	–	–	–	–	6%	–	–	–	2%
El Palmillo	Valley—Tlacolula	1949	11	78%	–	2%	<1%	<1%	8%	<1%		1%	6%	4%	<1%	<1%	–	<1%
Jalieza	Valley—Valle Grande	102	9	75%	2%	1%	–	1%	13%	1%	–	2%	2%	3%	–	–	–	–
Lambityeco	Valley—Tlacolula	1183	9	75%	1%	–	<1%	<1%	9%	<1%	–	<1%	7%	7%	–	–	–	<1%
Loma de Trapiche	Valley—Etla	4	3	50%	–	–	–	25%	25%	–	–	–	–	–	–	–	–	–
Tilcajete (Los Mogotes)	Valley—Valle Grande	60	5	8%	15%	2%	–	–	67%	–	–	–	8%	–	–	–	–	–
Macuilxochitl	Valley—Tlacolula	1008	11	75%	1%	4%	–	2%	9%	<1%	<1%	<1%	6%	3%	<1%	–	–	<1%
Mitla Fortress	Valley—Tlacolula	225	7	68%	–	<1%	–	–	27%	–	–	<1%	2%	2%	<1%	–	–	–
Monte Albán	Valley—Central	3514	12	46%	3%	<1%	–	4%	25%	<1%	–	<1%	4%	17%	<1%	<1%	<1%	<1%
Oc-Sjp-Sjp-129	Valley—Ejutla	15	2	73%	–	–	–	–	–	–	–	–	–	27%	–	–	–	–
Reyes Etla	Valley—Etla	1	1	–	–	–	–	–	100%	–	–	–	–	–	–	–	–	–
Fábrica San José	Valley—Etla	38	7	8%	3%	3%	–	29%	40%	–	–	–	16%	3%	–	–	–	–
Xoxocotlán (4 Mogotes)	Valley—Valle Grande	30	5	47%	–	20%	–	3%	27%	–	–	–	–	3%	–	–	–	–
Nejapa Viejo	Nejapa	1	1	100%	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Lower Río Verde	Lowland Oaxaca	11	5	–	9%	18%	–	–	9%	–	–	–	9%	55%	–	–	–	–
Río Viejo	Lowland Oaxaca	37	4	8%	–	–	–	–	27%	–	–	–	3%	62%	–	–	–	–
San Francisco de Arriba	Lowland Oaxaca	1	1	–	–	–	100%	–	–	–	–	–	–	–	–	–	–	–

*ZP = Zaragoza, GP = Guadalupe Victoria, PV = Pico de Orizaba, MH = Malpaís, PP = Paredón, SH = Sierra de Pachuca, TH = Tulancingo, PH = Tepalzingo, ZH = Zacualtipan, OM = Otumba, UM = Ucareo, CG = El Chayal, IG = Ixtepeque, SMJ = San Martín Jilotepeque route from West Mexico to the Pacific Coast of Oaxaca. Geospatial modeling has predicted the presence of a high-traffic route from the coast to the Mixtec highlands (White and Barber 2012, 2692). Sea trade along the Pacific Coast from West Mexico to Oaxaca as early as the Late Classic also brought a variety of goods to Huatulco, a major port for long-distance trade on the coast south of the central valleys (Ball and Brockington 1978, 112). Whether the West Mexican obsidian arrived on the coast by land or by sea, it most likely entered the Central Valleys of Oaxaca via Miahuatlán, a port of trade at the southern end of the valley system that participated in the Mixteca-to-coast trade network (Ball and Brockington 1978).

Based on geospatial modeling, high-traffic movement into the Valley of Oaxaca is predicted, with these routes converging at Monte Albán (White and Barber 2012, 2694). In spite of Oaxaca's mountainous topography, an abundance of materials from more distant parts of Mesoamerica were brought to Monte Albán and neighboring settlements in the Valley of Oaxaca, including marine shell from the Pacific Coast and obsidian from many sources (Nicholas et al. 2022). The shortest routes to Monte Albán from the coast were from the south (White and Barber 2012, 2686–87), in the direction of Ejutla. Purely in terms of travel time, the least costly routes were through the Ejutla or Sola Valleys, with one of the expected most highly trafficked routes passing through Ejutla (Figure 8.40).

Colonial-era ethnohistoric records from Oaxaca provide independent corroboration that the high-traffic corridors generated by the modeling do approximate the location of routes used during the prehispanic and colonial era for movement and exchange. The modeling also aligns with other archaeological evidence that the highest-traffic route between Monte Albán and the Pacific Coast passed through the Ejutla and Miahuatlán Valleys (Ball and Brockington 1978). Routes through Sola were more arduous (e.g., Bevan 1934). It is likely that West Mexican obsidian and Pacific Coast shell entered the Central Valleys of Oaxaca through Miahuatlán and then were traded north to Ejutla and eventually Monte Albán and elsewhere in the Valley of Oaxaca. Although the proportion of Ucareo obsidian in the assemblage at Monte Albán is much lower than at Ejutla, the city is the only other site in our sample from the valley with any significant amount of Ucareo obsidian (Feinman et al. 2018c; Nicholas et al. 2022), and as we have seen, Monte Albán obtained significant quantities of Pacific Coast shell. The other known prehispanic shell-working site in highland Oaxaca is Miahuatlán, which is along the predicted route to the coast and also has lots of obsidian (unfortunately unsourced), some of which was recovered mixed with shell fragments and debris (Brockington 1973; Markman 1981).

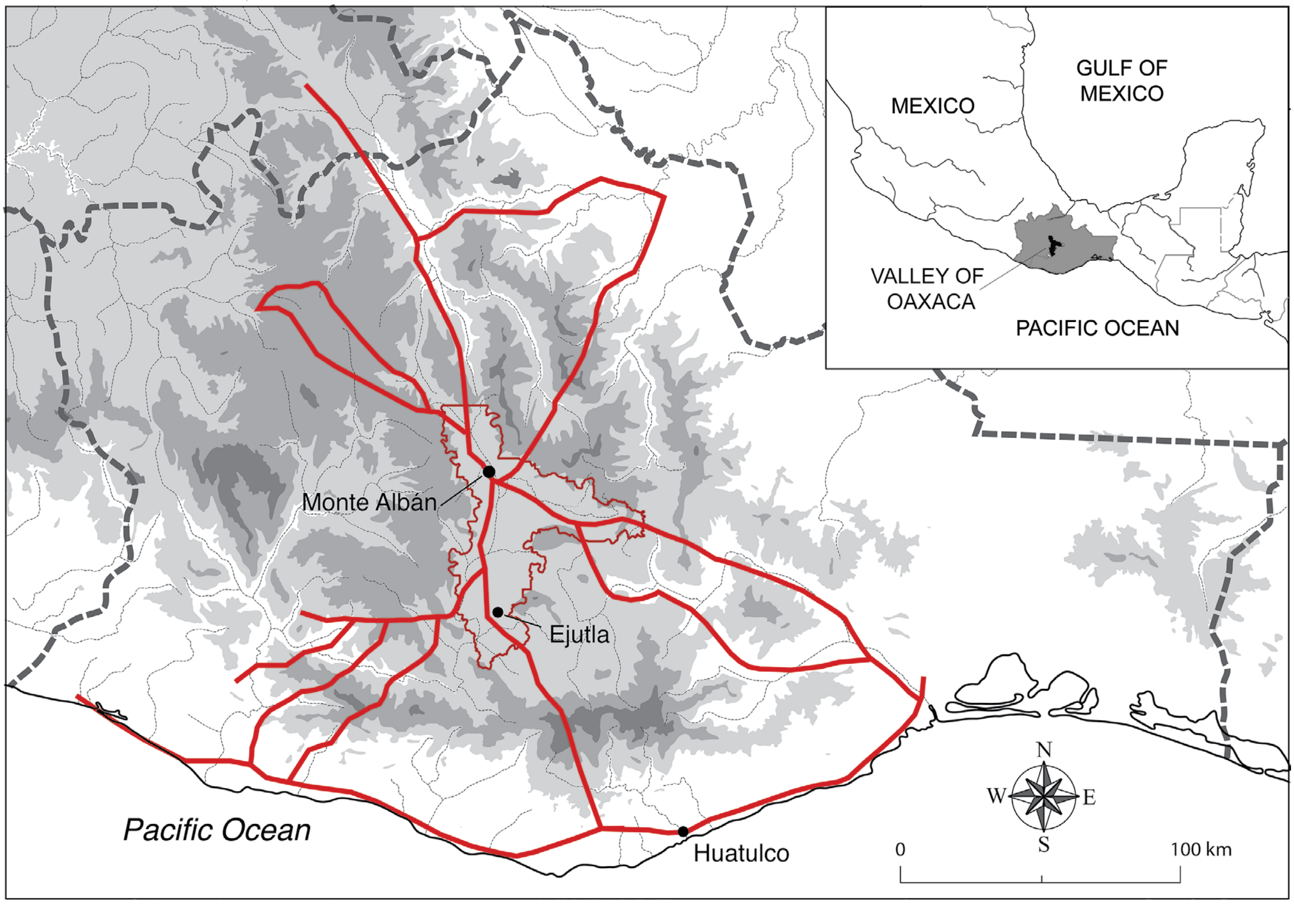

Figure 8.40. Map of Oaxaca showing high-traffic routes (routes from White and Barber 2012, figure 11), including route to Monte Albán from the Pacific Coast that passes through Ejutla.

Borah (1954, 25–28) used colonial records to sketch a similar route from Huatulco (on the Pacific Coast) through the Miahuatlán and Ejutla Valleys into the center of the valley during the 1500s (Figure 8.41). According to Borah (1954, 25), "[t]he additional road from Huatulco to Miahuatlán and Oaxaca City … probably followed one of the more important trails by which the Zapotecs found their way to the Pacific coast." Drawing on archaeological evidence, Ball and Brockington (1978) proposed that this route was in existence by the Late Classic period. That two of the only documented shell-working sites in the Central Valleys of Oaxaca are located in Miahuatlán and Ejutla attests to the importance of this route for bringing marine shells into the Valley of Oaxaca, and possibly beyond. Ejutla has a long history as an important commercial location, serving as a transit center for coastal and other agricultural products entering the valley system (Barrera 1946, 85–86; Beals 1975, 128). Into the twentieth century, the Ejutla market—one of eight major markets in the valley system (Beals 1975, 47; Diskin 1976, 51; Malinowski and de la Fuente 1982, 70)—had the highest percentage of vendors who served as middlemen, buying local produce in bulk to sell or bringing in goods from distant places (Diskin 1976, 59–60), practices indicative of the region's position as a gateway between the highland valleys and the mountains and coast to the south (Feinman and Nicholas 2013, 19; Malinowski and de la Fuente 1982, 84).

Historically, the Valley of Oaxaca was a center of trade routes connecting Central Mexico (to the north) and the Isthmus and beyond (to the south) (Malinowski and de la Fuente 1982, 70). The sixteenth-century route from Central Mexico to Oaxaca—probably along part of a main Aztec route—and then to the Pacific Coast passed through a series of valleys and basins, including the Central Valleys of Oaxaca, that, while longer, was much easier to navigate than the broken, mountainous terrain between Central Mexico and the Pacific Coast near Acapulco (Borah 1954, 25, 28). Another attraction for this route from Central Mexico was productive activities and natural resources in the Central Valleys of Oaxaca (Borah 1954, 25). Which brings us to mica.

One raw material that was imported to Teotihuacan from Oaxaca is mica. There are multiple sources of mica in the Central Valleys of Oaxaca that are distributed from the northern arm of the valley south to Ejutla and Miahuatlán. Large quantities of mica have been recovered from Monte Albán, especially on the North Platform (Rosales de la Rosa 2021, 241; Winter et al. 2002, 632–33). Although

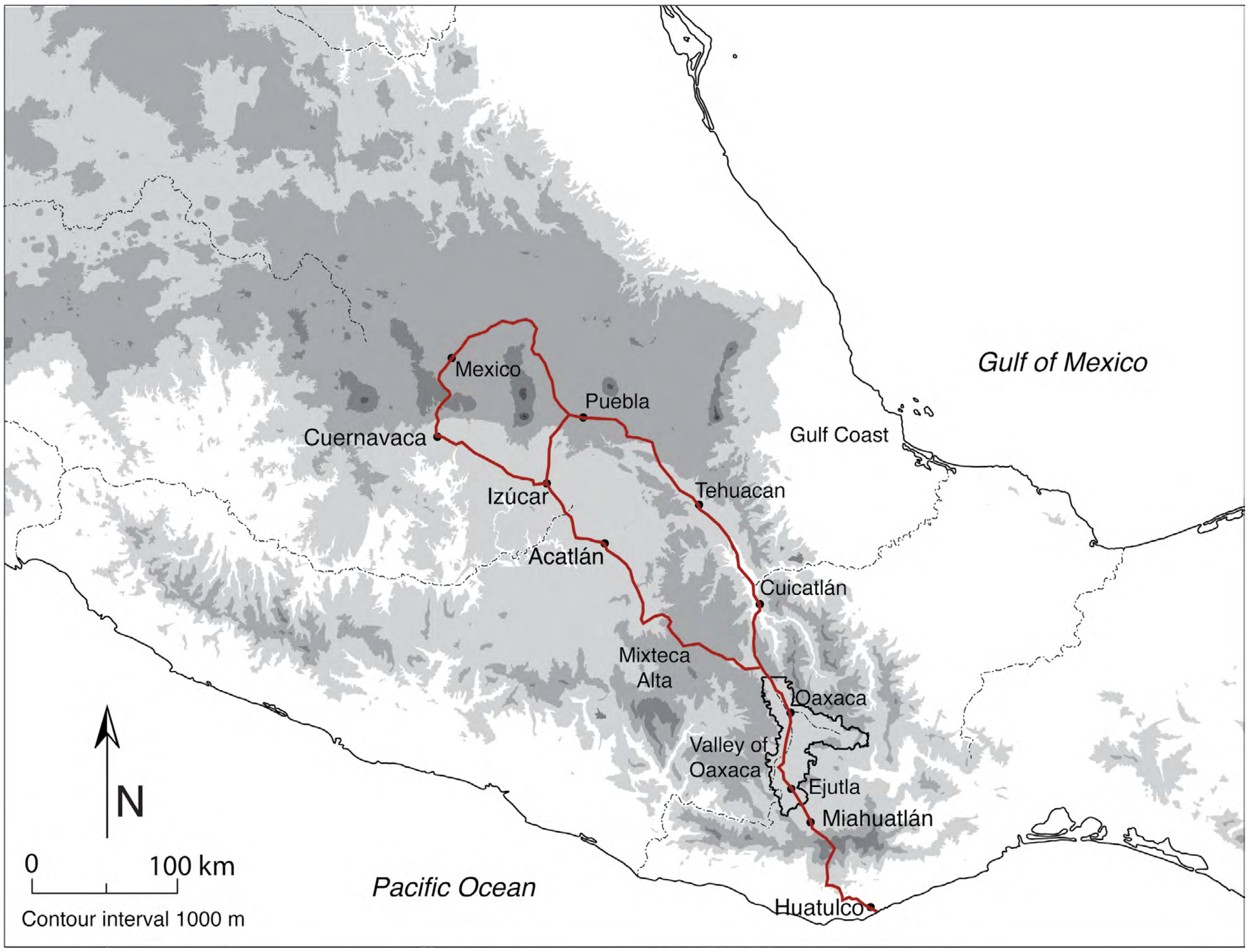

Figure 8.41. Map of colonial route from the Pacific Coast to Central Mexico (route from Borah 1954, 27) that passes through Miahuatlán, Ejutla, and the center of the Valley of Oaxaca.

there are no mica sources near Teotihuacan, mica has also been recovered from multiple residential compounds at that city, but especially dense concentrations were uncovered at the Xalla palace, where it was crafted into lapidary objects (Manzanilla 2017; Manzanilla et al. 2017; Rosales de la Rosa 2019, 2021). To determine the source of the mica, Linda Manzanilla and her team (Manzanilla et al. 2017, 2019) used neutron activation to analyze 18 archaeological samples, mostly from Teotihuacan and the North Platform at Monte Albán, and 9 mines, all from Oaxaca, including 2 from near Monte Albán and 4 from Ejutla. The composition of all of the archaeological pieces from both Teotihuacan and Monte Albán matched the samples from several mines in Ejutla (Figure 8.42). Although the analytical sample is small and more testing is needed, none of the archaeological mica came from the other mines in Oaxaca, including those near Monte Albán. And one sheet of cut mica from Teotihuacan (Manzanilla et al. 2017, figure 7) closely resembles one of the pieces of mica in the pit in the floor of the excavated house in Ejutla (see chapter 9). Although no archaeological pieces from the Ejutla site were analyzed in this study, the majority of pieces from the excavations were biotite mica, likely from the same mine (M11) that was included in the neutron activation analysis (Manzanilla et al. 2017, 25). A plausible scenario is that the mica was exchanged through networks that brought it from Ejutla to Monte Albán and then on to Teotihuacan, along with other goods, such as Pacific Coast shell.

With mica from mines in Ejutla documented on the North Platform of Monte Albán, and West Mexican obsidian likely reaching Monte Albán along similar networks that passed through Ejutla, it seems likely that at least some Pacific Coast shell, worked and unworked, also reached Monte Albán through Ejutla. Ejutla is located on several principal trade routes along which Pacific Coast shell and other coastal goods moved into the highlands. Whether shell from Ejutla might have been minimally processed, blanks, or finished ornaments is unknown, but there is nothing about the shell assemblage at Monte Albán, either the kinds of ornaments or how they were made, that precludes those possibilities. Of course, obsidian from other sources reached Monte Albán through different networks, as did shell from the Atlantic, and we have never suggested that all shell at Monte Albán came from Ejutla (contra Melgar Tísoc et al. 2010, 2018), only that we cannot rule out that Monte Albán obtained some shell from Ejutla (see Feinman and Nicholas 1995c, 2000).

During the Classic period, there was a considerable volume of coastal-to-highland marine shell exchange (e.g., Kolb 1987). Worked shell was abundant in the 'Oaxaca barrio' at Teotihuacan (Millon 1981, 227; Starbuck 1975, 150), where the predominant species was *Chama echinata*, a key species at both Ejutla and Monte Albán that apparently was less abundant elsewhere at Teotihuacan (Starbuck 1975, 150–51). Since mica from mines in Ejutla made its way to Monte Albán and then Teotihuacan, it also is not a stretch that some Pacific Coast shell also reached the Central Mexican metropolis along the same route. As Borah (1954) noted, the route from the coast through Ejutla and the Central Valleys of Oaxaca on to Teotihuacan was the easiest, if not the shortest, route from the Pacific Coast to Central Mexico (see also Carballo 2013).

Given the preponderance of evidence for domestic production in Oaxaca (e.g., Feinman 1999; Feinman and Nicholas 2000, 2004a, 2012), production and distribution could not have been easily controlled by central authorities, and producers and consumers likely engaged in other mechanisms of transfer, like marketplace exchange (see chapter 6; e.g., Feinman and Nicholas 2010, 2012; contra

Figure 8.42. A mica mine in Ejutla.

Melgar Tísoc et al. 2010, 2018). Markets appear to have been established early in the history of Monte Albán (Feinman et al. 1984; Nicholas and Feinman 2022), with goods arriving in the city from near and far (Nicholas et al. 2022). As illustrated, one of the least-cost routes to Monte Albán and the center of the valley from the Pacific Coast was through Ejutla. The Ejutla shell workers were among the only craft specialists in the valley who engaged in the high-intensity crafting of shell ornaments (bulk luxuries) for exchange, so it is likely that at least some Pacific Coast shell that passed through or was worked into ornaments in Ejutla reached Monte Albán along with mica from the Ejutla district and Ucareo obsidian that arrived in the Central Valleys of Oaxaca from the south along with Pacific Coast shell. The mica, and possibly some Pacific Coast shells, eventually could have reached Teotihuacan in Central Mexico. Specialized production in a domestic context was linked into exchange and transfer networks that traversed the western half of the prehispanic Mesoamerican world (Blanton and Feinman 1984).

9

Lapidary, Bone, and Tools of Production

Shell working and ceramic production were the principal, but not the only, craftwork activities of the Ejutla household. They were not even the only kinds of specialized economic production, as lapidary work also appears to have been carried out for exchange. Although the members of the excavated household produced shell ornaments and certain ceramic products at fairly high levels of intensity for exchange beyond their immediate household or community, they made lapidary items seemingly at lower frequency and intensity. Dog teeth, and some bone, were also modified, possibly for inclusion in neckwear with beads of shell. In addition, they made bone tools, spun fiber, and wove cloth. But these latter production activities were likely mostly or entirely for the consumption of this household.

In this chapter, we focus on these other secondary crafts and practices along with the tools of production. We start with the evidence for lapidary craftwork and the evidence of cross-craft technology (Shimada 1996, 2007). Specifically, we discuss hollow tubular cane drills that were used to shape both shell and stone materials. We follow with a consideration of the worked bone, including ornaments as well as tools that have been employed for weaving (Feinman et al. 2018b). We close the chapter with a discussion of the stone tools that the Ejutla artisans made to work the shell and lapidary materials. Some of these tools are discussed and depicted in chapter 5, as their use cannot be tied solely to craftwork, and they were likely used for other domestic tasks as well, including agricultural activities. Here we focus on their use for working lapidary stone and shell. Other tools are mentioned in section 8.4 in conjunction with shell-working techniques. In section 9.3 we provide additional information on the tools themselves.

9.1. Lapidary Craftwork

Among recovered artifacts in the middens and the house are numerous stone ornaments, unfinished lapidary objects, small carved stones, and semiprecious raw materials and production debris, including flakes of greenstone, mica, and large quartz crystals (Table 9.1). One of the most abundant lapidary objects are cylindrical drill cores or plugs. Most of these small cylinders are onyx, although a few are limestone or unidentified stone (Figure 9.1). The drill cores are generally between 1 and 3 cm long, with diameters of 10–12 mm. They were cut with a hollow tubular drill (Foshag 1957, 54–55; Holmes 1919, 350–51; Rau 1869, 393) made from cane, applying the same tools and technology that was used to obtain shell disks. The diameters of the drill plugs match those of the shell disks that were cut with tubular drills (Figure 9.2). Some plugs still have the characteristic lip at their base, while the base of others is rough and unsmoothed. The tops of several drill cores bear tubular cut marks showing where a prior level of drill cores had been removed; others have one concave side showing where an adjacent plug had previously been removed. None of the drill plugs were worked into ornaments but instead are the remnants from using tubular cane drills to hollow out stone blocks into rounded bowls (e.g., Diehl 1983, 101–02). There are no complete (or even partially complete) finished stone bowls in the assemblage of any size, only eight very small fragments that most likely represent failed attempts. Most of them were cut from the same material as the recovered drill plugs. One tiny piece of onyx microdebitage was recovered from the house floor, tying the working of onyx to the Ejutla household (Feinman et al. 1993, 38; Middleton 1998, 213–14). This use of ‘intersecting technologies’ (Earle 1994, 455; Hagstrum 1992) to produce very different items further supports the inference that this Ejutla household was involved in several craft activities, or ‘multicrafting.’

Most of the drill plugs were found in the dense midden or near the house, but 10 were collected from the surface in the area south of the excavated house, in the same area where there was dense shell debris and other possible houses. We suspect multicrafting was practiced by many households in this part of the Ejutla site, but the proportion of their time devoted to different crafts and the levels of intensity at which they worked likely varied from the house we excavated.

Other objects of onyx include flat, mostly rectangular plaques, flakes, and chunks of unworked material (Figure 9.3). Several plaques have at least one nicely cut edge, but only one of them appears to have been finished into an ornament. This ornament has a trapezoidal form, with all four edges smoothly abraded. One top corner is broken; the other corner has a small carved notch on the top and another longer one on the side just below the top, possibly to hold string for suspension. The possible pendant is approximately 4 cm long. The nearly complete scarcity of other onyx ornaments compared to debris is similar to the pattern for shell, with much more debris than finished or partly finished artifacts, indicating these ornaments also may have been made for exchange and thereby had been transferred from this context.

Semiprecious stones in the Ejutla assemblage include beads and larger unworked chunks of greenstone and other nonlocal material (Figure 9.4). Most of the beads