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