19. Obsidian Blade Manufacturing Debris on Terrace 37

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During the investigations at Chalcatzingo an extremely dense concentration of obsidian debris was noted on the surface of T-37. The apparent size of this concentration suggested that it was not just an ordinary trash deposit. An accumulation of blade manufacturing debris seemed an obvious possibility, and in the hope of verifying this the area was examined in detail.

DESCRIPTION OF THE CONCENTRATION

Excavation indicated that the surface manifestations were part of a remarkably dense deposit of obsidian flakes and blade fragments in a minimal soil matrix. A small quantity of sherds and other artifactual debris occurred mixed with the lithic material and provided a basis for dating the deposit to the Late Cantera subphase (Ann Cyphers, personal communication). Several features of apparent late Middle Formative age were recorded in the immediate vicinity of the obsidian concentration and presumably represent roughly contemporary activity in the area. Unfortunately, no direct connection could be established between the concentration and the features, which included two burials and a possible activity area evidenced by a line of three postholes cut into bedrock.

The obsidian concentration was excavated in 1 m × 1 m × 10 cm grid units (Fig. 19.1). Arbitrary levels were used since no useful natural or cultural strata were observable. The natural soil stratigraphy on the terrace generally involved only two zones, a loose plow zone and a grey-brown friable subsoil (Fig. 19.1). The highly disturbed plow zone was shoveled off without screening for artifacts. The remainder of the excavation was largely carried out with trowels and ice picks, at some hazard to the workers, who suffered many cuts and nicks from the abundant and very sharp obsidian.

The bulk of the concentration was recovered by screening through ¼″ screen. However, the overwhelming quantity of obsidian in the first screen loads made it obvious that complete recovery would be unreasonably time-consuming. As a result, only pieces approximately 1 × 2 cm or larger were saved. Even without the small pieces discarded from the screen and the material from the plow zone, the concentration still yielded over 28,000 individual obsidian pieces weighing about 51.4 kg altogether. The total area of the obsidian deposit below the plow zone was roughly 2 m^3; therefore there were approximately 25 kg of obsidian per m^3.

The concentration covered a horizontal area of about 2 × 3 m and extended from the ground surface to bedrock, a distance of approximately 40 cm (Fig. 19.1). The upper 10 cm level had been extensively disturbed by plowing and thus was spread out somewhat, but the main body of the deposit seemed to have fairly sharply defined boundaries. There was generally an abrupt shift from the obsidian deposit area to the surrounding normal situation for the terrace (i.e., soil with a light intermixing of artifactual debris including some obsidian). No change in the composition or color of the soil itself seemed to occur at the concentration boundary; the minimal soil matrix within the concentration appeared to be just like the surrounding terrace soil.

In addition to the small quantity of other artifactual remains mixed with the obsidian, a few fragments of human bone were recovered from the densest part of the concentration. Tentatively designated a burial (no. 138), this scatter consisted of skull fragments plus a second cluster of fragments including two poorly preserved long bones, possibly femurs. Obsidian was tightly packed around most of the bones, both above and below, making excavation extremely difficult. The possible femurs, which were resting side by side in a parallel alignment, occurred just at the southern edge of the obsidian concentration and extended beyond it into an unexcavated unit to the south.

It was not possible to obtain a clear picture of the depositional relationship between Burial 138 and the obsidian concentration; the bone was far too fragmentary and eroded. The only bones giving any suggestion of an articulated position were the probable femurs which occurred just at the edge of the concentration. This suggests that the burial may pre-date the obsidian and that the two may have become mixed during deposition of the lithic debris.

The overall evidence indicated that the obsidian concentration was a trash pile deliberately deposited on that spot by human agents. The configuration of the entire deposit, with its long axis perpendicular rather than parallel to the terrace slope, eliminated the possibility of wash from higher terraces. Furthermore, the extreme density and compactness of the concentration made it obvious that if the material was manufacturing waste, it certainly was not a primary deposit on a workshop floor. No indications that the obsidian filled a pre-existing pit were noted during the excavations, so it was presumed that the material was originally piled on the terrace surface. Subsequent deposition then raised the soil level until the trash pile was almost covered.

It seemed possible that evidence of a blade manufacturing workshop might be located nearby since there is no obvious reason for the waste to have been moved a great distance from its source. However, although test pits were excavated elsewhere on T-37 and on the terrace immediately above and to the south, no evidence of such an area was located.

COMPOSITION OF THE DEPOSIT

By an analysis of the items which made up the deposit, it should be possible to test our assumption that the concentration was trash from blade manufacturing activities. The types of debris to be expected from such activities can be outlined using Don Crabtree's (1968) detailed technological reconstruction of Mesoamerican obsidian blade production.

1. *Percussion flakes from core preforming.* Core preforming should produce a body of percussion flakes of various shapes and sizes. Since Chalcatzingo is not located at an obsidian source, the raw material for blade manufacture must have been transported into the site. Research at obsidian quarry sites (e.g., Holmes 1900; Graham and Heizer 1968; Spence and Parsons 1972; Sheets 1975) indicates that a substantial amount of core preforming, producing both biface blanks and "macrocores" (Hester 1972), was generally carried out prior to transportation. However, final shaping to produce such refinements as the desired overall core form, suitable core platform surface, and straight corner ridges presumably would have taken place at Chalcatzingo.

2. *Crested blades* (or *lames à crête*). These waste blades are the result of a particular pattern of core preforming. According to Crabtree, "an unconditional requisite of preforming polyhedral cores is to first establish corners (ridges) on the preformed core. Without these ridges there can be no polyhedral shaped and no prismatic blades, for they are used to remove and guide the blades, and they are the inception of the 'faceted' shape of this core. If the percussion preforming has left these corners (or ridges) uneven, or not straight, they must be straightened by careful retouch" (Crabtree 1968:460). One means of straightening these corners involves "removing a series of alternate short flakes along the vertical length of the material" (ibid.: 455). These prepared ridges will direct the first blades removed from the core, and the result will be the "crested blade" (Crabtree 1972:72) easily identified on the basis of the bidirectional flake scars on either side of the dorsal ridge.

3. *Waste blades.* Ideally, once the core is correctly preformed, blade production should generate little waste. However, as they are pressed off, the blades leave the core at considerable velocity, and accidental breakage and dulling were probably a continuing problem. Waste blades might also be produced by misjudging the angle and/or intensity of pressure applied in removing them from the core. Blades judged to be too thick or too short as well as blades ending in a hinge fracture or carrying away the entire distal end of the core might also contribute to the accumulation of waste blades in a workshop.

4. *Core recovery flakes.* During blade production, internal faults in the raw material and/or errors on the part of the maker may damage the core and interfere with the continued production of prismatic blades. In some cases careful trimming may correct problems of this type and allow for a fuller utilization of the damaged core (Crabtree 1968:466–467). Flakes produced during core rejuvenation of this sort would characteristically show remains of parallel blade scars on their dorsal side, edges, and/or flake platform.

5. *Core platform rejuvenation flakes.* During the actual analysis of the Chalcatzingo materials, core platform rejuvenation flakes were found to be both easily identifiable and relatively abundant, and as a result were tabulated separately from the bulk of more generalized core recovery flakes. Specifically, core platform rejuvenation flakes are flakes removed from the proximal or platform end of a blade core by a blow transverse to the core's long axis. Remnants of parallel blade scars occur around the edges of such flakes and are the characteristic feature which makes them so readily identifiable.

The attempt to rework the platform of a blade core by transverse flaking of this sort is suggested as a response to several possible situations. It might be used to correct the damage caused by crushing the platform edge during blade removal or to improve the configuration of the platform surface for better seating of the pressure tool. It might also be used on nearly exhausted cores to remove the proximal end which will have become severely constricted as a normal result of blade production. The slightly thicker bulbs of force at the tops of the blades will result in the top of the core constricting more rapidly than the lower portions (Crabtree 1968:457, 463, 467).

Crabtree indicates that the most efficient or ideal method of platform rejuvenation would involve the removal of the entire core platform with a single blow. Flakes of this sort are generally referred to as "core tablets" (e.g., Hester, Jack, and Heizer 1971; Sanger 1968; Movius et al. 1968). Although there are complete "core tablets" in the Chalcatzingo collection, there are also many other flakes removed transverse to the long axis of cores which did not carry away the entire platform. Many were probably produced subsequent to initial tablet removal to improve the configuration of the new platform. Both complete core tablets and these other transverse flakes from the proximal ends of cores are included in the category "core platform rejuvenation flakes."

6. *Exhausted cores.* Exhausted cores and fragments of cores are a probable component of workshop debris. However, exhausted cores are known to have been utilized as tools in a number of Mesoamerican contexts (see Hester 1973), and so their presence in large numbers cannot be regarded as an absolute requirement for a workshop deposit.

7. *Small trimming flakes.* A quantity of small pressure flakes should be produced while keeping the blade core in trim for continuing blade removal. This category of manufacturing debris is mentioned here as a final logical possibility. If such flakes were present in the T-37 obsidian concentration, most were probably too small to have been recovered by the screening procedures used during excavation.

Two technical steps which are sources of small pressure flakes are mentioned by Crabtree (1968:462–465). First, after the removal of each series of blades around the core, it is necessary to trim off the small lip or overhang left around the top edge of the core by the bulbs of pressure. Secondly, small flakes may be produced in preparing the blade platforms. A secure seat for the pressure tool used in blade production can be provided by removing a small flake at the edge of the core platform at right angles to the long axis of the core. Platforms may also be prepared by scoring or grinding.

Having outlined categories of debris which would be the logical products of a workshop, it is possible to evaluate the question of whether or not the T-37 concentration is in fact a deposit of blade manufacturing. For analytical purposes the deposit was divided into four quads (see Fig. 19.1). The actual composition of each of these units is presented in Table 19.1.

The analytical categories used in this

table do not precisely duplicate those just outlined and so require some further explanation. Complete blades, proximal blade fragments, distal blade fragments, and blade midsections are all self-explanatory categories of prismatic blades. The category "waste blades" discussed above, although a logical component of blade production debris, was not usable in an analytical context. Unless obviously malformed, waste blades and their fragments are likely to be very much like the remains of blades which have been used as tools and discarded. Breakage, dulling, and battering which occur after deposition as a result of natural erosional actions and later human activities should serve to strengthen the similarities between waste blades and blades discarded after use. Flakes and flake fragments serve as residual categories for all other flakes not included in the specialized categories, core recovery flakes and core platform rejuvenation flakes. Specifically, the category designated as "flakes" includes whole flakes and flake fragments with striking platform present. "Flake fragments" are portions of flakes which lack the striking platform area. "Chunks" is a residual category for blocky bits of debris which do not belong in any of the recognizable categories.

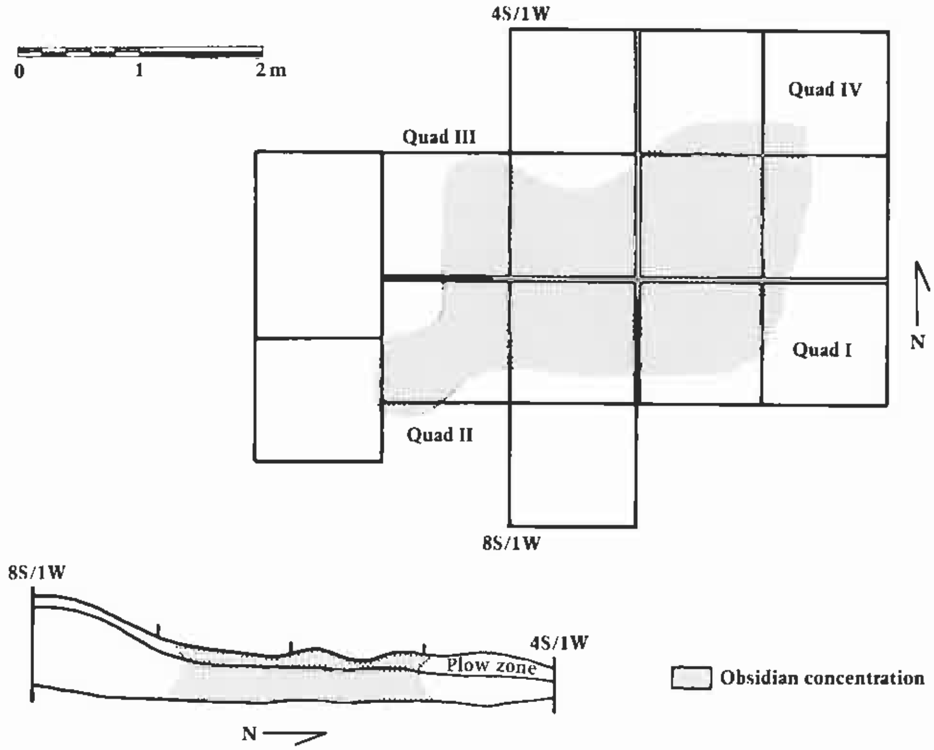

Figure 19.1. T-37 excavation units showing plan and profile of obsidian concentration (shaded).

Turning to Table 19.1, it is evident that slightly more than 25 percent of the lithic material in the concentration falls into the categories which are definitely recognizable as workshop debris. Specifically, crested blades make up 0.6 percent of the deposit, core platform rejuvenation flakes make up 11.5 percent, and core recovery flakes make up 14.4 percent. Blade cores and fragments, however, are rare, accounting for less than 0.1 percent of the material.

When the frequency of these workshop identifiers in the T-37 concentration is compared with their frequency in the analyzed lithic sample from other areas of Chalcatzingo (see Chapter 18), the differences are clearly significant (Table 19.2). Comparing crested blades, core platform rejuvenation flakes, and core recovery flakes with all other obsidian flakes and blades, the workshop identifiers make up 27 percent of the obsidian concentration collection and only 7 percent of the collection from other areas of the site. This evidence strongly supports the identification of the concentration as a specialized deposit associated with blade manufacturing activities. On an associational basis, it can be assumed that most of the concentration debris classified in the more generalized flakes and blade categories was also a product of workshop activities.

It is interesting that polyhedral blade cores and core fragments make up only a tiny portion of the T-37 concentration. In fact, when compared with the rest of the analyzed Chalcatzingo lithic sample, it is obvious that cores are significantly more frequent in other areas of the site (Table 19.3). Comparing cores and core fragments with all obsidian blades, cores can be seen to be eight times more frequent in the lithic sample from other areas. Specifically, they make up 0.09 percent of the core/blade assemblage from the T-37 concentration and 0.79 percent of the same assemblage from other areas.

The evidence thus suggests that cores were disposed of in some special manner and did not remain with the general manufacturing trash. Discarded blade cores and/or fragments are found in small numbers in all areas of Chalcatzingo. In addition, cores which have been utilized and in some cases reshaped as tools are also known from various parts of the site. Their economic value as tools may, in fact, explain the separation of exhausted cores from workshop debris.

TECHNOLOGICAL DISCUSSION

This large accumulation of manufacturing debris supplies a variety of interesting insights into the blade manufacturing procedures used during the Cantera phase at Chalcatzingo. The absence of large, rough trimming flakes in the concentration and elsewhere on the site and the general lack of cortex on the flake debris indicate that obsidian entered the site as partially prepared core blanks rather than as nodules or large irregular chunks. The fact that the majority of exhausted cores have a half-cylindrical shape with one flat, unworked side suggests that the core blanks may have had a tabular form.

There are really no very clear indications of the original size of these blanks. All the known cores from the T-37 concentration and elsewhere are exhausted specimens. The dimensions of the three complete specimens from T-37 are generally typical: (1) 63 mm long × 23 mm wide with a platform circumference of

Table 19.1. **All Lithic Materials Recovered from T-37 Obsidian Concentration**

	Obsidian Cores and Debitage										
Provenience	*Complete Blades*	*Proximal Blade Frags.*	*Distal Blade Frags.*	*Blade Midsections*	*Crested Blades*	*Flakes*	*Flake Frags.*	*Core Platform Rejuv. Flakes*	*Core Recovery Flakes*	*Complete Blade Cores & Frags.*	*Chunks*
Quad I											
10–20 cm	3	276	159	352	4	156	191	181	186	2	7
20–30 cm	5	717	364	930	28	447	442	390	394	0	14
30–40 cm	20	586	260	588	2	142	430	210	440	2	24
Quad II											
10–20 cm	1	381	222	515	9	191	228	218	225	0	15
20–30 cm	6	509	306	733	14	263	244	309	348	3	13
30–40 cm	1	315	205	294	13	132	139	191	279	4	19
40–50 cm	0	13	12	22	0	6	9	9	7	0	0
Quad III											
10–20 cm	4	704	501	895	26	316	336	445	653	0	31
20–30 cm	6	849	622	940	29	356	385	565	813	2	28
30–40 cm	1	36	31	50	0	24	17	28	37	0	1
Quad IV											
10–20 cm	4	401	238	465	14	186	240	356	278	0	13
20–30 cm	2	533	329	715	18	292	357	375	437	0	22
Subtotals	53	5,320	3,249	6,499	157	2,511	3,018	3,277	4,097	13	187
% of total collection	0.2	18.7	11.4	22.9	0.6	8.8	10.6	11.5	14.4	<0.1	0.7

	Chert Cores and Debitage				*Modified Pieces: Obsidian*		*Modified Pieces: Chert*	
Provenience	*Flakes*	*Flake Frags.*	*Blocky Flake Cores & Frags.*	*Chunks*	*Edge-Modified Pieces*	*Shaped Pieces*	*Edge-Modified Pieces*	*Shaped Pieces*
Quad I								
10–20 cm	4	3	0	0	2	0	0	0
20–30 cm	2	1	1	1	0	2	0	0
30–40 cm	0	5	0	0	0	1	0	0
Quad II								
10–20 cm	7	3	0	1	2	3	0	0
20–30 cm	0	4	2	5	2	2	0	0
30–40 cm	0	1	0	4	2	0	0	0
40–50 cm	1	0	0	0	3	1	1	0
Quad III								
10–20 cm	2	5	0	4	6	2	1	0
20–30 cm	7	4	0	2	6	5	0	0
30–40 cm	0	0	0	0	1	0	0	0
Quad IV								
10–20 cm	4	5	1	1	5	0	1	1
20–30 cm	3	4	2	1	4	3	0	0
Subtotals	30	35	6	19	33	19	3	1
% of total collection	0.1	0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1

Total obsidian cores and debitage	28,381 (99.5%)
Total chert cores and debitage	90 (0.3%)
Total modified pieces	56 (0.2%)
Grand total	28,527

Table 19.2. Comparison of Blade Workshop Identifiers in the T-37 Obsidian Concentration and in the Lithic Sample Analyzed from Other Areas of Chalcatzingo

Provenience	*Workshop Identifiers*[a]	*All Other Obsidian Blades and Flakes*	*Totals*
Obsidian Concentration	7,531	20,650	28,181
Other Areas	257	3,478	3,735
Totals	7,788	24,128	31,916
	$\chi^2 = 703.90$ $p < .001$		

[a]Crested blades, core platform rejuvenation flakes, and core recovery flakes.

Table 19.3. Comparison of Blade Core Frequency in the T-37 Obsidian Concentration and in the Lithic Sample Analyzed from Other Areas of Chalcatzingo

Provenience	*Polyhedral Blade Cores and Fragments*	*All Obsidian Blades*	*Totals*
Obsidian Concentration	13	15,121	15,134
Other Areas	20	2,513	2,533
Totals	33	17,634	17,667
	$\chi^2 = 57.62$ $p < .001$		

78 mm and a weight of 42 gm; (2) 67 × 16 mm with a 40 mm platform circumference and a weight of 19 gm; (3) 63 × 22 mm with a 62 mm platform circumference and a weight of 30 gm. Larger core sizes are indicated by platform circumferences of as much as 145 mm as evidenced by certain platform rejuvenation flakes which preserve the entire core tablet.

The presence of crested blades in the workshop debris indicates, as would be expected, that additional preforming of the cores took place after the core blanks reached Chalcatzingo. The general flake debris in the concentration is presumably at least partially a result of this activity also.

The abundance of general core recovery flakes and the specialized core platform rejuvenation flakes indicate that serious and presumably fairly extensive efforts were made to maximize the available raw material by reworking cores to improve their configuration after some blade removal had been accomplished. The platform rejuvenation flakes are of particular interest as evidence of this activity. Their frequency indicates that platform renewal was a standard procedure, while their size range (i.e., a significant proportion indicate larger platform areas than are typical of the known exhausted cores) suggests that such modification may have been effected more than once during the life of an individual core.

A second specialized type of core recovery flake was noted during analysis but because of the small size of the group was not tabulated separately. (Detailed attribute analysis would doubtless reveal other such subtypes.) This group consisted of relatively small flakes and short blades which had been pressed up from the distal end of the core in the direction opposite that of normal blade removal. Crabtree (1968:468) suggests just such a procedure as one means of correcting the problem created when a blade has hinged off rather than terminating properly: "This may be accomplished by creating a platform on the distal end of the core directly in line with the blade broken from the top of the core, though this is very difficult. When such a platform can be made, then the broken blade is pressed from the distal end of the core to intersect the hinge or step fracture and, if successful, the worker recovers the core and can continue in the original manner of blade removal."

Although not a major component of the workshop debris, the exhausted polyhedral blade cores are important technological indicators. The complete specimens and large fragments recovered from the T-37 concentration are typical of cores from the entire analyzed sample of Chalcatzingo lithics and as such will be described in some detail here. The dimensions of the three complete specimens have already been mentioned.

Three complete cores and five sizeable fragments were recovered from the obsidian concentration. Two raw material types were represented, a grey obsidian with dark banding (five specimens) and a grey obsidian with small, white, spherical inclusions (three specimens) (see Chapter 23 on obsidian source analysis). The majority of the specimens (five) had a half-cylindrical shape with one flat, unworked side. The three remaining specimens had had blades removed from their entire circumferences. Where present, the distal ends of all the cores were pointed.

Where it could be determined, the number of facets around the core circumference ranged from ten to thirteen, and maximum facet width ranged from 8 to 11 mm. Within this small sample, comparison of fully cylindrical and half-cylindrical cores did not indicate any differences in these ranges.

Only two specimens had intact core platforms; one was a single-facet surface and the other a multiple-facet surface. In both cases, the platform edges showed some crushing and other indications of final abortive attempts at blade removal. In the other three cases with proximal end intact, an attempt (apparently unsuccessful) had been made to rejuvenate the core. In each case, the old platform had been struck off by a single blow transverse to the core's longitudinal axis. The circumferences of the proximal ends of these five specimens ranged from 40 to 78 mm with a mean of 60.4 mm (SD = 14.975).

The exhausted cores in the concentration did share one characteristic not typical of cores from other proveniences—five of the eight specimens were fire-cracked. In fact, each of the three complete specimens was actually reconstructed from two or three fire-cracked fragments. This breakage had occurred after the cores were exhausted and platform rejuvenation, where present, had been attempted. This type of breakage was not observed elsewhere, and there is no clear explanation for its occurrence here. It may, however, explain the presence of these particular specimens in the workshop debris. As discussed previously, cores apparently did not normally remain with the workshop trash. The fire-cracked specimens were apparently broken in the workshop, either accidentally or as a result of some special usage, and then were swept up with the rest of the trash.

The blade fragments which make up the bulk of the obsidian concentration also provide certain technological information. As was indicated previously, the blades in the concentration do not generally seem to differ from the blade fragments found throughout the site. Again, an exhaustive attribute analysis might provide a basis for distinguishing between workshop waste and blades discarded after use, but at the present analytical level this was not possible.

As was true for the lithic sample in general, the blades in the concentration were parallel-sided and in a majority of cases showed two parallel ridges running the length of the dorsal side. A smaller proportion of the blades had a single dorsal ridge, and very rarely three or more parallel ridges were observed. At the proximal end, the blades constricted to a tiny platform which in the majority of cases was single-faceted; crushed platforms and more rarely multifaceted platforms were also noted in the collection. Neither blade platforms nor core platforms showed any signs of preparation by striating or grinding.

Based on a 10 percent random sample of blade midsections (N = 71) from the second level of unit 5–6S/0–1W (Quad III), blade width ranged from 7 to 26 mm with a mean of 13.6 mm (SD = 4.057). Blade thickness ranged from 1 to 7 mm with a mean of 2.5 mm (SD 0.976). For the same sample, 72 percent of the specimens had two dorsal ridges, while 28 percent had only one. None of the specimens in this particular group had more than two dorsal ridges. Turning to blade platform characteristics, a 10 percent random sample of proximal blade fragments (N = 61) from the same unit and level included 70 percent with single-faceted platforms and 30 percent with crushed platform areas. No multi-faceted platforms occurred in this sample.

A group of complete blades from the obsidian concentration were also examined in detail, and their physical characteristics are of some interest. It is, however, important to remember that if the entire deposit is workshop waste, then these complete blades almost certainly do not represent the optimal results of late Middle Formative blade production at Chalcatzingo. A collection of thirty blades from all four quads were analyzed. All of the specimens in this collection had normal distal ends (that is, none had hinged off). Blade length ranged from 42 to 93 mm with a mean of 61.2 mm (SD = 13.114); blade width ranged from 8 to 28 mm with a mean of 16.7 mm (SD = 5.192); thickness ranged from 2 to 9 mm with a mean of 4.3 mm (SD = 2.006); and blade weight ranged from less than 1 to 12 gm with a mean of 4.0 gm (SD = 3.918). Crushed platform areas were noted for 14 (47 percent) of the complete blades, while one specimen had a multifaceted platform; the remainder (fifteen) were single-faceted. Ten (33 percent) of the blades had a single dorsal ridge and four (13 percent) had three or more ridges; the remaining 16 (53 percent) had two dorsal ridges.

INTERNAL STRUCTURE OF THE CONCENTRATION

It was initially supposed that the obsidian concentration would be internally homogeneous, since the deposit seemed to be a secondary trash dump rather than a primary activity area. With a little further consideration of the problem, however, it was realized that secondary deposition would not necessarily lead to complete mixing of materials. Any original patterning of the material on the workshop floor would probably be reflected in a distorted and confused manner in the trash deposit. In addition, the very act of gathering up the debris and redepositing it might result in some unintentional sorting. An everyday example of this second possibility is evident in the way that particle sizes are sorted as dust is swept up into a dustpan.

The internal homogeneity of the obsidian concentration is examined in Tables 19.4 and 19.5. The overall results indicate that when the various excavation levels are compared across the entire deposit, homogeneity is quite evident (Table 19.4). However, when the four quads making up the deposit are compared, distribution of material is no longer random (Table 19.5). Specifically, although Quads I and III appear to be quite similar in composition, they are significantly unlike Quads II and IV. The vertical homogeneity is largely maintained when levels are compared on an individual quad by quad basis. Similarly, the nonrandom horizontal character of the deposit is generally supported when the quads are compared on a level by level basis.

The horizontal differentiation in the deposit presumably is a reflection of one or both of the potential sources of sorting mentioned above. The vertical homogeneity suggests that the manufacturing activities which produced the debris remained constant throughout the period of deposition. This in turn suggests that the entire period of deposition may have been relatively brief.

A second line of evidence also supports the idea that deposition occurred over a short period. As mentioned previously, each of the three complete cores recovered from the concentration consisted of several fragments. In one case, both fragments came from the same unit in Quad II, Level 2 (20–30 cm); however, the elements of the other two were more widely separated. One of these cores involved two pieces, one in Quad II, Level 3 (30–40 cm) and the other in Quad III, Level 2 (20–30 cm). The third core involved three pieces, one each in Quad I, Level 1 (10–20 cm); Quad I, Level 3 (30–40 cm); and Quad II, Level 3 (30–40 cm). Thus, Levels 1, 2, and 3 (10–40 cm) of Quads I, II, and III are all linked by these core fragments.

PRODUCTION ESTIMATES

Recognition of the obsidian concentration as a specialized deposit of workshop debris leads to the intriguing question of how much labor or how many original blade cores it might represent. Since the cores themselves are not present, the quantity of crested blade seems the best available basis for an estimate. Crabtree

(1968:460–462) indicates that a blade core can be started with only one prepared corner but may have two, three, four, or as many more as the knapper cares to create. The fact that the majority of the exhausted cores recovered from the concentration have a half-cylindrical shape with one unworked side suggests that corner preparation at the Chalcatzingo workshop was often restricted to only one or two ridges. Cores which are preformed with three, four, or more ridges will develop the full polyhedral shape. This observation, then, provides a basic assumption for use in estimating the number of cores represented by the deposit.

Other essentially uncontrollable factors also need to be mentioned, however. On the one hand, corner preforming can be accomplished without the special bidirectional flaking which results in a crested blade. In other words, the number of crested blades may be smaller than the number of prepared corners in the original group of cores represented by the concentration. On the other hand, the lithic items classified as crested blades during the analysis include both complete blades and fragments of blades. This means that several fragments from a single corner may be included as separate items, thus inflating the estimate of the number of cores represented. These two factors may tend to cancel each other out to some extent.

Keeping all these difficulties in mind, Table 19.6 provides estimates of the number of cores at T-37 based on one crested blade per original core and on two per original core. Using an estimate of 50–150 blades per core (Sheets 1975), it is then possible to estimate the total blade production these cores would have represented.

Assuming that all the blades in the concentration represent manufacturing waste, it is also possible to relate this figure to the estimated original cores and the blades they would have produced. Using two crested blades per core as a basis, the total waste per core is estimated at between 100 percent and 45 percent of core output. This would be an extremely low level of efficiency in the production of usable blades, and it suggests that if all the blades in the concentration are in fact waste, then the estimated number of cores is too small. When only a single crested blade per core is assumed, the waste per core becomes 66 percent to 20 percent, which seems more reasonable although probably still on the high side.

A second cross-check on the estimated number of cores is provided using the core platform rejuvenation flakes. No good estimate of the number of such flakes which might be produced in the reduction of a single core seems to be available; however, there is a tendency in the literature (Crabtree 1968:463, 467; Hester, Jack, and Heizer 1971:80) to see the process of core truncation as primarily a last-ditch effort to get a few more blades off a nearly exhausted core. This would suggest a rather small number per core. On the other hand, Crabtree also suggests that in some obsidian blade technologies difficulties in finding a secure seat for the pressure tool on the blade platform might lead to repeated core truncation. Specifically, he sees this problem arising where neither grinding nor scoring was used in platform preparation. Neither of these techniques is evidenced in the T-37 concentration. Hence, platform rejuvenation flakes might be somewhat more numerous per core. Still, it must be remembered that each truncation would shorten the core, making it doubtful that this operation could be carried out very many times before the core became too short for use.

Using two crested blades per core as a basis for estimating 80 original cores gives a total of 41 core platform rejuvenation flakes per core. Just as the propor-

***Table 19.4.* Comparison of the Composition of Levels 1, 2, and 3 for the Entire T-37 Obsidian Concentration**

Provenience: Levels (Quads I–IV)	*All Obsidian Blades and Fragments*	*All Obsidian Flakes and Fragments*	*Totals*
1 (10–20 cm)	*5,181.24*[a]	*4,378.76*	
	5,174[b]	4,386	9,560
2 (20–30 cm)	*7,626.61*	*6,445.39*	
	7,655	6,417	14,072
3 (30–40 cm)	*2,423.15*	*2,047.85*	
	2,402	2,069	4,471
Totals	15,231	12,872	28,103
	$\chi^2 = 0.77$ $p = .70$		

[a]Expected
[b]Observed

***Table 19.5.* Comparison of the Composition of Quads I, II, III, and IV for the Entire T-37 Obsidian Concentration**

Provenience: Quads (Levels 1–3)	*All Obsidian Blades and Fragments*	*All Obsidian Flakes and Fragments*	*Totals*
I	*4,283.19*[a]	*3,619.81*	
	4,294[b]	3,609	7,903
II	*3,409.54*	*2,881.46*	
	3,524	2,767	6,291
III	*4,698.34*	*3,970.66*	
	4,694	3,975	8,669
IV	*2,839.93*	*2,400.07*	
	2,719	2,521	5,240
Totals	15,231	12,872	28,103
	$\chi^2 = 19.69$ $p < .001$		

[a]Expected
[b]Observed

***Table 19.6.* Possible Estimates of the Total Number of Original Obsidian Blade Cores Represented by the T-37 Debris Concentration**

	Estimates Based on 1 Crested Blade per Core	*Estimates Based on 2 Crested Blades per Core*
Estimated no. of original cores (rounded) (157 crested blades used as basis)	160	80
Estimated total blade production (cores × blades per core[a])	8,000–24,000	4,000–12,000
Waste blades per core (5,373 waste blades[b] ÷ cores)	34	67
Proportion of total estimated blade production represented by waste blades (waste blades per core ÷ blades per core)	68%–23%	100%–45%
Core platform rejuvenation flakes per core (3,277 CPRF ÷ cores)	20.5	41

[a]An average of 50–150 blades is estimated for the typical Mesoamerican blade core (Sheets 1975).

[b]Complete blades (53) and proximal blade fragments (5,320) are combined to arrive at minimum total waste blades in the concentration.

tion of waste for the 80 core estimate seemed too high, this figure seems too large. When one crested blade per core is used to arrive at a 160 core estimate, the figure for platform flakes is reduced to 20.5 per core. As was the case with waste blades, this figure seems more reasonable although still on the high side. The final conclusion thus seems to be that the concentration represents the waste from a minimum of 160 cores and may well represent more.

Having set caution aside to a large degree in attempting to arrive at a figure for minimum estimated cores (MEC), it seems worthwhile to speculate a bit more. It should be kept in mind, however, that the MEC figure which forms the basis for these additional estimates is largely unsubstantiated.

It has been estimated that an expert worker would have needed from two to four hours per blade core for core preforming and removal of blades (Santley 1977a:8). This being the case, the 160 MEC represented by the T-37 concentration would have required 320–640 worker-hours for blade production. In other words, one full-time worker could have produced the waste deposit in two to four months. There is, of course, no reason to suppose that knapping was carried out on a full-time basis.

Using well-controlled data from a Late Formative site and a Classic village, Robert Santley (1977a:7) has proposed certain average annual rates of obsidian consumption. Although these figures may not be directly transferable to the situation at Chalcatzingo, they do provide a tantalizing means for taking the T-37 production estimates one tentative step further. For the Late Formative site, Santley estimates that a household of five discarded approximately forty obsidian fragments per year or the equivalent of six to nine blades and seventeen pieces of debitage. Using these figures as a basis, the 160 MEC represented by the T-37 debris would have produced the annual blade quota for approximately nine hundred to four thousand households or a ten-year supply for ninety to four hundred households.

Bearing in mind that these estimates are rough at best, the figures suggest that the T-37 blade manufacturing debris could easily have been produced by one or two part-time artisans. The volume of material produced would have been appropriate to supply Chalcatzingo and nearby smaller agricultural communities with obsidian tools for approximately a decade.

RESUMEN DEL CAPÍTULO 19

Las excavaciones T-37 revelaron la existencia de una abundante concentración de desperdicio de obsidiana en la subfase Cantera Tardío, lo cual hizo surgir la hipótesis de que fuera el resultado de la manufactura intensa de esquirlas cortantes en esta área. La concentración cubría un área de 2 × 3 m y se extendía 40 cm desde la superficie del suelo hasta el tepetate. Las perforaciones de prueba, hechas alrededor de la concentración, revelaron no haber muestra de que un taller de manufactura de esquirlas cortantes pudiera haber estado asociado a los desechos, aun cuando se pudo determinar que la concentración de obsidiana constituía un montón de basura puesto intencionalmente en ese lugar.

El análisis de las herramientas propiamente dichas y de los desechos que constituían la concentración revela que fueron definitivamente producto de la manufactura de hojas de obsidiana. Los identificadores del taller de hojas constituyen el 27 por ciento de los depósitos de basura y solamente el 7 por ciento del conjunto de obsidiana de las otras áreas del sitio. La ausencia de lascas de corte burdo y de cortex en el desperdicio de las lascas indica que la obsidiana que entró al sitio había sido preparada parcialmente en forma de núcleos limpios en vez de nódulos o pedazos grandes. La preparación adicional se llevó a cabo después de que los núcleos en blanco hubieron llegado al sitio. Los núcleos fueron retrabajados varias veces con objeto de conseguir el mayor número de esquirlas cortantes en la producción.

Si se emplea el número de hojas cumbreras como criterio para reconstruir el número de núcleos utilizados en la producción de este hacinamiento de desperdicio, puede llegarse a estimar el número de hojas provenientes de cada núcleo. El número mínimo de núcleos calculados, 160, se estima además haya requirido 320–640 horas hombre, tal vez el trabajo de uno o dos artesanos no totalmente dedicados a esta labor durante uno o dos meses. Es posible que el esfuerzo que refleja esta sola concentración de obsidiana haya producido la cuota anual de esquirlas cortantes que requería 900–4,000 unidades habitacionales, ciertamente lo suficiente para proveer a Chalcatzingo y las comunidades de sus alrededores durante varios años.