Adaptive Radiations in Prehistoric Panama

Edited by

Olga F. Linares

Smithsonian Tropical Research Institute

and

Anthony J. Ranere

Temple University

PEABODY MUSEUM OF ARCHAEOLOGY AND ETHNOLOGY
HARVARD UNIVERSITY, CAMBRIDGE, MASSACHUSETTS
1980

ISBN 0-87365-905-8

LIBRARY OF CONGRESS CATALOG CARD NUMBER 79-57108

This book was set in Palatino by the Cold Type Center, Harvard University Printing Office, and was printed and bound by the Halliday Lithograph Corporation. Manufactured in the United States of America.

Report Number 14

Stone Tools from Volcan Baru

P.D. SHEETS, E.J. ROSENTHAL, AND A.J. RANERE

INTRODUCTION

In 1971, we conducted preliminary excavations at the first locality (BU-17a) of Sitio Pitti-Gonzalez in the valley of Cerro Punta, Chiriqui province (report no. 4). The following year we did more extensive excavations in another section of the site (BU-17b). We also conducted test excavations at the nearby Fistonich site (BU-22) in 1972 and at the large archaeological site of Barriles (BU-24), downriver in El Hato basin (Stirling 1950; Ichon 1968b; Linares et al. 1975). In addition to the excavations in 1972, we completed an intensive survey of the Rio Chiriqui Viejo valley, from the Cerro Punta basin to the El Hato basin (report no. 2). The 3,100 pieces of worked stone collected in the excavations and survey operations from both years are the subject of this report.

The chipped stone assemblages and the ground and polished stone tools were initially analyzed by Sheets (1972). The cobble and boulder artifacts used in grinding and pounding were initially analyzed by Rosenthal (1972). The entire collection was reexamined in 1978 by Ranere. In this last examination, a stereoscopic microscope (6x to 50x) was used to detect wear patterns. The weathering of the igneous rocks used for manufacturing the overwhelming majority of the Volcan tools undoubtedly obscured most evidence of wear on tools used in the performance of light tasks and on tools used for short periods of time. However, wear patterns were detected on a number of tools that had received heavy use; these are discussed under the appropriate category in the section on artifact descriptions.

Tool categorization is based primarily on the final method of manufacture (see report no. 15). Tool form and inferred function were used to further subdivide tool categories.

CHIPPED STONE

Present in the Volcan Baru area in the early centuries of the first millennium A.D. was a chipped stone industry that can be called a cottage industry (Sheets 1975). A variety of cores are found at habitation sites, along with flakes modified and/or used as tools (table 1). The flaking was very simply done. Neither core preparation nor platform preparation was undertaken. Hard hammer percussion was the dominant and perhaps only flaking technique employed. The volcanic rocks used in the manufacture of stone tools are abundant throughout the region. It appears that blocks of raw material, often recovered from stream gravels, were kept at the sites and

flakes were struck off as needed. Although we classified a few flakes as blades, their production is best considered fortuitous. There were no blade cores recovered from the survey or excavations. With two exceptions (discussed below), none of the tools produced necessitated any great skill at knapping. In fact, the modest skills required to produce these tools were probably possessed by most adults in the area.

There is in the collections a single example of a well-made keeled scraper-plane that seems out of place in the early first-millennium A.D. assemblages from Volcan Baru. It is, on the other hand, a diagnostic tool for the preceramic phases (5000–300 B.C.) documented for the Chiriqui highlands (Ranere 1975 and report no. 8). The artifact was recovered from the surface of site BU-28, which produced chipped stone from one section and ceramics from another, thus opening the intriguing possibility that the site has two components, one preceramic and one ceramic. A second site, BU-50, yielded only chipped stone tools and may have been preceramic (it was destroyed by road-building activities shortly after its discovery). However, none of the tools recovered was particularly diagnostic.

One further chipped stone artifact deserves special mention; a type we have called dacite laterally flaked slabs (see artifact description in section 9.0). It is difficult to imagine a utilitarian purpose for these flat, asymmetrical stemmed objects. The nature of the bifacially flaked and sometimes battered or crushed edges suggests that the overall shape of the objects, not the edge morphology, was of paramount importance. Hafted on the end of a long shaft, these objects may have served some sort of ceremonial or symbolic purpose. A number of dacite waste flakes were recovered from Sitio Pitti-Gonzalez, suggesting that these implements were manufactured there.

GROUND AND POLISHED STONE

In contrast to the chipped stone tools, the ground and polished stone tools (almost entirely celts) are quite well made (table 2). The finished tools are ground over most of their surface and often polished as well. The chipping out of the preforms (one complete example was recovered) was skillfully done as well. Celt manufacturing in the Volcan Baru sites was pretty clearly a specialized activity. The distribution of celt manufacturing and/or resharpening flakes supports this conclusion. Only 10 of the 45 sites recorded show any evidence for celt manufacturing or resharpening, and in three cases, only a single flake was recovered (see table 1). We hasten to point out that the sample size is small (9 or less specimens) in all cases except for the extensively excavated Sitio Pitti-Gonzalez (n=363).

It is instructive to compare Sitio Pitti-Gonzalez (BU-17) with La Pitahaya (IS-3) in the Gulf of Chiriqui (see report no. 15) in terms of celt recovery and evidence for celt resharpening and manufacturing. At IS-3, 67 ground and polished stone artifacts, primarily celts and celt fragments, were recovered. Of the 208 flakes of celtlike materials in the excavated collections, only 19 are possible celt manufacturing flakes. The remaining 189 flakes have polished,

TABLE 1 THE DISTRIBUTION OF CHIPPED STONE FROM VOLCAN BARU SITES

	Conical cores	*Bifacial cores*	*Irregular cores*	*Miscellaneous cores*	*Blades*	*Scraper-planes*	*Flake scraper-planes*	*Flake choppers*	*Scrapers*	*Flake scrapers*	*Flake knives*	*Perforators*	*Dacite laterally flaked slabs*	*Chipped celts*	*Totals (tools)*	*Flakes*
BU-17 surface	2	7	2			1	3		1		1	3			20	
BU-17a ex.		5				1	1	1		1	2	1			12	
BU-17b ex.	1	1	7	1	2	1	1		2	4	2	2	5		29	
BU-17b above floor	1	2									1				4	
BU-17b house floor						1	1		1	3			3		9	
BU-17b below floor	2		2			1			1	1			9		16	
BU-17b above floor level							1								1	
BU-17b floor level		1	1						1	2			1		6	
BU-17b below floor level	3		1					1					2		7	
BU-17 total	9	16	13	1	2	5	7	2	6	11	6	6	20		104	2.051
BU-14											1				1	
BU-15		2	3		1									1	7	45
BU-16									1						1	
BU-18			1												1	1
BU-20																5
BU-21			1												1	3
BU-22	2												1	1	4	74
BU-24	1					1						1			4	111
BU-26			1			1									2	1

BU-27			1					3							4	13
BU-28	1					1		1							3	10
BU-29								1							1	2
BU-31			1												1	5
BU-36	1														1	4
BU-38			1											1	2	2
BU-39	1		1										1		3	25
BU-40						1									1	6
BU-42		1			1										2	5
BU-43	3		1					1							5	12
BU-44		1	1												2	3
BU-45	1	4	1										1		7	23
BU-46		1			1							1			3	9
BU-49	2		2			1						1			6	65
BU-50	1	1	1						1						4	7
BU-51																1
BU-52																2
BU-53		1													1	1
BU-54																2
BU-55			1				3								4	39
BU-57	1			1		2							1		5	41
BU-60		1				1							1		3	11
BU-62			1												1	
BU-63																1
BU-64							1								1	
BU-65		2	1												3	11
No site		1													1	
Totals	23	31	32	2	5	13	11	8	8	12	7	9	25	3	189	2,591

TABLE 2 DISTRIBUTION OF GROUND AND POLISHED STONE FROM THE VOLCAN BARU SITES

	Type A celts	*Type B celts*	*Type C celts*	*Celt fragments*	*Miscellaneous celts, pecked*	*Chisels*	*Polished pebbles*	*Totals (tools)*	*Celt flakes*	*Probable celt flakes*
BU-17 surface	6			2				8		
BU-17b ex.	1				1	1		3		
BU-17b above floor	1							1		
BU-17b house floor	1			1				2		
BU-17b below floor		1	1					2		
BU-17b above floor level				1				1		
BU-17b floor level	2			1				3		
BU-17b below floor level	*									
BU-17 Total	11	1	1	5	1	1		20	100	263
BU-15	1			1			1	3	2	1
BU-16									1	
BU-20	1							1		
BU-22	1	1		2				4	9	
BU-24									3	6
BU-27		1						1		
BU-31	1							1		
BU-33									1	
BU-36				1				1		
BU-39				2				2	2	3
BU-44		1						1		
BU-45		1						1		
BU-46					1			1		
BU-49	1							1	5	3
BU-55				1				1	3	
BU-65										1?
No site		1						1		
Totals	16	6	1	12	2	1	1	39	126	277

*One specimen glued to piece from layer above

ground, or pecked dorsal surfaces and/or platforms, indicating that they were removed from already finished tools. In contrast, while only 20 ground and polished artifacts were recovered at BU-17, 263 possible celt manufacturing flakes were found. An additional 100 flakes with polished, ground, or pecked surfaces were recovered. Flakes which could have resulted from initial celt manufacturing are 40 times more common (per finished ground and polished artifact) at BU-17 than at IS-3. Thus while we can easily account for all celt flakes at IS-3 as products of reshaping, celt breakdown, or

accidental removal, at least some initial manufacturing is indicated for BU-17.

Nonetheless, it would be erroneous to call BU-17 or any other site in the Volcan Baru area a celt manufacturing center on the basis of present evidence. In our limited excavation of a rather large site (BU-17), we did not encounter anything remotely resembling a lithic workshop, although one may well exist at the site. Only a few of the tools associated with celt-making (e.g., hammerstones, whetstones, pebble burnishers) were recovered. The largest concentration of flakes from celtlike materials occurred just to the east of the house. In all, 72 possible celt manufacturing flakes and 10 resharpening flakes were found together with a celt and two polished stone fragments (112 flakes of non-celtlike materials were also present). Experimental replication of chipped stone celt preforms produced between 95 and 201 flakes (minimum width 1/4 inch) per artifact (section 8.0), a result that suggests that the knapping activity represented by the flake concentration near the house was not extensive. Initial celt manufacturing must have taken place at quarry-workshop sites lying beyond the survey area. Such sites are known from an area twenty kilometers to the east, but closer sites probably exist as well.

It seems preferable to consider sites which contain celt flakes as celt maintenance or repair centers rather than as celt manufacturing centers; that is, places where damaged and dulled celts could be reshaped and resharpened by specialists. Six of the eight largest sites in the survey region yielded celt flakes, which we take to mean that they were celt repair centers. Four sites (Barriles and BU-3-4, and 5) occupy the Southwest or downriver end of the survey region (a fifth large site, BU-1, located in the same region was incompletely evaluated in the field and may be a repair center as well). The other two large sites (Sitio Pitti-Gonzalez and BU-34) occupy the center of the Cerro Punta basin at the upriver end of the survey region. Of the remaining 37 sites, only one, BU-18, yielded more than a single celt flake (BU-33-28 and 8 yielded single flakes). Interestingly, this site is located in Bambito, midway between the Southwest and Cerro Punta sites and had numerous small villages around it from which to draw clientele.

The probable sequence involved in the manufacture and subsequent reworking of a celt is summarized in figure 14/1.

PECKED, GROUND, OR BATTERED STONE

Tools for grinding, mashing, and battering are important components of the Volcan Baru lithic assemblages (table 3). The most easily recognized are metates and manos. Since charred maize kernels and cobs were recovered from Sitio Pitti-Gonzalez, the presumption that these tools were principally used to grind maize is warranted. The striations on the metates and manos indicate that a back and forth grinding motion was employed. A number of metates are legged, and thus are similar to the table metate, the standard maize-grinding implement throughout most of the Americas. These metates were manufactured from vesicular basalts and andesites, and were

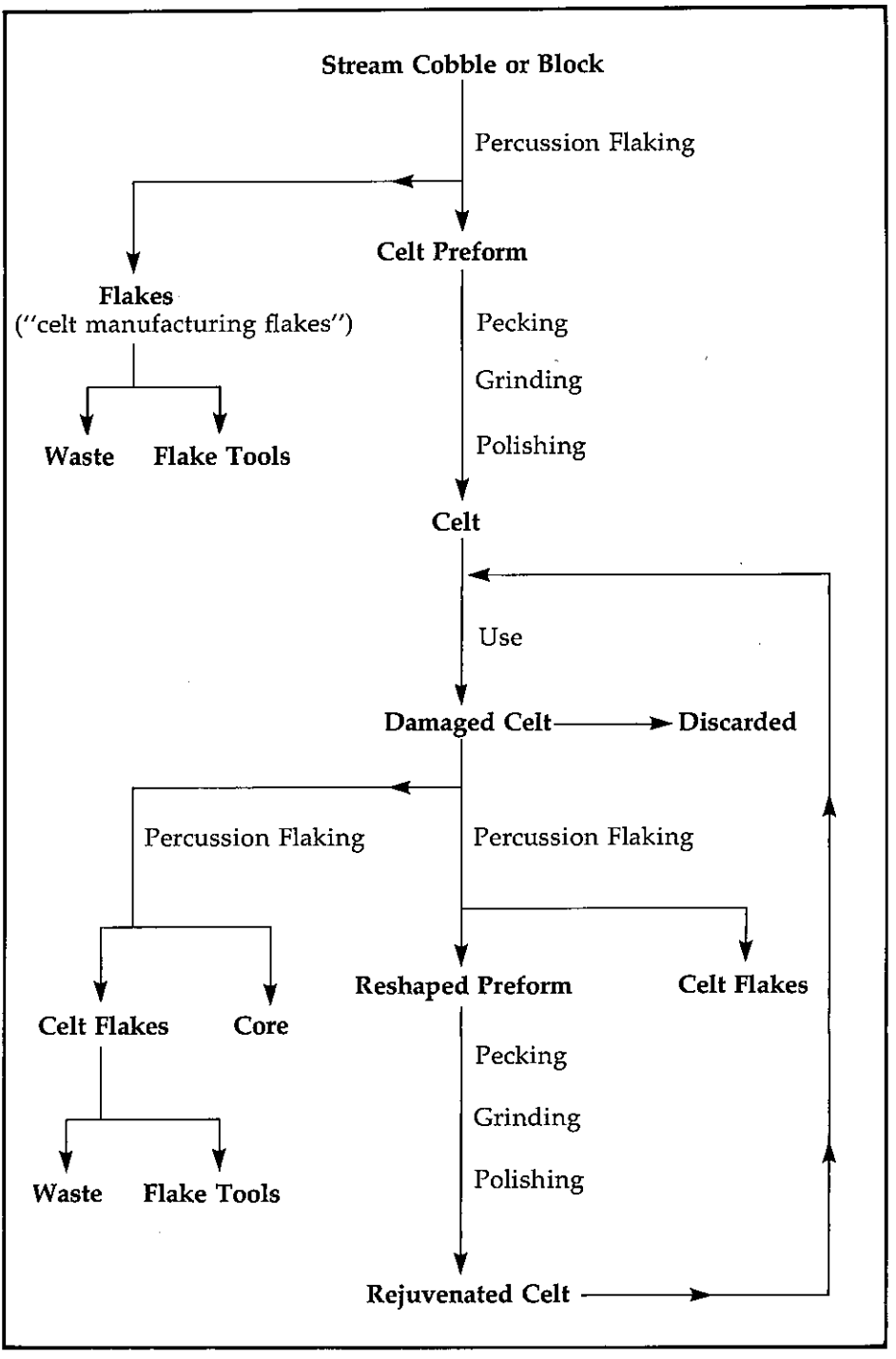

Figure 14/1: Celt manufacturing and use sequence.

pecked into final form. Some of the specimens have sculpted borders and legs (see Linares, Sheets, and Rosenthal 1975).

Other food processing tools occur as well. A significant number of boulder milling stones were encountered in the Volcan Baru region. These large boulders of dense volcanic rock have a circular shallow depression pecked and/or ground into one surface. Presumably the oval and subspherical handstones were used with these milling stones. These implements were apparently used with either a circular grinding motion or a pounding motion. At any rate, they were not used in the back and forth grinding motion documented for the manos and metates. The boulder milling stone bases and their handstones are best interpreted as being general mashing and grinding tools for use with a variety of substances.

A single boulder containing several small, deep depressions has been called a nutting stone. Similar stones are used today to aid in the cracking of palm nuts for meat extraction. Since palm nut fragments were recovered from BU-17 (section 10.3), the interpretation seems a reasonable one.

Two boulder mortars and one pestle were recovered from BU-17. In addition, a number of boulder or bedrock mortars were located along stream courses during the survey. These tools were presumably used for mashing vegetal foods and perhaps other materials as well.

ARTIFACT DESCRIPTIONS

In presenting measurements for incomplete specimens, the estimated original dimensions were placed within parentheses following the actual measurements. Edge angles were taken by measuring the angle made by tangents to the surface of both faces of an implement at a distance of 10 mm from the edge. The angle was measured at the center of the tool where possible, and rounded off to the nearest 5°. Proveniences for the artifacts are summarized in tables 1, 2, and 3.

I. Chipped Stone

A. Cores (fig. 14l2)

1. Conical, single platform: 23 specimens. Most are made on subrounded to subangular cobbles. Two large specimens are made on angular fine-grained andesite blocks. Occasionally, cores are reduced to the point where no cortex is left. Natural surfaces of the cobbles were commonly used as platforms, although exhausted or nearly exhausted cores had flaked platforms. The cores vary from having flakes removed from one side only to having flakes removed from the entire perimeter. Most of the larger cores are still capable of producing useful flakes. The smallest cores can be considered exhausted. Most of the cores are of andesite, although examples of dacite and granite are also present.

2. Bifacial: 31 specimens. An acute angled edge was used as the platform on these cores, and flakes were struck from both faces, that is,

TABLE 3 DISTRIBUTION OF PECKED, GROUND, AND BATTERED STONE IN THE VOLCAN BARU SITES

	Milling stones	*Legged metates*	*Slab metates*	*Metate fragments*	*Mortars*	*Palettes*	*Nutting stones*	*Semicircular slab discs*	*Cylindrical manos*	*Oval manos*	*Spherical manos*	*Mano fragments*	*Smooth pebbles*	*Pestles*	*Hammers on cobbles*	*Hammers on cores and flakes*	*Whetstones*	*Miscellaneous*	*Totals*
BU-17 surface	4	2	1	3	2				3	2			1					1	19
BU-17a ex.							1								1				2
BU-17b ex.	2			3				1		1	2	1	2				1		13
BU-17b above floor						1			1				1		1	1			5
BU-17b house floor	1										2		3			1			8
BU-17b below floor		2	1						2			1	2						8
BU-17b above floor level				1															1
BU-17b floor level	1									1			3		1	2			7
BU-17b below floor level		2	1										1						4
BU-17 total	8	6	3	7	2	1	1	1	6	4	4	2	13		3	4	1	1	67
BU-15																2			2
BU-21		1																	1
BU-22									3				1			1			5
BU-23				1															1
BU-24	4	1	1	1					1			1	1						10
BU-27		2		5					3			1		1					12
BU-29						1													1

	Milling stones	Legged metates	Slab metates	Metate fragments	Mortars	Palettes	Nutting stones	Semicircular slab discs	Cylindrical manos	Oval manos	Spherical manos	Mano fragments	Smooth pebbles	Pestles	Hammers on cobbles	Hammers on cores and flakes	Whetstones	Miscellaneous	Totals
BU-30	1										1								2
BU-31										1									1
BU-32						1					1								2
BU-33										1									1
BU-36			1	1															2
BU-37											1	1							2
BU-39	1	1				2			2				1			1		1	9
BU-40				1															1
BU-42	1					2					2	1							6
BU-43									1							1			2
BU-44	1			2				1											4
BU-45	1		2	1					2							2	1		9
BU-46										1									1
BU-49	1	1							1	2	2		2				1		10
BU-57			1						1										2
BU-60		1																	1
BU-61		2		1								1							4
BU-64									1										1
Total	18	15	8	20	2	7	1	2	21	9	11	7	18	1	3	11	3	2	159

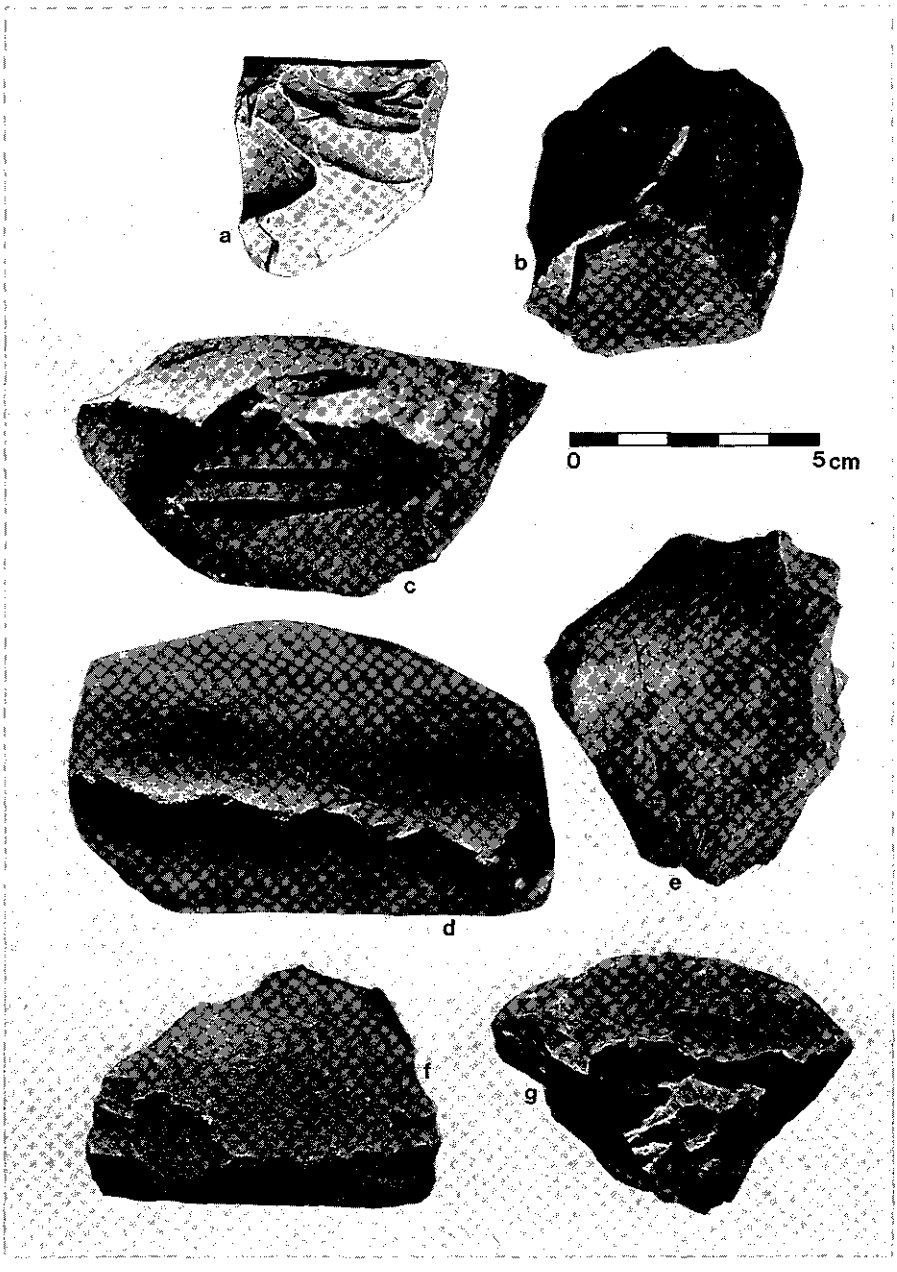

Figure 14|2: a-b. Unifacial cores; c-d. bifacial cores; e-g. multidirectional or irregular cores.

bifacially. A number of the smaller more completely flaked specimens are disk shaped and biconvex to biconical in cross section. Flakes were removed from only a single edge on many of the larger specimens. Cortex is visible on most large specimens and a few smaller ones. Most cores are made on subrounded to subangular cobbles. The larger cores could still be

used for flake detachment with the exception of two specimens exhibiting multiple step fractures. The smallest cores appear to be exhausted. Andesite and to a much lesser extent basalt were the materials employed.

Some of these cores may have had light use as choppers or scrapers. The weathering of the andesite obscures use marks that are not moderately well developed.

3. Irregular (multidirectional): 32 specimens. These cores are grouped together solely on the basis of having had flakes struck from more than two directions. Some of the larger cores have only three or four flakes removed, each one from a different platform and in a different direction. Some of the smaller cores are subspherical in shape and no longer useful for flake production. Cortex is visible primarily on larger specimens and indicates that these cores were made on rounded to subrounded cobbles. Andesite is the most common material employed, with a few specimens made of granite and dacite.

4. Miscellaneous: two specimens. One core was made on a rounded boulder of what appears to be granite. Flakes were removed from a single platform from slightly over one-half of the perimeter of the core. If not for its enormous size, 170 x 170 x 70 mm, this core would have been considered a conical core.

A second large core, this one of dacite, is represented by nine large fragments, four of which can be fitted together. One piece has been modified after detachment by steep unifacial retouch and has been classified as a scraper-plane. The original core must have been a small boulder.

B. Blades (fig. 14l3 a-d)

Very few specimens have attributes which conform with the definition of true blades, i.e., a flake whose length is at least twice its width, with the direction of force applied parallel to the long axis. All of the five specimens included here may well have been fortuitous. Only one specimen is complete (81 x 32 x 9 mm), although three others are missing only a small section of their distal ends. Two of these blades show evidence of use as knives and are described under the heading "flake knives."

There are a number of distal ends, proximal ends, and midsections of flakes that might have been blade fragments. None is twice as long as wide, however, and therefore they are not included in the specimen count.

C. Scraper-planes (fig. 14l3 e-g)

Thirteen specimens. These tools have steep unifacial flaking on at least one edge, and in three cases completely around the perimeter. The largest specimen has wear polish clearly visible (using a stereoscopic microscope) on the flaked edge and extending back along the flat surface of the tool. Working edges of these heavy duty tools vary from convex (nine examples) to concave (two examples).

One tool (from BU-28) is a keeled scraper-plane unifacially retouched around the entire circumference. Made on a thick bladelike flake, the bulb

of force has been removed by flaking of the ventral surface. All are made of andesite.

D. Flake scraper-planes (unifacially retouched large flakes) (fig. 14/3 h-j)

Eleven specimens. These tools have light unifacial retouch normally along one edge only. No wear patterns were identified, primarily because of the heavy weathering of most specimens. Their size and shape suggest that they would have served well as heavy duty planes. All were made of andesite.

E. Flake choppers (bifacially retouched large flakes)

Eight specimens. Light bifacial retouch occurs along one or more edges of these large flakes. Some crushing and small use flakes can be seen on a few of the specimens. All were made of andesite.

F. Scrapers (fig. 14/4 a-f)

Eight specimens. These tools are characterized by purposeful unifacial retouch along one or more edges. Working edges vary from convex (three examples) to straight (three examples) to concave (two examples). The contour of the working edge can be smooth (four examples) or jagged (four examples). One is made on a celt flake which still retains a polished surface and a portion of the bit as the striking platform. All are made of andesite.

G. Flake scrapers (fig. 14/4 g-j)

Twelve specimens. These flakes have edges appearing to be modified by use only. The use flakes are removed from one face of the working edge only. These presumed scraping edges occur on a variety of flake forms. Working edges vary from convex (four examples) to straight (four examples) to concave (four examples). They differ from purposefully made scrapers by having rather more acute working edge angles. Four tools have wear polish visible on the working edges. One is on the snapped edge of a large bladelike flake and appears to have been used as a small plane. Another tool of particular interest has two concave working surfaces exhibiting a high degree of polish on both surfaces, but no use flakes. The polished area extends 1–2 mm onto one face only of each working edge. There are striations visible in the polished facets perpendicular to the edge, suggesting that the tool was held at a 90° angle to the surface of the worked material (which was unyielding, perhaps wood) and moved in a scraping motion. All are made of andesite. Flake scrapers were undoubtedly much more common in the Volcan assemblages, but have gone unrecognized because of the obliteration of wear patterns by weathering.

H. Flake knives (fig. 14/4 k-m)

Seven specimens. These tools are distinguished either by having use flakes removed bifacially from the working edge or by having wear polish

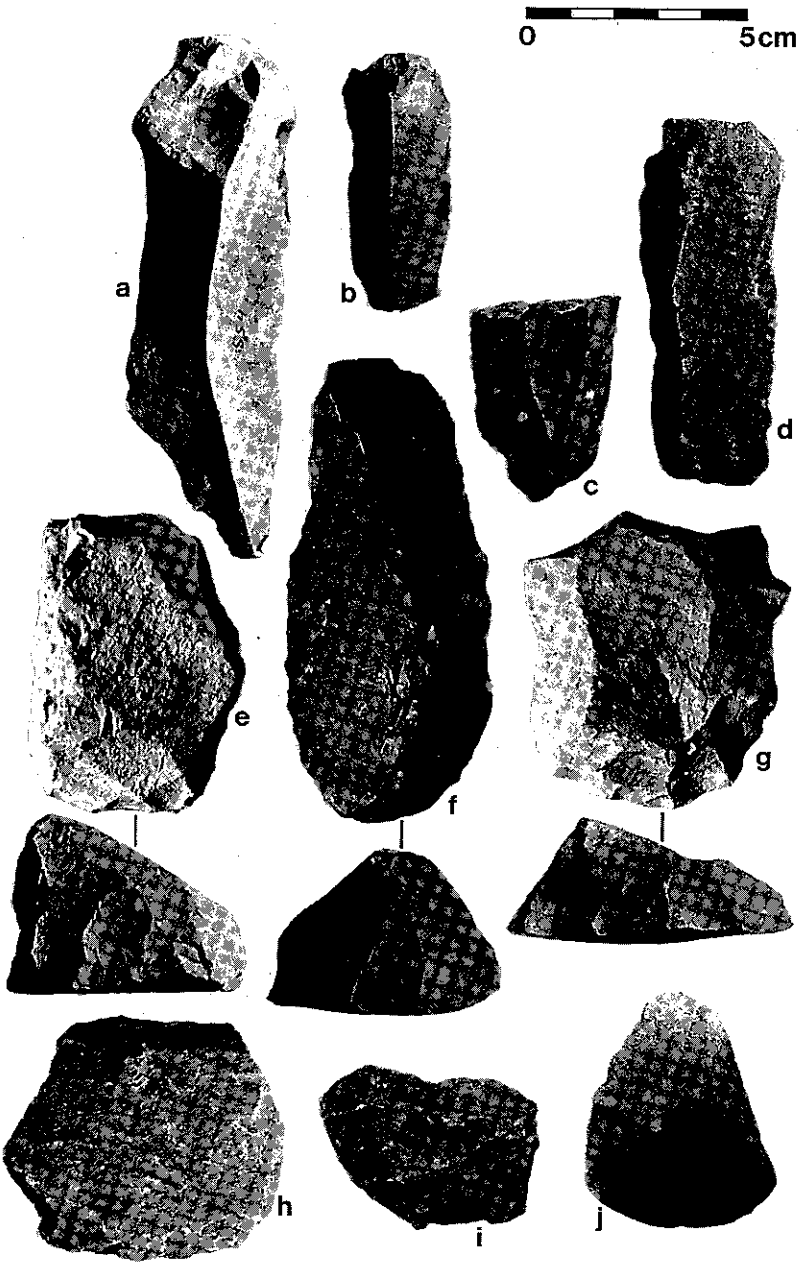

Figure 14B: a-d. Blades; e-g. scraper-planes; h-j. flake scraper-planes.

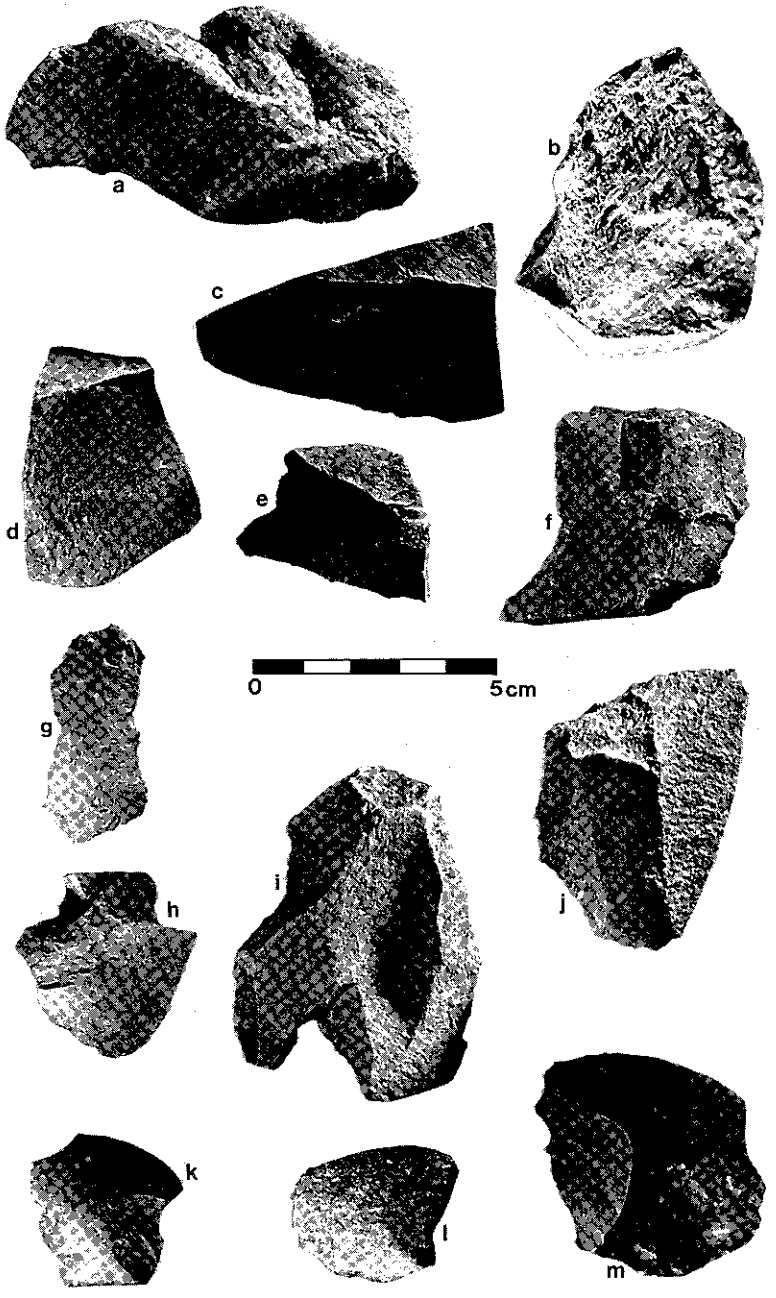

Figure 14/4: a-f. Scrapers; g-j. flake scrapers; k-m. flake knives (made on celt flakes).

extending onto both sides of the working edge. None appears to be deliberately manufactured. Three are on blade fragments, however. Six of the specimens have wear polish visible under the microscope as well as use flakes removed. One particularly well-used tool is a blade fragment (distal end) which has use polish extending away from the working edges 3–5 mm. Striations parallel to the working edges (both sides of the tool were used) suggest that the tool was used in a sawing motion. Another knife on a blade (distal fragment) has very shallow notches opposite each other near its proximal end. These notches along with polish on the high spots of both dorsal and ventral surfaces extending for 20 mm from the proximal end indicate that the tool was hafted (the polish is attributed to rubbing of the knife against the haft). The final knife on a blade fragment (distal end) has small bifacial use flakes and moderate polish along both edges and the tip of the tool.

Two of the remaining specimens are made on celt flakes; one, in fact, retains a full 23 mm of the bit end of what was probably a type A celt. It is the opposite end of the flake which has bifacial use flakes and polish. The tools are made of andesite and dacite.

I. Perforators

Nine specimens. There are several quite distinct tools that have a point or "nose" formed by unifacial retouch. One of the edges leading to the point is usually concave, the other straight. Five of the specimens have wear polish visible on the point and back some distance along both edges. One is particularly noteworthy as the polish is clearly visible without the aid of a microscope. This tool is made on a thick pointed flake, triangular in cross section. The rounded tip is nearly 5 mm across. Heavy rounding of edges and polish extends back along the total length of the acute-angled edge (74 mm) and back 35 mm on the straight edge and dorsal ridge. The polish follows the contours of the flake scars, suggesting that the tool was used on a soft yielding material. This tool is by far the largest of the perforators. The others are remarkably similar in size. All are made of andesite.

J. Bifaces

Three bifacially flaked specimens were recovered which appear to be preforms for either celts or chisels. The single complete specimen measured 68 x 35 x 25 mm, was planoconvex in cross section, and was heavily weathered (andesite). Two narrow bifacially flaked fragments were found that may have been preforms for chisels. Both were biconvex in cross section. One specimen measured 62 x 36 x 25 mm and was made of basalt. The other fragment, a midsection, measured 47 x 28 x 13 mm and was made of andesite.

K. Flakes

More than 2,500 flakes were recovered from sites in the Volcan Baru region (2,000 from BU-17), all but six made of igneous rocks, primarily

andesite; the rest were, one of quartz and five of chalcedony. Cortex visible on a large number of flakes indicates that they were struck from rounded to subangular cobbles. Such cobbles are available in stream gravels throughout the region. Platforms tend to be wide, with "lipped" back edges. Bulbs of percussion are normally diffuse, and *éraillure* scars rare. The dominant mode of flake removal inferred is hammerstone percussion where the hammer is a soft rock and/or has a broad striking facet, and where the blow is struck well back from the core edge. All of these flakes might be considered as waste or debitage but for the fact that heavy weathering has undoubtedly destroyed the evidence of use on many of them.

II. Ground and Polished Stone

A. Celts (fig. 14l5)

1. Type A (pear-shaped): 16 specimens. These celts have bits that extend in a smooth curve back along the sides of the tool, giving it a pear-shaped appearance. They are all biconvex in cross section although some are slightly asymmetrical. The entire surface of the bit end is ground and polished. The poll may be similarly treated, although sometimes it is left as a pecked or (rarely) a chipped surface. Some specimens have a center ridge (in one case double ridges) on either face near the poll end. More commonly, the surface contour of the faces is smooth. Some of the bits have clearly been reground. The new bit is made at a steeper angle than the original so that an obtuse angle is formed on the surface of the celt faces ca. 10 mm behind the bit. On one specimen the new bit angle measured 70° while the original bit angle was reconstructed to be closer to 55°. Most of the large celt fragments have been reused as cores.

Only two celts are complete enough to provide measurements; they are 86 x 46 x 20 mm and 145 (175) x 86 x 43 mm. Edge angles on the surviving bits varied between 40° and 70°. The celts are made from fine-grained andesite and basalt.

2. Type B: six specimens. These celts have straight subparallel sides that taper gently from the bit to the butt end. All have a ridge along the midline and are diamond-shaped in cross section. Flake scars from the initial stage of manufacture are occasionally visible at the butt end. Evidence of pecking can be seen on most specimens from the midsection on back to the butt end. The bit end is completely ground and polished, and in a few cases the entire celt is similarly treated. The three bits left intact for measurement had edge angles of 55°, 55°, and 60°. The celts are made of fine-grained andesite and basalt.

3. Type C: one specimen. This is a small, well-made celt with a flaring bit and incurvate sides. The butt end is missing. The well-controlled flaking is clearly visible on all but the bit section. Some pecking occurs on the middle of both faces, giving the celt a smooth biconvex cross section. Grinding and polishing are restricted to the bit itself. Bit angle is 40°. The celt measures 76 (100) x 68 x 16 mm, and is made of fine-grained basalt.

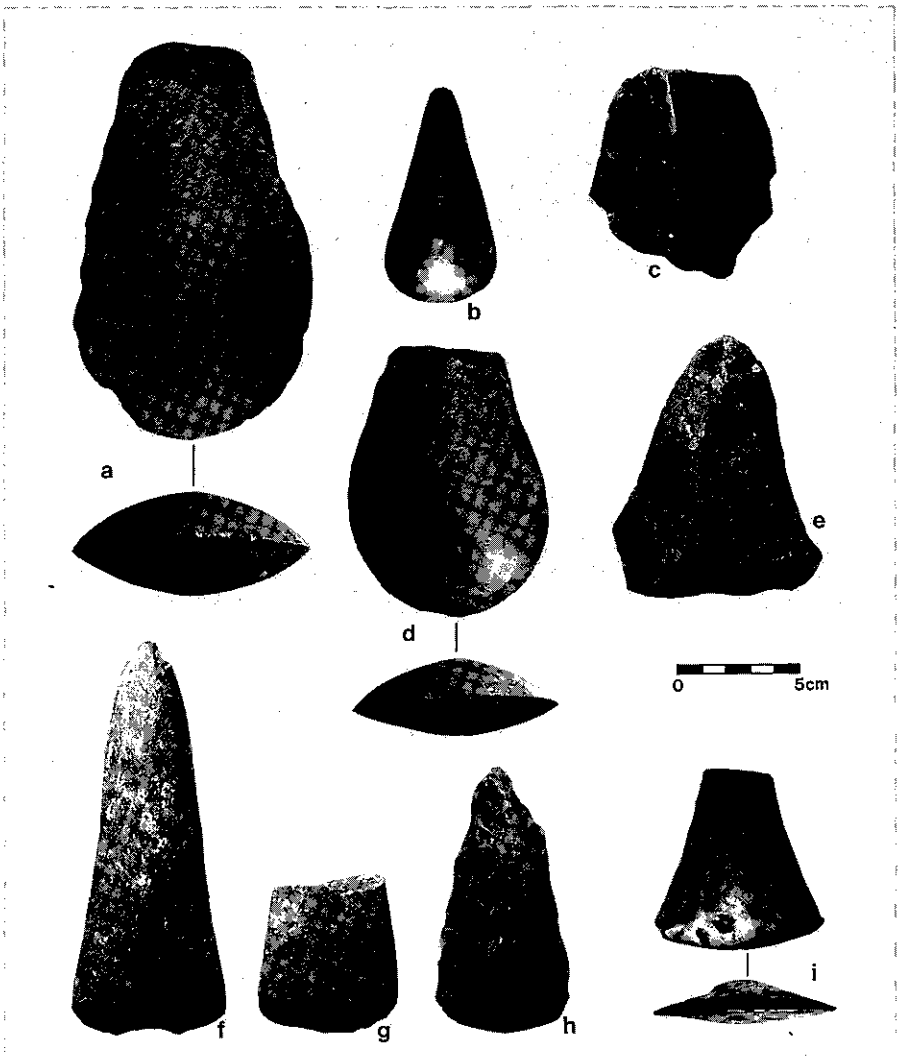

Figure 14.5: a-e. Type A celts; f-h. Type B celts; i. Type C celt.

4. Fragments: 12 specimens. A number of celt fragments were either too small or too altered to be categorized further. Seven are polls, four are midsections, and one is a bit section. The last mentioned fragment had been reworked (probably from a type A celt) and used as a chisel. The resharpened bit has an angle of 55°. All of the midsections and at least some of the polls were reused as cores. All were made of andesite and basalt.

5. Miscellaneous: One chipped and pecked celt preform was recovered. The bit on the tool had not yet been formed. It measured 78 x 51 x 24 mm and was made on rather coarse-grained andesite.

A flaked and pecked midsection recovered may have been a broken preform or perhaps a part of a chisel. The fragment measured 53 x 28 x 18 mm and was made of andesite.

B. Chisel

The bit fragment of a chisel (28 x 15 x 10 mm) was recovered from BU-17. The entire surface of the fragment was finely polished. The bit was only 7 mm wide, and had an edge angle of 40°. The tool was made of fine-grained andesite.

C. Polished pebble

A flat triangular-shaped fragment was recovered from BU-15 (33 x 29 x 14 mm). The fragment was polished on all surfaces, but a few flake scars remained incompletely obliterated on one edge. Its purpose is unknown.

D. Celt flakes

A total of 126 flakes retained pecked, ground, and/or polished surfaces on their striking platforms or dorsal sides. These flakes were either purposefully struck in order to reshape damaged cores or to produce flakes from damaged cores, or they were accidental by-products of heavy celt use. We suspect that most were deliberately struck from damaged celts; 23 of the total were clearly not from the bit end of celts and can be safely considered purposefully detached. Thirty-nine flakes retain a portion of the bit on their striking platforms (64 celt flakes could have come from either the bit or from somewhere else on the celt). The large number of celts showing evidence of resharpening and the large number of celt fragments that had been reused as cores support the inference that most celt flakes were deliberately struck. All celt flakes are of fine-grained igneous rocks.

E. Possible celt manufacturing flakes

A total of 277 flakes of fine-grained igneous rock *may* be by-products of celt manufacturing activities. Since flakes without pecked, ground, or polished surfaces can be removed in the celt reshaping process (ca. 30 percent in experimental reshaping — see Ranere, section 8.4) and in reusing celts as cores, not all of these flakes were manufacturing by-products. There are, in addition, a few nonground and polished stone artifacts made of fine-grained igneous rocks. Nonetheless, if these flakes of celtlike materials came only from reworking finished ground and polished tools, we would expect to find only 40 or so of them in the collections instead of 277. This estimate is based on celt reshaping experiments and on the ratio of celt flakes to flakes of celtlike materials from other sites in western Panama (section 8.4).

III. Pecked, Ground, or Battered Stone

A. Milling stones (fig. 14/6 h,i)

Eighteen specimens. These implements are boulders of dense andesite or dacite having a pecked and/or ground shallow, circular depression on one

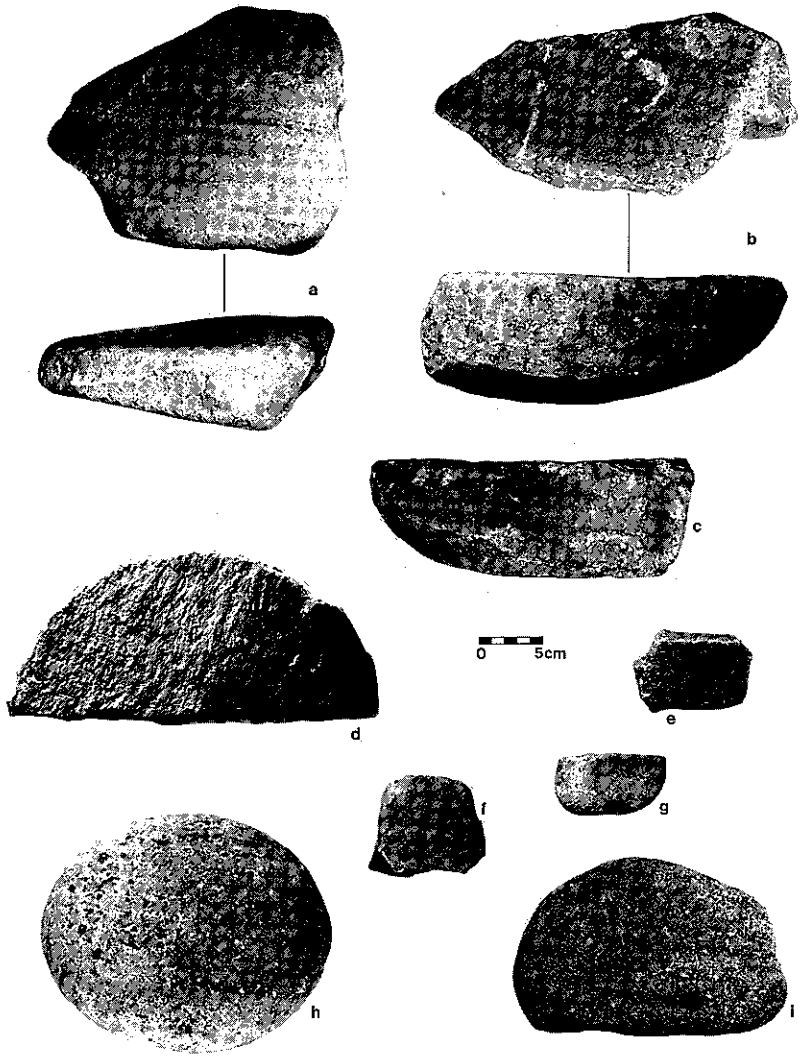

Figure 14/6: a-c. Slab metates; d. semicircular slab; e-g. palettes; h-i. milling stones.

side. The boulders used were generally rounded to subrounded (rarely angular). The two whole specimens recovered measure 211 x 178 x 93 mm and 226 x 156 x 97 mm. One large fragment had a diameter of 312 mm and a thickness of 115 mm. The handstones used with these milling stones were presumably used in a circular grinding motion and/or in pounding.

B. Metates

1. Legged (fig. 14/7): 15 specimens. These grinding tools were manufactured from vesicular igneous rocks by pecking. The working surface or table

is flat or slightly concave and is modified through use of a handstone against it in a back and forth motion. These metates have four legs which can be either tapered or straight, and either round or square in cross section. Some of the legs and table borders of these specimens are decorated with sculpted figures, trophy heads being most common. All specimens were fragmentary, so that their dimensions cannot be determined with accuracy. However, based on the size of the legs and the thickness of the tables, two size classes can be inferred. The most common (12 specimens) is a smaller size with a table thickness varying from 18 to 42 mm (averaging 26 mm). Legs are round in cross section and either tapered or straight. Maximum diameters of the legs vary from 41 to 87 mm (averaging 56 mm). In contrast, the larger metates (3 specimens) have a table thickness varying from 41 to 67 mm (averaging 58 mm), and legs that are square in cross section and average 120 mm across.

2. Slab (fig. 14/6 a-c): eight specimens. These metates are made of a volcanic rock somewhat denser than the rock used for legged metates. They are simply flat slabs having one surface dressed by pecking. The back and forth wear pattern on the working surface duplicates that found for the legged metates. The single complete specimen measured 364 x 231 x 38 mm. Fragments of other slab metates varied in thickness from 35 to 70 mm.

3. Fragments: 20 specimens. These metate fragments were too small to classify further.

C. Mortars

Two specimens. These boulders of andesite have deep, circular depressions pecked into one or more surfaces. Both are broken. One specimen has a main depression 85 mm deep and 150 mm in diameter plus two smaller depressions. The second mortar has a single depression 112 mm deep and 190 mm in diameter. Similar-sized depressions were noted in boulders and bedrock along stream courses in the survey region. These implements were presumably used with pestles in pounding or mashing activities.

D. Palettes (fig. 14/6 e-g)

Seven specimens. These artifacts are small slabs of dense andesite and dacite having one surface smoothly ground. Two specimens have slight circular depressions apparently formed through use. Perhaps these palettes were used in the grinding of pigments.

E. Nutting stone

One boulder of andesite (324 x 210 x 110 mm) contains five well-defined depressions and six incipient ones. The five definite depressions vary from 20 to 30 mm in diameter and from 6 to 12 mm in depth. Today such stones are used in the area for smashing palm nuts.

F. Semicircular slabs (fig. 14/6 d)

Two slabs of andesite were shaped by steep flaking and pecking into

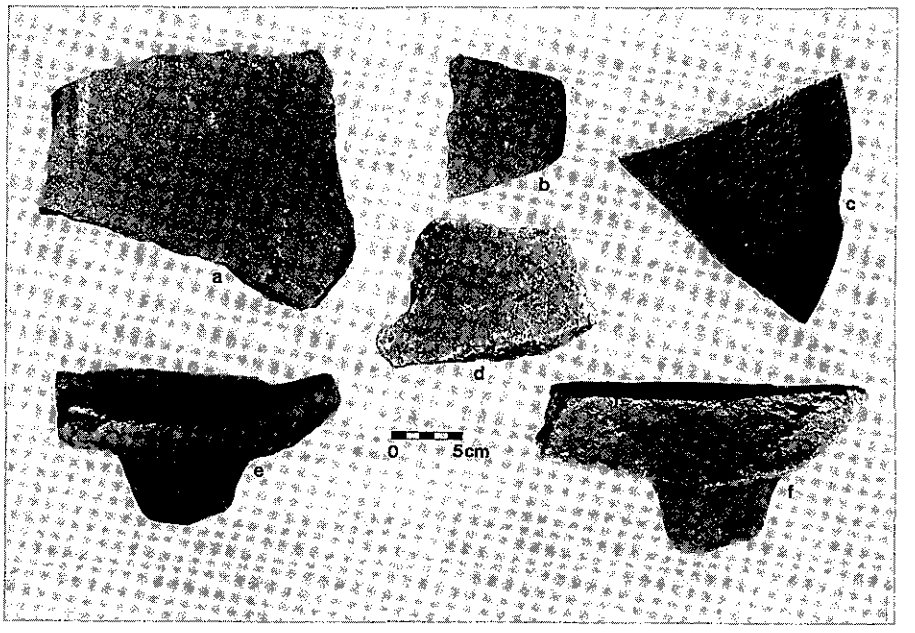

Figure 14/7: Legged metate fragments.

semicircular forms. The smaller specimen, which is fragmentary, may have one surface altered by grinding. The larger one shows no signs of use. Their purpose is unknown.

G. Manos (fig. 14/8)

1. Cylindrical: 21 specimens. These implements are pecked into cylindrical form primarily from coarse-grained igneous rock (two specimens are of a finer-grained andesite). Through back and forth grinding against metate surfaces, flat work facets are developed on one to four faces. One well-used mano is rectangular in cross section. One specimen (224 x 87 x 87 mm) appears to be only partially complete. It has been pecked on all surfaces but is not uniform in appearance and is unused.

2. Oval: 9 specimens. These tools are rounded, flat river cobbles which have been used on one or both flat sides for grinding. They vary in outline from nearly circular to elongated ovals. The grinding surfaces are flat to slightly convex in contour. They are made of dacite and granite.

3. Spherical: 11 specimens. These tools are similar to oval manos in that they represent rounded stream cobbles modified only by use. They are all subspherical in shape, having two opposite faces that are somewhat flattened. These grinding facets are all somewhat convex. A circular grinding motion is inferred from the facet shape, although weathering of the surfaces obscured any striations which might originally have been present. All were made of dacite.

4. Fragments: 7 specimens. These handstone fragments could not be assigned to a more specific category.

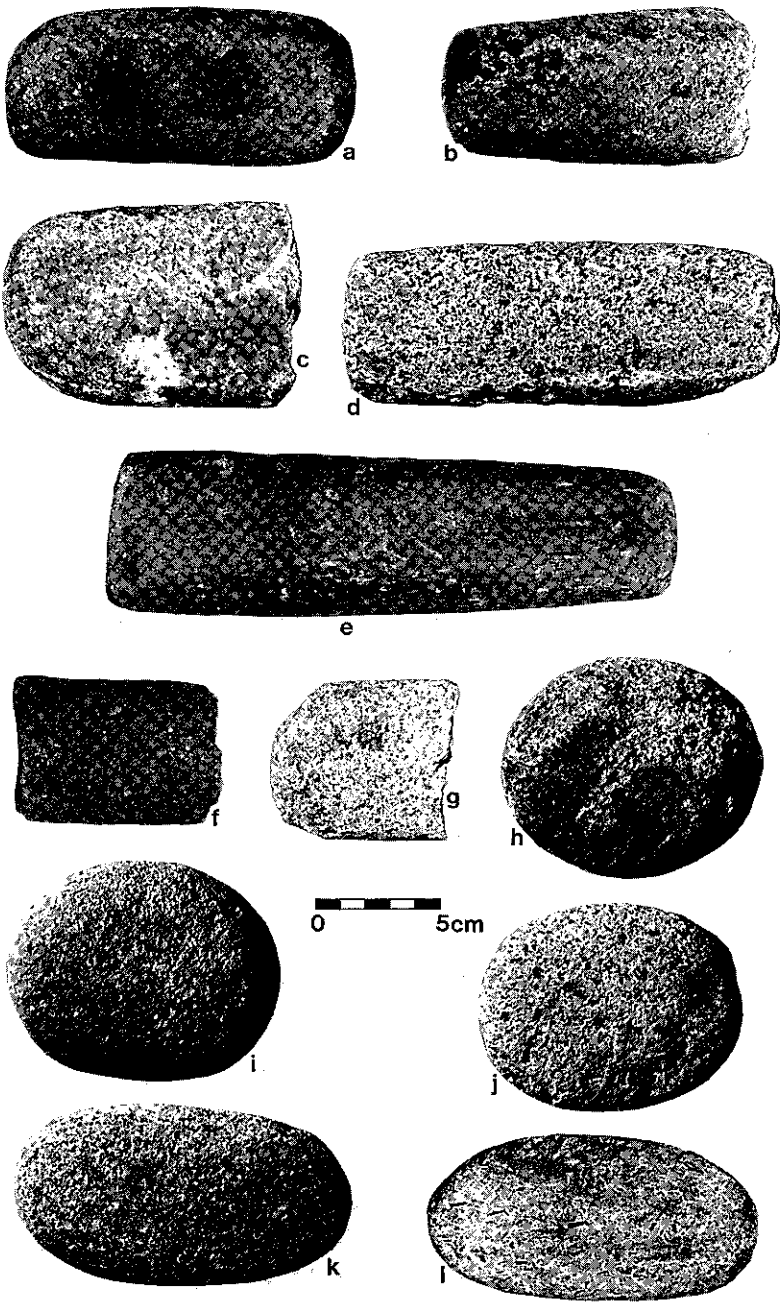

Figure 14l8: a-g. Cylindrical manos; h-l. oval manos.

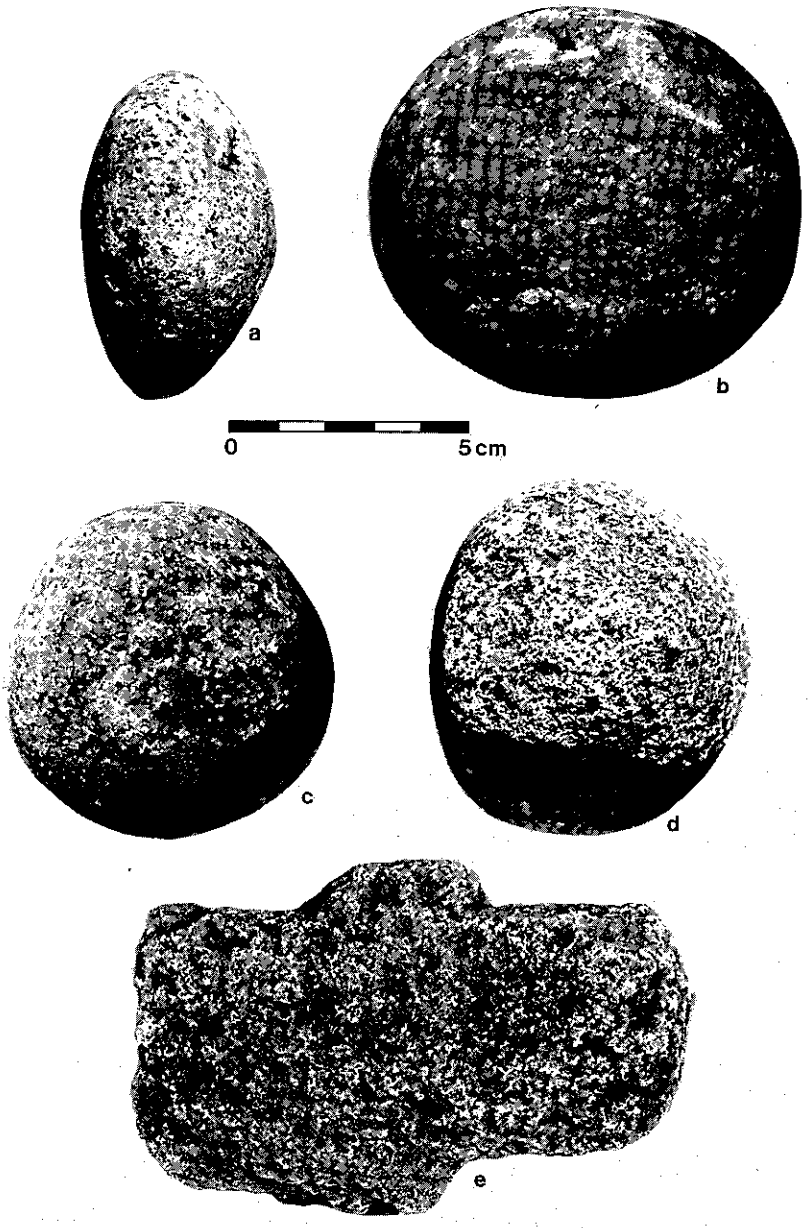

Figure 14/9: a-d. Smoothed pebbles; e. sculpted fragment.

H. Smoothed pebbles (fig. 14/9 a-d)

Eighteen specimens. These are small oval (13) and round (15) pebbles of andesite and dacite which have definitely smoothed or possibly smoothed facets. Their function is unknown.

I. Pestle

One elongated cobble of igneous rock was recovered which appeared to have been used as a pestle. It was almost square in cross section and tapered toward one end. A broad pounding facet occurs at the large end, and a small, off-centered facet at the opposite end. It measured 174 x 60 x 58 mm.

J. Hammerstones

1. Cobble: three specimens. All show heavy use as hammers. One (58 x 54 x 35 mm) is disk-shaped and has a hammering facet completely encircling its perimeter. The other two cobbles (76 x 57 x 54 mm and 50 x 32 x 28 mm) have broad hammering facets at opposite ends of the tool. All are made of fine-grained andesite.
2. On cores and large flakes: 11 specimens. These hammers have been made (through use) on remnants of irregular and bifacial cores as well as on large flakes (2 examples). Facets range from broad and continuous around the tool perimeter to being light and localized along one edge. All are of andesite.

K. Whetstones

Three specimens. One whetstone consists of an angular pumicelike stone which has one slightly concave, very smooth surface. Linear striations are visible, running parallel to the long axis of the tool. The opposite face and sides are unmodified. A second fragmentary specimen has one slightly concave, smooth surface, but no striations. The third specimen is a large flat dacite slab with a smooth, very slightly concave surface. Subparallel grooves 2–3 mm in width are visible on this surface as well as finer striations.

L. Incised cobble

One elongated andesite cobble has a number of fine lines incised into its surface. No particular pattern can be discerned.

M. Sculpted fragment (fig. 14/9 e)

A single piece of vesicular basalt has been sculpted in a fashion that resembles bas-relief. One side vaguely resembles a human face. It is probably a fragment from a metate table leg.