# AN ARCHAEOLOGICAL INVESTIGATION AND TECHNOLOGICAL ANALYSIS OF THE STOCKHOFF BASALT QUARRY, NORTHEASTERN OREGON

By

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AN ARCHAEOLOGICAL INVESTIGATION AND TECHNOLOGICAL ANALYSIS OF THE STOCKHOFF BASALT QUARRY, NORTHEASTERN OREGON

ABSTRACT

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The Stockhoff Basalt Quarry (35UN52) is located in the Blue Mountains of northeastern Oregon, 19 km southeast of La Grande. The site lies along a small tributary of Ladd Creek in the upper end of Ladd Canyon.

During surface collection and excavation, over 700 basalt implements and 3900 pieces of chipping detritus were recovered. A test excavation which revealed the presence of basalt implements beneath a deposit of Mazama ash indicated exploitation of the site's lithic resources by 6700 B.P. The implements recovered from the site bear a strong technomorphological resemblance to implements of the Cascade Phase 8000-4500 B.P. This suggests that the site's lithic resources may have been exploited as early as 8000 B.P. The paucity of diagnostic lithic material post-dating the Cold Springs Horizon 6000-4000 B.P. suggests non-utilization of these resources after 4000 B.P. The Stockhoff site served aboriginal folk as a major source of lithic raw material for approximately 4000 years.

Technological analysis revealed that over 70% of the implements are bifaces and biface fragments in various stages of reduction. Application of the stage concept to the bifaces resulted in the formulation of four sequential

stages of manufacture. A lithic replication experiment was conducted, and data generated tend to support the application of the stage concept to the bifacial material and detritus.

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# CHAPTER 1

## INTRODUCTION

The Stockhoff Basalt Quarry (35UN52) is located in the Blue Mountains of northeastern Oregon. The Stockhoff site lies along the north side of Interstate 80 North on a small tributary of Ladd Creek, approximately 19 km southeast of La Grande (Fig. 1).

The Stockhoff Basalt Quarry was first recorded in 1955 by Alan L. Bryan and Donald R. Tuohy during a survey of the proposed Pacific Northwest Natural Gas Pipeline route. Surface collection and excavation within the pipeline right-of-way resulted in the accumulation of 165 artifacts. Of these, 38 were recovered from a test excavation and were said to occur within the upper 30 cm of the modern meadow soil. A single radiocarbon sample obtained from the test excavation was assayed by the Phoenix Memorial Project. The sample yielded a radiometric age estimation of 2600 ± 200 years B.P. (Bryan and Tuohy 1960). Based on artifact morphology and the age estimation, the Stockhoff quarry was equated with the Rabbit Island I component of the "Walula Gap Phase" (Bryan and Tuohy 1960:489). The Walula Gap Phase (Crabtree 1957:118) parallels the late prehistoric Cayuse Phase of Plateau prehistory (Swanson 1962:48).

After analyzing the artifacts recovered from the quarry during the pipeline survey, Bryan and Tuohy reached certain conclusions regarding the site's function. Keeping with Kirk Bryan (1950) they believed that the majority of artifacts found at quarries were simple scrapers, choppers, broken knives and points produced on flakes, rather than large core technique bifaces made for export.

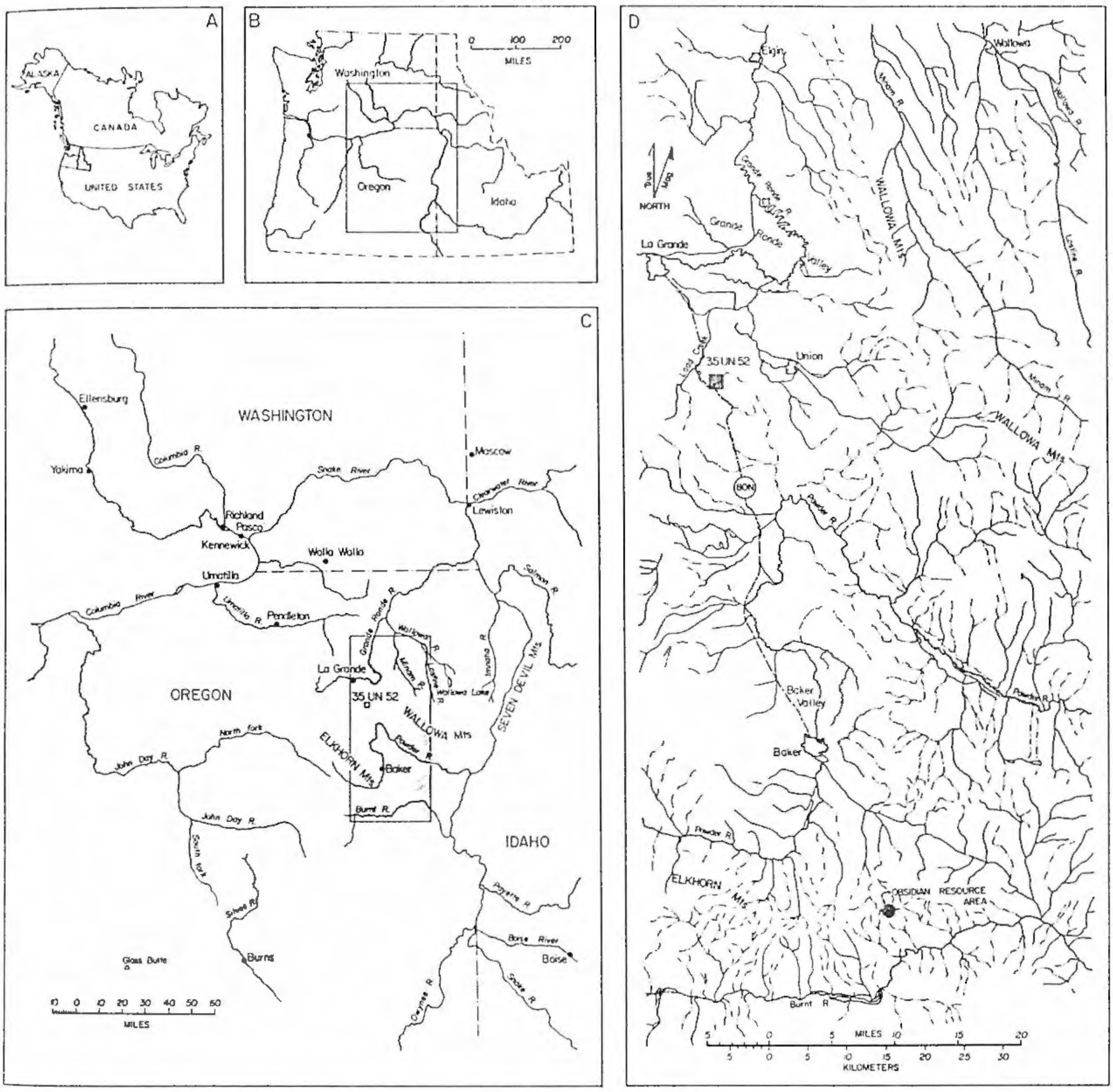


Fig. 1.--Site Location Map

As part of the pipeline survey, Bryan and Tuohy conducted an investigation throughout the general area of the quarry. These investigations revealed the presence of a supposed habitation mound about 60 m long, 30 m wide and 1½ m deep. Bryan and Tuohy (1960:489) state, "the mound may well hold the key to the cultural and chronological relationships of the area."

In the spring of 1975, Gene Stockhoff, who was then owner of the land, agreed to an excavation on the "habitation mound." Under the direction of Dr. George Mead and myself, the Eastern Oregon State College archaeological field school began test excavations on the mound. The objectives of the field methods class were as follows: (1) to determine whether or not the "habitation mound" was, in fact, a habitation mound, and (2) to establish the cultural and chronological relationships of the Stockhoff site with other sites in the Plateau, and (3) to provide archaeological field experience for field school students. Testing revealed the existence of a modern refuse dump rather than a prehistoric midden. Materials recovered in the test excavations included rusty wire cut nails, window glass, car springs and a 1948 Oregon automobile license plate. All test excavations on the mound were dug to sterile soil in hopes that the "habitation mound" might lie below the modern refuse deposits. However, this was not the case. In a further attempt to locate prehistoric cultural deposits on the mound eleven 2 m deep auger tests were made on the mound. No prehistoric cultural deposits were found beneath the modern refuse. After two days of testing, work on the so-called "habitation mound" was discontinued.

Saturated soil conditions caused by spring runoff in most of the quarry area prevented further excavation. Test excavation was discontinued and controlled surface collection was undertaken until the end of spring quarter. Test excavations on the mound failed to establish either cultural or chronological control at the site. However, extensive controlled surface collection by the field school did reveal the existence of numerous bipointed projectile points and knives, as well as edge-ground cobbles. Both bipointed projectile points and edge-ground cobbles are considered hallmark artifacts of the Cascade Phase (Leonhardy and Rice 1970:9). The Cascade Phase dates from approximately 8000 to 4500 B.P. (Leonhardy 1975). The occurrence of Cascade-like material at a quarry which had previously been assigned to the late prehistoric, strongly indicated a need for further investigation.

During the early part of June, 1975, the site was visited by Dr. Frank C. Leonhardy and Guy Muto of Washington State University. Dr. Leonhardy suggested further test excavation for the coming summer. In the summer of 1975 a test excavation was conducted by myself. This master's thesis is an outgrowth of the data obtained from the test excavation combined with data from the controlled surface collection recovered by the 1975 Eastern Oregon State College archaeological field school.

### *The Problem*

As stated above, Bryan and Tuohy (1960) were the first professional archaeologists to investigate the Stockhoff site. As a result of the investigation certain conclusions regarding the site were reached. The quarry was equated with the Walula Gap Phase of Plateau prehistory (Crabtree 1957:118) and assigned a radiometric age estimation of 2600 ± 200 B.P. (Bryan and Tuohy 1960:489).

Conclusions were reached regarding the function of the Stockhoff site based on Bryan and Tuohy's analysis of the artifacts recovered during the survey. Bryan and Tuohy believed that simple flake tools such as choppers and scrapers were the primary implements manufactured at the Stockhoff site.

The research conducted by myself negates Bryan and Tuohy's 1960 conclusions regarding both chronology and technology. The occurrence of cultural material resembling that of the Cascade Phase (Leonhardy and Rice 1970:9) both above and beneath a Mazama tephra layer makes Bryan and Tuohy's chronological placement of the Stockhoff site within the late prehistoric period more than suspect. The recovery of 671 artifacts from the quarry, 520 of them bifaces, conflicts with Bryan and Tuohy's conclusions regarding technology and site function. It would seem that bifaces rather than simple flake tools such as choppers and scrapers were the primary implements manufactured at the quarry.

Since Bryan and Tuohy's (1960:503-504) conclusions regarding the technological function and chronology of the Stockhoff site are no longer valid, my objectives are two-fold: (1) to provide an adequate description and interpretation of the technology reflected in the lithic implements and chipping detritus recovered from the quarry, and (2) to place the quarry within the chronological framework of Plateau prehistory. Contained within each of these objectives, particularly the first, are a number of problems.

The lithic assemblage recovered from the quarry is characterized by a predominance of bifacially worked basalt implements exhibiting an extreme degree of variation in size and particularly degree of refinement. The variation exhibited by these bifaces appears to represent sequential stages of manufacture in a biface reduction system. The majority of the chipping detritus recovered in surface collection and excavation at the quarry appears to have been derived from the manufacture of the bifaces. There is also evidence which suggests that a "levallois-like technique" (Muto 1976) may have been used in the manufacture of some of the bifaces. The problems contained within the first objective, the description and interpretation of the technology reflected in the assemblage are as follows:

1. To demonstrate the existence of a biface reduction system at the quarry.
2. To define that system.

3. To demonstrate the relationships of the chipping detritus to the biface reduction system.

4. To demonstrate the existence of a "levallois-like" reduction system at the quarry.

5. To define the system.

The problems contained within the second objective, the chronological placement, of the Stockhoff site within the framework of Plateau prehistory are as follows:

1. To demonstrate the existence of a time stratigraphic marker of known age at the quarry.

2. To demonstrate that the Cascade-like lithic material recovered from the quarry bears a strong technomorphological resemblance to Cascade lithic materials of known age.

### *Significance of the Study*

The construction of numerous hydroelectric power plants along the Snake and Columbia Rivers within the last two decades has led to rather extensive archaeological salvage operations. The result has been that archaeological research in the Southern Plateau has been focused on the rivers while the mountainous regions have been ignored. The written prehistory of the Southern Plateau is therefore heavily biased towards the Snake and Columbia Rivers and their primary tributaries. If the prehistory of the Plateau is to be fully understood the mountainous regions must be investigated, for there should be little doubt that they formed an integral part of aboriginal subsistence patterns. This is evidenced at the Stockhoff Basalt site which is an upland site located in the Blue Mountains. The quarry appears to have served as a major source of lithic raw materials to aboriginal Plateau populations. The Stockhoff site can by no means supply all the missing data, however it can provide an archaeological insight into a region which is relatively uninvestigated as well as providing a data base for further research.

The lithic implements recovered from the Stockhoff site bear a strong technomorphological resemblance to lithic implements recovered from Cascade components along the Snake and Columbia Rivers. The strong similarities exhibited by these implements suggest that early Archaic Cascade populations may have been responsible for the manufacture of the numerous basalt implements found at the quarry. If this is the case, then the Stockhoff site should provide Plateau archaeologists with an insight in the reductive strategies of early Archaic Cascade flintknappers which would otherwise be difficult to obtain. The Stockhoff site possesses lithic implements in almost every stage of manufacture whereas the more permanent Cascade sites along the rivers yield mostly completed lithic implements. The current study should also provide an insight into an aspect of stone tool manufacture which is usually lacking in habitation sites: the failures and mistakes made by the flintknapper during the manufacturing process. Because the manufacture of a stone tool is a subtractive process (Muto 1971a:111), mistakes made by the flintknapper will not often be preserved. If lithic raw materials are in relatively short supply, the flintknapper will not discard a piece of lithic raw material because of a mistake. He will either correct the mistake or modify the implement, in which case the mistake may no longer be visible. At the Stockhoff site tool stone was extremely abundant. If the flintknapper made a mistake he might make a few attempts at correcting it. If his attempts at correcting the mistake failed he could simply discard the problematic piece and begin anew. At the Stockhoff site the flintknapper's mistakes as well as his attempts at correction have been preserved on the implements which were discarded.

Both Cascade-like lithic implements and a Mazama tephra deposit occur at the quarry. The Cascade-like lithic material suggests relationships with the Stockhoff site and early Archaic sites along the Snake and Columbia Rivers.

The Mazama tephra deposit serves as a time stratigraphic marker for occupation of the site. The occurrence of diagnostic artifacts in almost every stage of manufacture occurring at a major upland quarry in a relatively uninvestigated area should prove to be a significant contribution to the prehistory of the Plateau.

*Site Description*

The exact physical limits of the Stockhoff Basalt site are presently unknown. A description of the site will be limited to the area surveyed by myself. The area surveyed covers approximately 400 acres (Fig. 2).

The topography of the site is varied. It occupies elevations ranging from 1098 m to 1280 m above sea level. A small perennially flowing tributary of Ladd Creek traverses the site. Downcutting by the small westwardly flowing creek has resulted in the formation of a small stream-cut canyon in the north-eastern portion of the site. In this area of the site the slopes of the canyon are rather steep, rising 91 vertical m in less than .4 km. Both the north-facing and south-facing slopes of the canyon are characterized by vertical exposures of Columbia River basalt. Dense, fine-grained basalt cobbles occur in colluvial deposits on the south-facing slope. On the south-facing slope the occurrence of the fine-grained cobbles is extensive from 1189 m to 1280 m above sea level. The fine-grained basalt occurs in boulder form in sporatic clusters along the ridge top of the south-facing slope. The north-facing slope produces cobbles sporadically and does not appear to have been utilized in the manufacture of the artifacts; whereas, aboriginal use of the cobbles was extensive along the south-facing slope. This is evidenced by the occurrence of large amounts of chipping waste and by the occurrence of large biface blanks (Fig. 3).

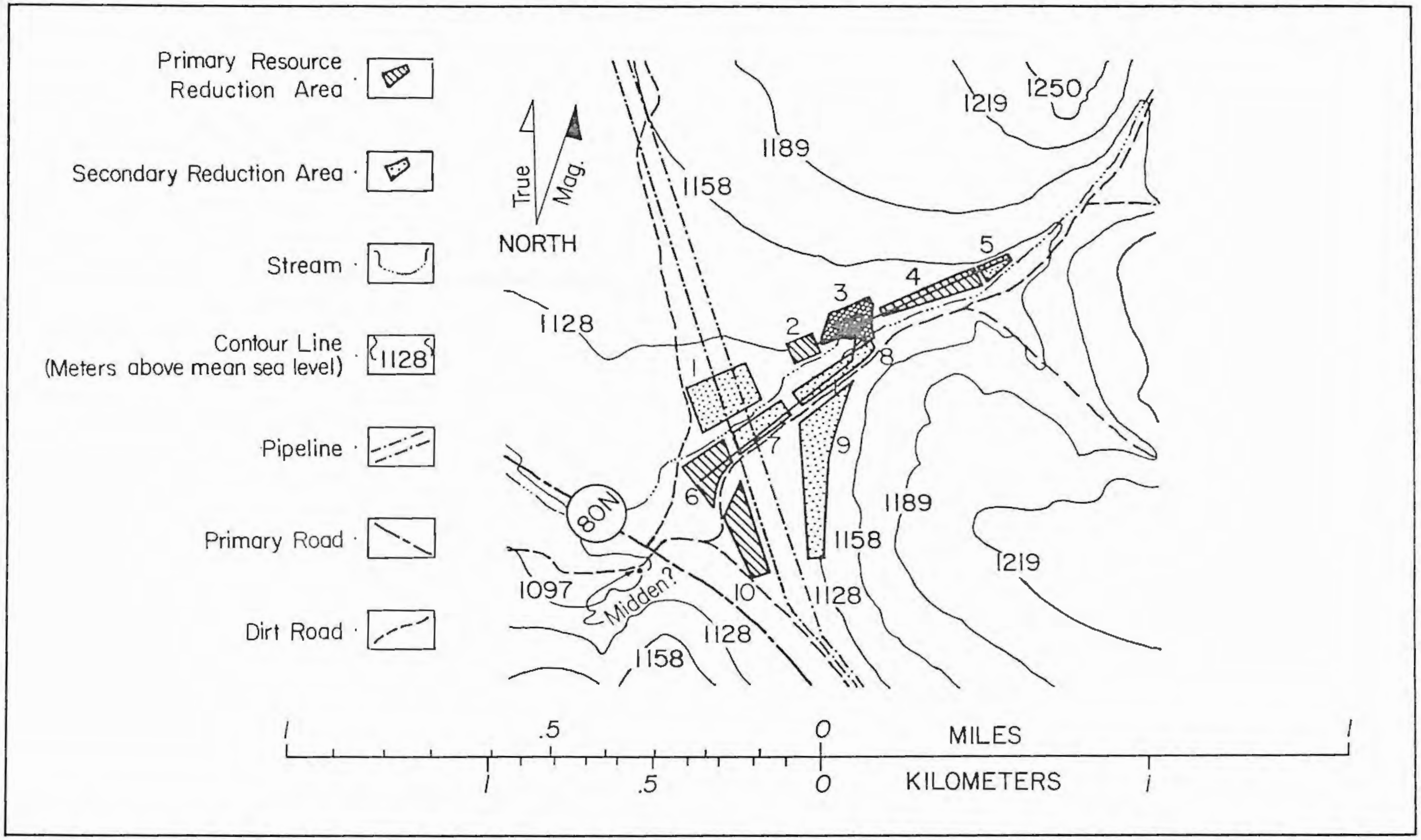


Fig. 2.--Map of 35UN52 Site Locality. Test excavation located in Area 3.

Fig. 3.--Primary Reduction Area

At the mouth of the canyon the south-facing slope becomes more gradual. Continuing in a westerly direction, the south-facing slope decreases in steepness until it merges with relatively flat alluvial deposits which lie a short distance beyond the mouth of the canyon. Fine-grained basalt cobbles continue to occur in colluvial deposits on the south-facing slope.

At the mouth of the canyon the north-facing slope turns abruptly southeast. Unlike the north-facing slope, the south-facing slope decreases little in the degree of steepness. Deposits of fine-grained basalt cobbles do not occur on the south-facing slope in this portion of the site.

Two terraces are set within the mouth of the tributary canyon. They occur as an upper and lower terrace on both the north and south sides of the tributary stream. On the north side of the creek the terrace deposits are quite extensive while the south side houses a remnant portion. An upper and lower terrace parallel the creek for approximately 300 m. Numerous basalt artifacts were recovered from the surface of these terraces. The excavation, which will be described later, was located on the lower terrace near the mouth of the canyon (Fig. 2, Area 3).

Beyond the mouth of the canyon a large broad alluvial fan occurs. The fan extends approximately 400 m in a westerly direction until it abuts Interstate 80 North. At its toe the alluvial fan is approximately 400 m wide. The small, perennially flowing tributary stream responsible for the formation of the alluvial fan now flows in a westerly direction across the northern edge. During the spring the entire southern portion of the fan becomes waterlogged. This condition appears to be caused by spring seeps emanating from the south-facing slope. Near the western end of the fan, fine-grained basalt cobbles occur in lag concentrate deposits. These lag deposits cover an area of approximately 10 acres.

Numerous large biface blanks occur in association with lag deposits. As with the slope deposits, completed artifacts are rarely found in the lag concentrates. The occurrence of completed forms is for the most part limited to the terrace deposits and areas adjacent to the creek. The highest concentration of completed forms was found in the south side of the creek in an area approximately 30 m wide near the mouth of the canyon and running parallel to the creek for approximately 400 m (Fig. 2, Areas 7 and 8).

Deposits at the western end of the alluvial fan have been disturbed by recent construction of a four-lane freeway. Construction of Interstate 80 North literally obliterated the western end of the site. The construction of haul roads and barrow pits further disturbed this part of the site. The western end of the site was also affected by construction of the Pacific Northwest Natural Gas Pipeline. The pipeline crosses the western end of the site in a north-south direction. The pipeline route is plainly visible and is marked by a mound approximately ½ m high and 3 m wide extending across the entire western portion of the site.

Aerial photographs taken in 1962 reveal that portions of the alluvial fan south of the creek were under cultivation. According to Mr. Stockhoff, portions of the alluvial fan which lie along the south side of the creek were used to grow hay at the time the aerial photographs were taken. This locality yielded the majority of completed artifacts. At present the land on which the quarry lies is utilized as summer grazing range for cattle.

## *Physiography*

Physiographically, the Stockhoff Basalt Quarry (35UN52) is within the Blue Mountains section of the Columbia Intermontane Province (Freeman, Forrester, and Lupher 1945). The Blue Mountains section trends east from northcentral Oregon into western Idaho, and is composed of numerous individual ranges. From west to east these ranges are the Ochoco, Aldrich, Strawberry, Greenhorn, Elkhorn, Wallowa, and Seven Devils Mountains. The greatest relief is found in the eastern end of the Blue Mountains Province in the Wallowa Mountain Range. The highest peaks in the Wallowas rise as much as 2744 m.

The Blue Mountains Province forms a division between the Columbia Plateau Province to the north and the Basin and Range Province to the south. The Blue Mountains rise sharply from the Columbia Plateau and merge gradually with the higher plateaus to the south.

The major rivers draining the province are the John Day, Grande Ronde, Imnaha, and Powder Rivers. The John Day River, with its many tributaries, drains the western half of the Blue Mountains and empties into the Columbia in the north. The Grande Ronde, Imnaha, and Powder Rivers drain the eastern portion of the Blue Mountains and empty into the Snake River. The more gently sloping south face of these mountains is drained mainly by seasonally flowing streams which empty eventually into depressions in the Basin and Range Province.

The geology of the Blue Mountains is quite complex. Late Paleozoic and early Mesozoic sedimentary deposits were intruded by igneous bodies during the late Triassic Period, resulting in minor uplift and deformation of the sedimentary deposits. During the Cretaceous these already complex formations were intruded by two major granitic batholiths, the Wallowa and Bald Mountain batholiths. The implacement of these large granitic bodies appears to have triggered a major orogeny which continued late into the Cenozoic Era, at least as late as the Miocene Epoch. Uplift of the Blue Mountains to their present elevation probably occurred prior to the onset of the Pleistocene Epoch. This is confirmed by the occurrence of numerous alpine glacial features common to the higher elevations of the Blue Mountains.

A discussion of the Columbia River Basalts is of particular importance to the understanding of the area surrounding Stockhoff site as well as the site itself. During the Miocene Epoch portions of Oregon, Washington, and Idaho were covered by successive flows of Columbia River basalt which in some areas reach depths of approximately 600 m (Baldwin 1959). These flows did not originate from volcanoes but were extruded from long fissures or cracks fed by large subsurface reservoirs of magma. The fissures and reservoirs from which the Columbia River basalts originated were not randomly distributed throughout the area now covered by Columbia River basalt. The fissures and reservoirs were relatively localized and related to specific dike swarms. The Stockhoff site lies in close proximity to the heart of the Chief Joseph Dike Swarm (Gilmour 1970), located near Enterprise, Oregon. As the giant reservoirs which feed the dike swarms were emptied, the support for the overlying strata was decreased. This decrease in support combined with the added weight of the extruded basalt appears to have resulted in down faulting of the strata overlying the now empty magmatic reservoirs (Kendal Baxter, personal communication). The result was the formation of a series of faulted or graben valleys. The nearby Grande Ronde and Baker Valleys are two such graben valleys.

The Stockhoff site lies on a block of Columbia River basalt separating the two graben valleys, the Grande Ronde and Baker Valleys. This basalt block has been dissected by stream erosion and serves to divide the drainages of the two valleys.

> The spur, some ten to fifteen miles wide, extends in a northeasterly direction until it merges imperceptibly with the foothills of the Wallowa Range. It does not attain the great heights of the mountains it connects, which often reach elevations of 8,000 feet or more, but it does rise some 4,000 feet above sea level, and 300 to 500 feet above the general level of the two river basins flanking it. Although it is a relatively low relief feature, it divides the drainage of the Powder River to the southeast from that of the Grande Ronde River to the northwest [Bryan and Tuohy 1960:487].

The Grande Ronde Valley (Fig. 1) located approximately 16 km northwest of the Stockhoff site deserves special attention. There is some evidence which suggests that the valley may have been partially covered by a shallow lake.

Kocher (1926) noted that much of the Grande Ronde Valley's soil appears to be reworked lacustrine sediments. Long time residents of the valley speak of rowing boats across the southeastern end of the valley from the Hot Lake to Union, a distance of approximately 6 km. The southeastern end of the valley is presently an uninhabitable marsh which has been set aside as a federal water fowl refuge. If the Grande Ronde Valley was in fact a lake it may have contributed significant quantities of fish and water fowl as well as other lacustrine resources to aboriginal Plateau populations. A lake in close proximity to the Stockhoff site would have served as an added incentive for the exploitation of lithic resources available at the quarry.

The Stockhoff site is situated along both sides of a perennially flowing stream which has cut into a block of Columbia River basalt. Downcutting by the stream has resulted in the formation of a small stream-cut canyon. Numerous flows of Columbia River basalt have been exposed along both sides of the canyon. One or more of these flows is the source of the fine-grained basalt which served as a major source of lithic raw material.

The cobbles from both colluvial and lag deposits are generally tabular and are only moderately rounded. This indicates that the cobbles in both colluvial and lag deposits have undergone little transportation.

A sample of the basalt was submitted to the Washington State University Department of Geology for analysis. Dr. Hooper, Chairman of the Department, identified the material as probably an andesite. The material is composed of sodic plagioclase feldspar, oligioclase feldspar and pyroxene phenocrysts encompassed in a silicate glass ground-mass. Orientation of the crystals within the ground-mass indicates that this material is of flow origin. Dr. Hooper (personal communication) suggests the flow represents a brief localized outpouring of andesitic lavas occurring at the same time that the more common Columbia River basalts were extruded.

Lithic material occurring at the quarry has been consistently referred to as basalt in the literature. Whether the material is called andesite or basalt bears little relationship to the flakeability of the stone and will continue to be referred to as basalt.

*Environment*

The purpose of this section is to provide the reader with a general understanding of the environment in which the Stockhoff site is located. A partial listing of the flora and fauna presently existing at the Stockhoff site is presented and may represent resources which would have been available to aboriginal populations occupying the site.

The Stockhoff site lies within the semiarid subdivision of the Transition Zone.

> The semiarid division of the Transition Zone as marked by the yellow pine forests covers the broad basal slopes east and south of the Cascades and the extensive plateau levels of the Blue Mountain section [Bailey 1936:22].

The semiarid subdivision occupies elevations ranging from 600 to 1800 m above sea level. Climatic conditions throughout the semiarid subdivision of the Transition Zone are quite similar, with an average annual rainfall of approximately 50 cm (Bailey 1936).

By mid-December the site is generally covered by a mantle of snow. During the winter months temperatures fall well below freezing. Due to the topography and location of the site, high winds and drifting snow are not uncommon occurrences. Snow storms continue well into May. Snowbanks and drifts remain on the north-facing slopes until late June. Summer temperatures above 105° F have been recorded at the quarry. However these are unusually high temperatures for the area. Normal daytime summer temperatures seldom climb above 80° F.

The types of vegetation occurring at the Stockhoff site are as varied as the topography. Growing on the north-facing slope are stands of Western larch (*Larix occidentalis*), Ponderosa pine (*Pinus ponderosa*), Lodgepole pine (*Pinus contorta*), and Spruce (*Picea*). The south-facing slope lacks forest cover. The vegetation which predominates on the south-facing slope consists of various species of the family Graminaceae. The area in which the Stockhoff site lies falls within the bunch grass section (Peck 1925). According to Peck, grasses common to this section are *Agropyron spicatum, Festuca idahoensis,* and *Poa secunda.*

The types of vegetation which occur along the creek are various species of willow (*Salix*) and wild rose (*Rosa*). Trees growing along the creek are Ponderosa pine ( *Pinus ponderosa*), Mountain alder (*Allium oregona*), and Cotton-wood (*Populus*). Wild onion (*Allium douglasii*) grows along the lower portions of the south-facing slope near the creek.

The predominant vegetation growing on the alluvial fan is bunch grass, i.e., *Agrogpyron, Festuca,* and *Poa.* Common Camas (*Camassia quamash*) grows in the wetter areas of the alluvial fan.

Mammals, birds and reptiles occurring within the general vicinity of the Stockhoff site are those which are characteristic of the semiarid division of the Transition Zone (Bailey 1936:31). Mammals of the order Artiodactyla common to the area are Rocky Mountain elk (*Cervus Canadensis roosevelti*), Rocky Mountain mule deer (*Odocoileus hemionus macrotis* ), and yellow-tailed deer (*Olocoileus virginianus ochrourus*). Mammals of the order Carnivora occurring in the area are Rocky Mountain cougar (*Felis concolor hippolestes*), Rocky Moun-tain bobcat (*Lynx rufus vinta*), Mountain coyote (*Canis latrans lestes*), North-western raccoon (*Procyon lotor pacifica*), California badger (*Taxidea taxus neglecta*), Great Basin skunk (*Mephitis occidentalis notata*). Mammals of the order Lagamorpha include the Blue Mountain cony pika (*Shisticepts jewetti*). Smaller mammals of the order Rodentia commonly found in the vicinity of the Stockhoff site include the Golden-manteled ground squirrel (*Callospermophilus chrysodeirus*) and Yellow-bellied chipmunk (*Amoenus luteiventris*).

Birds occurring in the vicinity include the Canada ruffed grouse (*Bonasa umbellus togata*) and the Eastern bobwhite (*Colinus virginianus*). Birds of prey include the Western red-tailed hawk (*Buteo borealis calurus*) and Cooper's hawk (*Accipiter cooperi*).

Reptiles commonly occurring at the Stockhoff site include both snakes and lizards. Pacific garter snakes (*Thamnophis sirtalis infernalis*) are frequently seen in the creek which traverses the site. Pacific rattlesnakes (*Crotalus oreganus*) are reported to have been seen in the rockier areas of the site. Western blue-bellied lizards (*Sceloporus occidentalis biseriatur*) are numerous in slope deposits of the south-facing slope.

# CHAPTER 2

# FIELD METHODS

The cultural material recovered from the surface was acquired through both controlled and uncontrolled collection. Those materials recovered in an uncontrolled manner were collected by various undergraduate students from Eastern Oregon State College. Artifacts collected in this manner have been labeled as general surface finds. While the exact provenience of the artifacts is not known, they appear to be representative of those recovered during later controlled surface collection.

## *Surface Collection*

To obtain controlled surface collections a steel datum was established in the western end of the alluvial fan. Using a transit, a transect was established across a major portion of the quarry. Wooden stakes were placed at 30 m intervals for 1230 m. Each stake was labeled with its distance from the datum. The transect was situated so that it crossed lag deposits, alluvial deposits, and colluvial deposits (Fig. 2). Within each deposit concentrations of artifacts were selected for controlled surface collection. Collection was limited to the area between the stakes and 3 m on either side of the transect. When collecting in alluvial deposits, all flaking detritus and artifacts were collected. When collecting in slope and lag deposits, all artifacts and flakes showing signs of work were collected. Because of the vast amount of detritus occurring in slope and lag deposits, all flakes were not collected. However, the nature and types of flakes occurring were recorded. Artifacts and detritus were bagged and labeled with their location within the transect.

Surface collection was later expanded to include a much greater portion of the site. Ten areas were defined and collected from. They are labeled as Areas 1 through 10 (Fig. 2). These areas are not precisely defined. Some of the areas possess definite boundaries such as fence lines, roads, or creek edge. Others are defined on such criteria as topographic location and the types of deposits on which they occur.

*Excavation*

In an attempt to establish chronological control at the quarry, a test excavation was conducted. The test excavation was located on the lower terrace on the north side of the creek near the mouth of the tributary canyon. The excavation was located on the terrace since it appeared to represent an area of maximum alluvial deposition. A rectangular grid system consisting of ten 3x3 m squares was laid out on the terrace. The long axis of the grid was oriented in north-south direction. The squares were labeled 1 through 10. Each 3x3 square was then divided into two 1.5x3 m squares forming an "A" and a "B" section for each pit. Excavation was limited to pits 6-A and 6-B (Fig. 2). Horizontal control was maintained by taking two measurements, one from a latitudinal line, the other a longitudinal line. Each line was assigned a specific numerical designation. In order to maintain vertical control a datum was established on the northern end of the dividing line separating pit 6-A and pit 6-B. Vertical measurements for both pit 6-A and 6-B were taken from this datum. The datum was assigned an arbitrary elevation of 30 m.

Because of the nature of the soil, physical stratigraphy was not visible while the soil was in a wet state. The excavation was carried out using arbitrary 15 cm levels. The first five levels in pits 6-A and 6-B were removed using hand trowels and flat-nosed shovels. Both horizontal and vertical measurements were taken for all artifacts with the exception of a few smaller projectile points recovered in screening. All back dirt from the first five levels in both 6-A and 6-B was screened through a ¼ in mesh screen. All flaking detritus was collected. Concentrations of flaking detritus within each level was recorded. In level 6 of both pits clay was encountered. The clay could not be screened in a wet state nor could it be removed with a hand trowel. After brief exposure to the air, the clay hardened, forming a very hard surface. Removal of the clay was an extremely slow process which required the use of an entrenching tool and a small pick. Only small amounts of the clay could be removed at a time. Therefore, there was little difficulty in noting the exact provenience of the artifacts occurring in the clay. All flaking detritus which could be seen was collected. Smaller flakes which remained within the matrix of the clay were not recovered.

The northern end of pit 6-A was excavated to a depth of 3 m. Excavation in pit 6-B was discontinued at a depth of 120 cm.

No organic material, such as wood or bone, was encountered during the excavation. Minute fragments of charcoal were found sparsely scattered throughout all levels. Due to the small amount and random occurrence, charcoal was not collected. No features were encountered during the excavation. Prior to back filling, profiles were drawn of the north and east walls of pit 6-A. The physical stratigraphy of the north wall of pit 6-A was photographically recorded. A gross description of the physical stratigraphy was then made. Two soil monoliths were taken from the north wall of pit 6-A to obtain a more complete record of the physical stratigraphy. These monoliths represent a cross section of the entire vertical profile exposed during excavation. The monoliths were analyzed and a detailed formal description of the physical stratigraphy was completed (Appendix B).

Before backfilling, a permanent metal datum stake was driven into the northern end of the excavation, and assigned an arbitrary elevation of 100 m

(Fig. 2). Using the arbitrary datum as a point of reference the horizontal limits of the excavation and the terrace on which the excavation was located was mapped using ½ m contour intervals. Contour elevations were either added to or subtracted from the 100 m arbitrary datum.

The excavation units were lined with plastic so they could be located in the event of further work at the site. The units were then backfilled.

# CHAPTER 3

## ANALYSIS AND DESCRIPTION OF BIFACE TECHNOLOGY

### *Introduction*

The lithic assemblage recovered in surface collection and excavation at the Stockhoff site is characterized by a predominance of bifacially worked implements made from fine-grained andesitic basalt or andesite. For definitions of flintknapping terms used in this section, see Appendix A. Of the 671 artifacts recovered from the site, 77% are bifaces and biface fragments. Complete bifaces range from 100 mm to 375 mm in length and from 6 mm to 74 mm in thickness. The bifaces are characterized by what appears to be substantial variations in workmanship. At one extreme the biface may be crudely thinned and shaped with cortex on one or both surfaces and an asymmetrical outline both in longitudinal and plane views. At the other extreme the biface may be finely thinned and shaped possessing a very symmetrical bipointed outline. Between these extremes the bifaces can be seen grading technologically and morphologically from crudely worked forms to finely thinned symmetrical bifaces. I contend that: (1) the extreme variation in what appears to be degree of workmanship actually represents stages of biface manufacture, and (2) the majority of the bifaces found at the quarry represent bifaces which were rejected or broken during various stages of manufacture.

Renaud (1936) and Davis, Brott, and Weide (1969), when analyzing assemblages similar to the Stockhoff biface assemblage, tended to equate stages of manufacture, particularly the early stages, with finished implements. After analyzing bifaces, blanks, and preforms from various quarries and workshops in Wyoming, Renaud (1936) equated these unfinished forms with European Paleolithic coup de pong hand axes. Davis et al. (1969) compared lithic materials from the Panamint Valley basalt quarry in California against quarry and workshop materials from Arizona, Nevada and Wyoming, and formulated the "western lithic co-tradition" (Davis et al. 1969:11). This co-tradition was based primarily on similarities in the morphology of quarry blanks. Both Renaud (1936) and Davis et al. (1969) failed to recognize the early stages of stone tool manufacture.

In the late 1800's Holmes (1890) recognized the significance of the extreme variation in degree of refinement seen in bifaces from quarries. Holmes believed that the variation in degree of refinement seen in these implements could be equated with stages of manufacture. After examining over 1700 bifaces from a quarry in the District of Columbia, Holmes (1890:11) formulated three stages of implement manufacture based on degree of refinement. He believed that most of the bifaces represented in each stage were either broken or rejected during manufacture. After carrying out experiments involving replication of the manufacturing sequence Holmes concluded:

> I have found that in reaching one final form I have left many failures by the way, and that these failures duplicate, and in proper proportions all the forms found upon the site.
>
> I further find by these experiments, and the fact is a most important one, that every implement resembling the final form here described made from a boulder or a similar bit of rock must pass through the same or much the same stages of development [Holmes 1890:13]

Further investigations by Holmes (1919) of quarries and workshops throughout the eastern portion of the United States and Central America tended to confirm the earlier conclusions. Holmes noted the repeated occurrence of quarry and workshop assemblages characterized by a pronounced degree of variation in biface elaboration.

More recently, Sharrock (1966) analyzed numerous quarries and workshops characterized by a predominance of bifacially reduced implements and relied heavily on the biface reduction stage concept for his interpretation of these materials. Using criteria such as presence or absence of cortex, thickness of cross section, width-thickness ratio, degree of sinuation of the edge, and degree of symmetry of the outline, Sharrock (1966:43-46) formulated five sequential stages of biface manufacture. Sharrock states:

> The categories used in this report for classifying quarry and workshop chipped stone blanks are neither completely artificial, bearing little or no relationship to reality, nor are they types, according to the definition of a type as a category that corresponds with a cultural trait (Krieger 1944). Rather quarry and workshop chipped stone blanks are here segregated on the basis of numerous criteria into manufacturing stages that are, it is hoped, valid in that they roughly represent actual steps or stages in the aboriginal's chipping process [Sharrock 1966:36].

Sharrock further states:

> In sum, refining stone by the method of chipping from larger cobbles to smaller and thinner objects can best be done by stages.
>
> To summarize, any stone-be it a quartzite block or flake, a quartzite cobble, or a chert block or flake-to be reduced to a small symmetrical object, must be refined by removal of the outer surface of the blank, layer by layer with successively finer flaking as the blank becomes thinner and smaller. To reduce a typical Lyman surface cobble to a small, thin blade perhaps 2 in. long by 1 in. wide evidently could not be done in fewer than five stages [Sharrock 1966:40].

Sharrock notes, however, that a flake may enter the manufacturing sequence at a latter stage if it approximates the desired end product in length and thickness.

Unlike many archaeologists working in the 1960's, Sharrock included the chipping detritus from one of the workshops in his analysis. The chipping detritus was separated into three general categories, primary, secondary, and tertiary flakes, which were then roughly equated with stages of biface manufacture. Primary flakes were associated with stages I and II; secondary flakes were associated with stages III, IV, and V; and tertiary flakes were believed to have been pressure flaked from stage V bifaces.

Muto (1971*a*) analyzed a number of bifaces from the Simon site cache (Butler 1963) and bifaces from the Spring Creek cache and Braden burial site not previously reported in the literature. The majority of these bifaces had previously been classified as finished implements such as knives. In his analysis of this material, Muto recognized most of the bifaces as representing sequential stages of biface manufacture. Muto (1971*a*:111) notes that most taxonomic and typological classification systems are geared to the classification of finished implements, a system which tends to obscure the early stages of stone tool manufacture. In the case of the Simon site material, Muto states:

> A progression of preforms showing a manufacturing sequence toward the large Clovis points, was hidden by the typological assumption which called for finished types. The preforms were identified as knives [Muto 1971*a*:111].

Muto further states:

> A reduction technology such as flintknapping by its nature produces a series of stages antecedent to the final form of each implement produced. In an extreme since each flake removed from the piece of raw material is a stage of manufacture [Muto 1971*a*:111].

The works of Holmes (1890-1919), Sharrock (1966), and Muto (1971*b*) indicate the applicability of the reduction stage concept to assemblages characterized by a predominance of bifacially worked materials. The breakdown of a bifacial assemblage into sequential stages gives insight into both morphological and technological changes which occur during the manufacture of a biface. For this reason I have applied the reduction stage concept to the Stockhoff bifacial materials.

Application of the criteria developed by Sharrock (1966:43-46) and criteria developed by myself to the Stockhoff bifacial materials has resulted in the formulation of four sequential stages of manufacture. The criteria applied by myself in addition to those developed by Sharrock (1966) are: (1) application of pressure retouch, and (2) the manufacture of a hafting element. All eight criteria have been applied in formulating the four sequential stages of biface manufacture.

In keeping with Sharrock (1966), the stages are not to be equated with categories that correspond to cultural traits. They are thought to represent stages through which a biface passes during manufacture. I am aware that the manufacture of a biface represents a continuum in which each stage represents a segment. Any stage may be somewhat arbitrary as a series of bifaces can grade into a stage above or below; however, I suggest these stages approximate actual steps in the manufacturing process. Muto (1971*b*) presents a brief description of the manufacturing process:

The process of manufacture is in general as follows:
1. selection of nodule or flake of adequate size to produce the finished implement,
2. selection of fabricator,
3. removal of the rind from the nodule,
4. thinning of the objective piece to the approximate section and cross section,
5. finishing the edge and hafting mechanism if any [Muto 1971*b*:48].

The four sequential stages of biface manufacture formulated by myself can be roughly equated with the last four steps in the above description of the manufacturing process:

1. Removal of the cortex or rind from a flake or cobble results in the formation of a stage I biface.

2. Thinning of the objective piece to the approximate section and cross section results in the formation of a stage II biface.

3. Securing the final outline and sections results in the formation of a stage III biface.

4. Finishing the edge, and hafting element if any, results in the formation of a stage IV biface.

It is important to note that all bifaces do not necessarily pass through each of the four stages of manufacture. A small percentage of the bifaces, particularly from stages II and III, appear to have been made on flakes approximating the thickness of a finished implement. This is evidenced by the occurrence of a remnant of the initial ventral flake scar occurring on finished artifacts, particularly small bifaces and projectile points. With only minimal thinning and shaping of a thin flake the initial stage or stages of manufacture would be skipped and the sequence entered at an advanced state of reduction. However, the majority of the Stockhoff bifaces appear to have been manufactured on large, relatively thick flakes and tabular cobbles and would have progressed through stages similar to the four stages formulated by myself.

The manufacturing process may be truncated at any stage of reduction for reasons other than breakage or rejection. A biface may be roughed out in one area of the quarry and then taken to another area to be further reduced. This is evidenced by the occurrence of predominantly primary flakes in some areas and secondary flakes in other. Bifaces may also be removed from the quarry to be finished at a later date. While no direct evidence for this type of activity exists at the Stockhoff site one can assume that it did take place. Sharrock (1966), Green (1972), and Ruebelmann (1973) have reported the occurrence of extensive workshops possessing bifaces in various stages of completion. In each of these instances the raw material was obtained in another locality and then transported to the workshops to be further reduced.

### *Biface Descriptions and Discussion*

Description of stage I bifaces (Fig. 4):

*Material:* Basalt

*No. of specimens:* 42 biface fragments
99 complete bifaces

*Dimensions of stage I biface fragments:*

| | *Range* | *Mean* |
|---|---|---|
| Length | 42 mm - 222 mm | 125 mm |
| Width | 10 mm - 160 mm | 76 mm |
| Thickness | 13 mm - 56 mm | 28 mm |

Stage I biface fragments are represented by tips of bifaces, bifaces lacking one tip, and bifaces broken through the mid-section.

Fig. 4.--Stage I Bifaces

*a-c* Plane view

*d* Longitudinal section view. Note sinuosity of the edge.

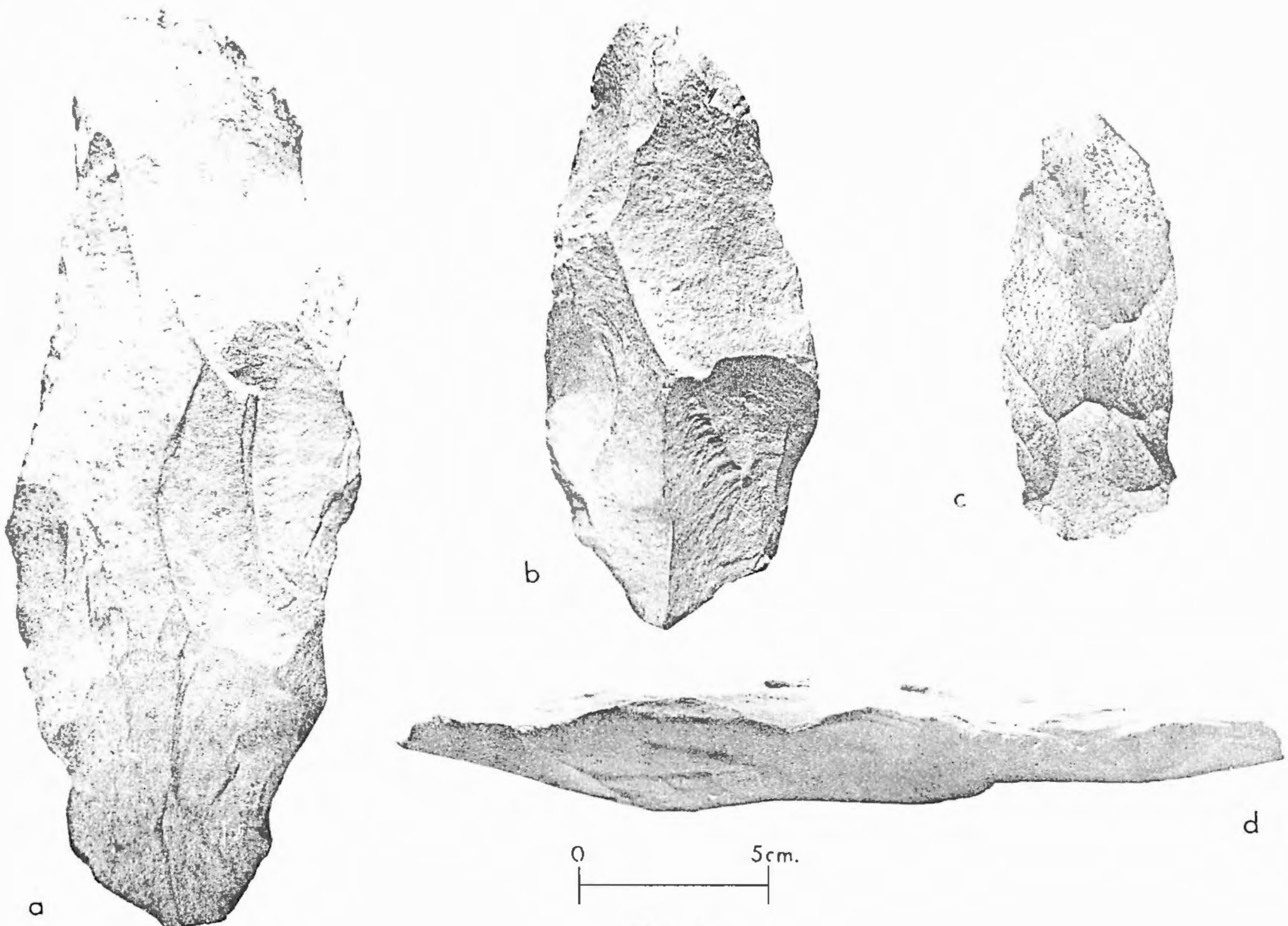


Fig. 4

*Types of fractures occurring on stage I biface fragments:*

| | | |
|---|---|---|
| End shock fractures | 29 | 69% |
| Perverse fractures | 13 | 31% |

*Dimensions of stage I complete bifaces:*

| | *Range* | *Mean* |
|---|---|---|
| Length | 100 mm - 375 mm | 195 mm |
| Width | 42 mm - 136 mm | 92 mm |
| Thickness | 17 mm - 74 mm | 33 mm |

*Mean thickness to width ratio:* 1:3

*Plane view:* Asymmetrical biconvex to parallel margins, points of bifaces are subrounded to acute; bifaces are lanceolate in outline.

*Longitudinal section:* In sectional view the margin is markedly sinuous.

*Cross section:* Generally asymmetrical biconvex to plano-convex.

*Flake scar pattern:* Irregularly flaked, may be flaked over the entire surface of both faces, or flaked overall on one face and only marginally flaked on the opposite face.

*Flake scar morphology:* Flake scars occurring on stage I bifaces are relatively deep and expanding. Flake scars may exhibit distinct undulations, radial striations, and salient accuminate negative bulbs of force. It is the occurrence of these deep salient, accuminate negative bulbs of force which produce the markedly sinuous edge characteristic of a stage I biface. Many of the flake scars terminate in step or hinge fractures (Crabtree 1972: 62-93).

*Presence of absence of cortex:* Cortex occurs on both faces of 13 stage I bifaces, and on one face of 44 stage I bifaces.

Discussion of stage I bifaces:

A few stage I bifaces were manufactured on thin tabular cobbles. This is evidenced by the occurrence of cortex on both surfaces of 13 stage I bifaces.

This type of reduction appears to have been secondary to flake reduction. Cobbles thin enough to be used in reduction are rare at the Stockhoff site; furthermore, cobble reduction requires the decortication of two surfaces rather than one which is the case with a flake. Experimentation by myself and others at the quarry indicates that the subangular cobbles are particularly well suited to biface manufacture. The angularity of the cobbles creates numerous natural platforms. Using the block on block technique (Crabtree 1970:48) which involves striking the natural platform of the cobble against an anvil, large flakes up to 40 cm in length and 3 cm thick are easily removed. Many of the larger basalt boulders occurring in colluvial deposits at the quarry exhibit signs of repeated battering on projections (Fig. 5). These projections may have served as anvils against which the natural platform of the cobbles were struck.

Large flakes obtained in this manner would be much easier to reduce than would an entire cobble. This, together with the fact that 34 stage I bifaces possess a remnant of the initial ventral flake scar, suggests that flake reduction was the predominant mode of manufacture. There is evidence to suggest that flakes may also have been removed using the Levallois-like Cascade technique (Muto 1976). This will be discussed in depth in Chapter 7.

The large expanding flake scars characteristic of most stage I bifaces may indicate that they may have served a dual function. Stage I bifaces may have served as flake cores while at the same time being reduced to functional bifaces. The flakes removed in thinning could be used in the manufacture of small knives and projectile points.

The flake scars occurring on stage I bifaces are deep and expanding, possess distinct negative, salient, accuminate cones of force, undulations and radial striation (Muto 1971*b*:76). Crabtree (1967, 1970), Muto (1971*b*),

Fig. 5.--Large Fine Grained Basalt Showing Signs of Repeated Battering. Note overlapping negative cone of force.

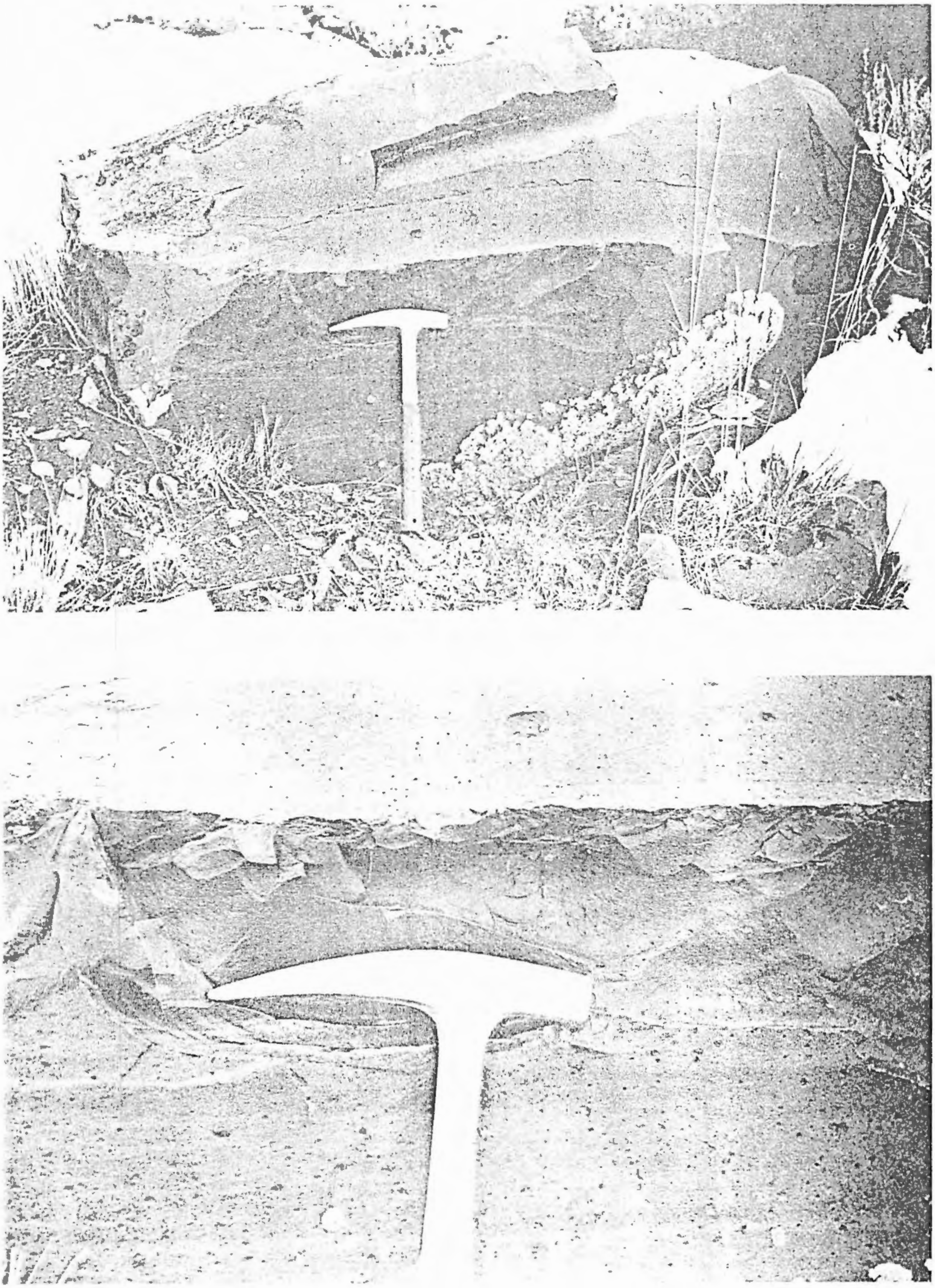

Fig. 5

Bucy (1974) and others have tended to equate these attributes with the use of hard hammers. These hard hammer attributes are consistently associated with stage I bifaces and decortication flakes recovered from the quarry. Hammer stones as hard as or harder than the basalt also occur at the quarry. This evidence when considered together is suggestive of the use of hard hammer percussion in the manufacture of a stage I biface.

Of the 141 stage I bifaces recovered from the quarry, 99 are complete and 42 are fragments. The majority of these bifaces possess accumulations of multiple step and hinge fractures (Muto 1971:60-61). Bucy (1974) in his analysis of the Midvale Basalt quarry states:

> Since it is slightly less flexible and more grainy than the glassier materials and yet is tougher to fracture, the worker must direct his blows straighter into the material, the work is subject to more breakage and particularly to step fractures which are difficult to recover. Because flow structure may interfere and impede flake removal and the recovery of errors, the development of step fractures may spell certain disaster to the tool maker using basalts [Bucy 1973:28].

Those bifaces which are unbroken probably represent bifaces rejected during manufacture. This would suggest that the aboriginal flintknapper recognized the point at which further reduction was no longer feasible, and simply discarded the biface.

Broken stage I bifaces possess either end shock fractures (Faulkner 1972:140) or perverse fractures (Muto 1971:72). Both types of fractures can occur during the manufacturing process, and are usually unintentional. End shock fractures are usually initiated at the end opposite the point of impact, and are usually caused by excessive force applied to the end of the biface. This usually results in the end of the biface being snapped off. Sixty-nine percent of the broken stage I bifaces possess end shock fractures, and the majority of these are biface tips. End shock fractures are transverse fractures occurring at right angles to the longitudinal axis of the biface.

Perverse or helical fractures are initiated at the point of impact along the lateral margin of the biface. Perverse fractures often result when attempts are made at clearing excessive mass resulting from stacked step or hinge fractures. Thirty-one percent of the broken stage I bifaces possess perverse fractures. Some fractures are transverse, but the majority are diagonal.

Stage I bifaces could be classified as blanks. At this stage of manufacture it is not possible to determine the intended form of the end product.

Description of stage II bifaces (Fig. 6):

*Material:* Basalt

*No. of specimens:* 17 complete bifaces
102 biface fragments

*Dimensions of stage II biface fragments:*

| | *Range* | *Mean* |
|---|---|---|
| Length | 20 mm - 156 mm | 130 mm |
| Width | 20 mm - 106 mm | 45 mm |
| Thickness | 5 mm - 35 mm | 28 mm |

Broken stage II bifaces are represented by the tips of bifaces, bifaces lacking one tip, midsections lacking both tips and bifaces broken through the midsection.

*Types of fractures occurring on stage II biface fragments:*

| | | |
|---|---|---|
| End shock fractures | 76 | 64% |
| Perverse fractures | 43 | 36% |

*Dimensions of stage II complete bifaces:*

| | *Range* | *Mean* |
|---|---|---|
| Length | 55 mm - 138 mm | 78 mm |
| Width | 26 mm - 56 mm | 35 mm |
| Thickness | 9 mm - 16 mm | 11 mm |

Fig. 6.--Stage II Biface Fragments

*a-c* Plane views

*d* Longitudinal section view

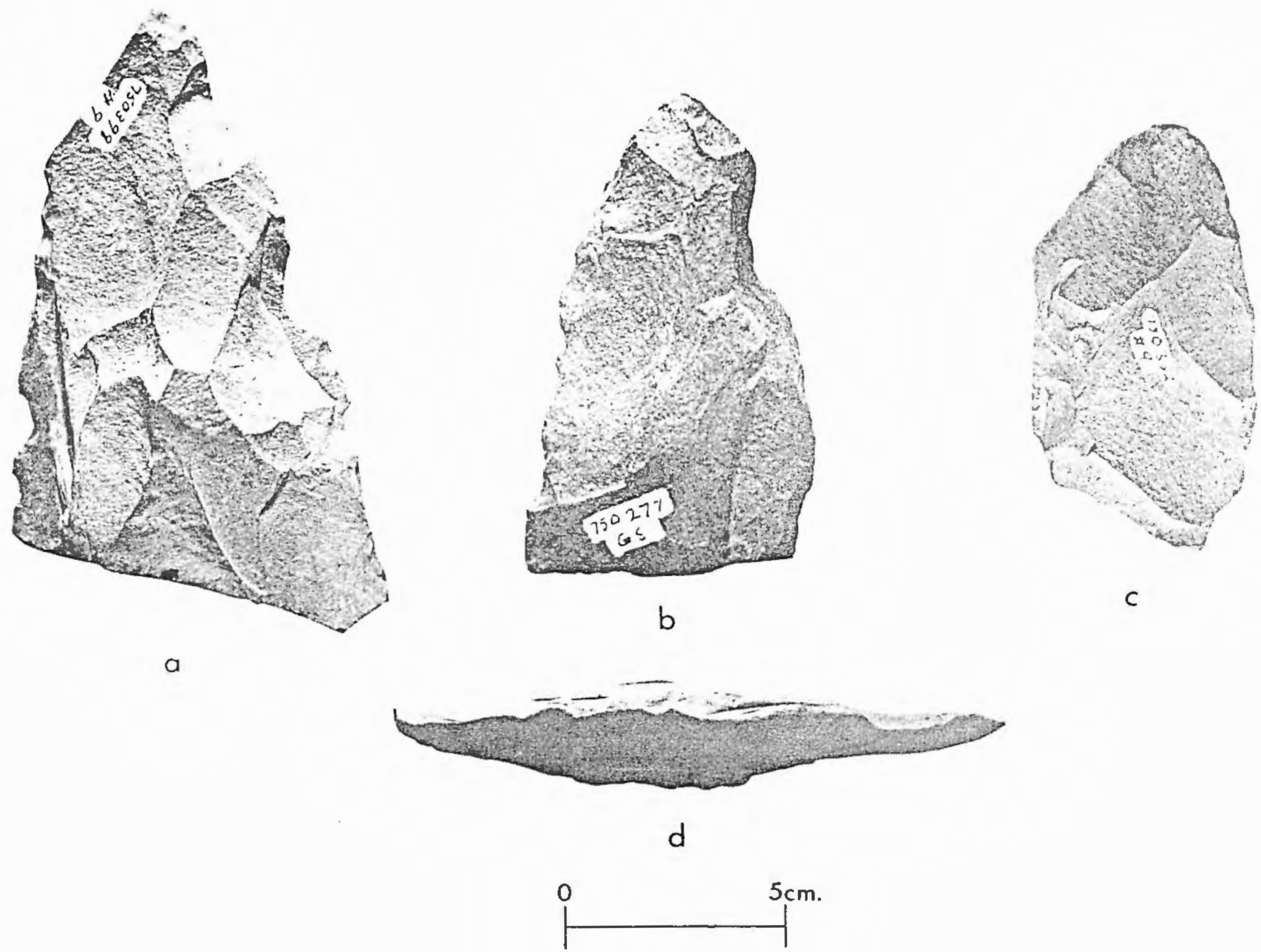


Fig. 6

*Mean thickness to width ratio:* 1:4

*Plane view:* Five smaller stage II bifaces possess asymmetrical triangular outlines. The majority possess asymmetrical biconvex to parallel margins, points of bifaces are subrounded to acute. Bifaces are generally lanceolate in outline. Stage II bifaces are generally asymmetrical in outline, however they are somewhat more symmetrical than stage I bifaces.

*Longitudinal section:* In sectional view the margin is sinuous, however less so than stage I.

*Cross section:* Generally biconvex, becoming more symmetrical and thinner than stage I.

*Flake scar pattern:* Irregularly flaked; usually flaked over the entire surface of both faces.

*Flake scar morphology:* Flake scars occurring on stage II bifaces are generally shallow and possess salient negative bulbs of force. Termination of flake scars are less abrupt. Fewer flake scars terminate in step or hinge fractures.

*Presence or absence of cortex:* Cortex occurs infrequently as isolated remnants on one face.

Discussion of stage II bifaces:

Stage II bifaces are generally thinner and more symmetrical than stage I bifaces and possess a straighter edge. The flake scars are much shallower and possess salient bulbs of force. Undulations and striations are much less distinct. These characteristics have been equated with the use of antler billets (Crabtree 1967*a*, 1970; Muto 1971*b*; Bucy 1974). These markings occur consistently in flake scars of stage II bifaces and on thinning flakes recovered from the quarry. Antler billets are known to have been used by aboriginal populations (Holmes 1919:193). Both deer and elk antler would have been available to prehistoric populations exploiting the Stockhoff site. When this evidence is considered together there is no reason to assume that antler billets were not used at the quarry.

With the exception of the few relatively small bifaces, the majority appear to have broken in manufacture, rather than being rejected. Of the 107 stage II bifaces 90 are broken and only 17 are complete. Thirty-five percent of the fragments exhibit perverse fractures. This represents a 4% increase in the number of perverse fractures over the preceding stage.

Bifaces of both stage I and II can be classified as blanks. In both cases the shape and form of the end product cannot be determined.

Description of stage III bifaces (Fig. 7):

*Material:* Basalt

*No. of specimens:* 28 complete bifaces
130 biface fragments

*Dimensions of stage III biface fragments:*

| | *Range* | *Mean* |
|---|---|---|
| Length | 18 mm - 140 mm | 54 mm |
| Width | 18 mm - 75 mm | 40 mm |
| Thickness | 15 mm - 46 mm | 8 mm |

Stage III fragments are represented by tips, bifaces lacking one tip, mid-sections lacking both tips, and bifaces broken through the midsection.

*Types of fractures occurring on stage III biface fragments:*

| | | |
|---|---|---|
| End shock fractures | 80 | 61% |
| Perverse fractures | 50 | 39% |

Description of stage III knife preforms:

*No. of specimens:* 11

Fig. 7.--Stage III Bifaces

*a-c* Plane views. Note increased symmetry of the outline.

*d* Longitudinal section view. Note decreased sinuosity of the edge.

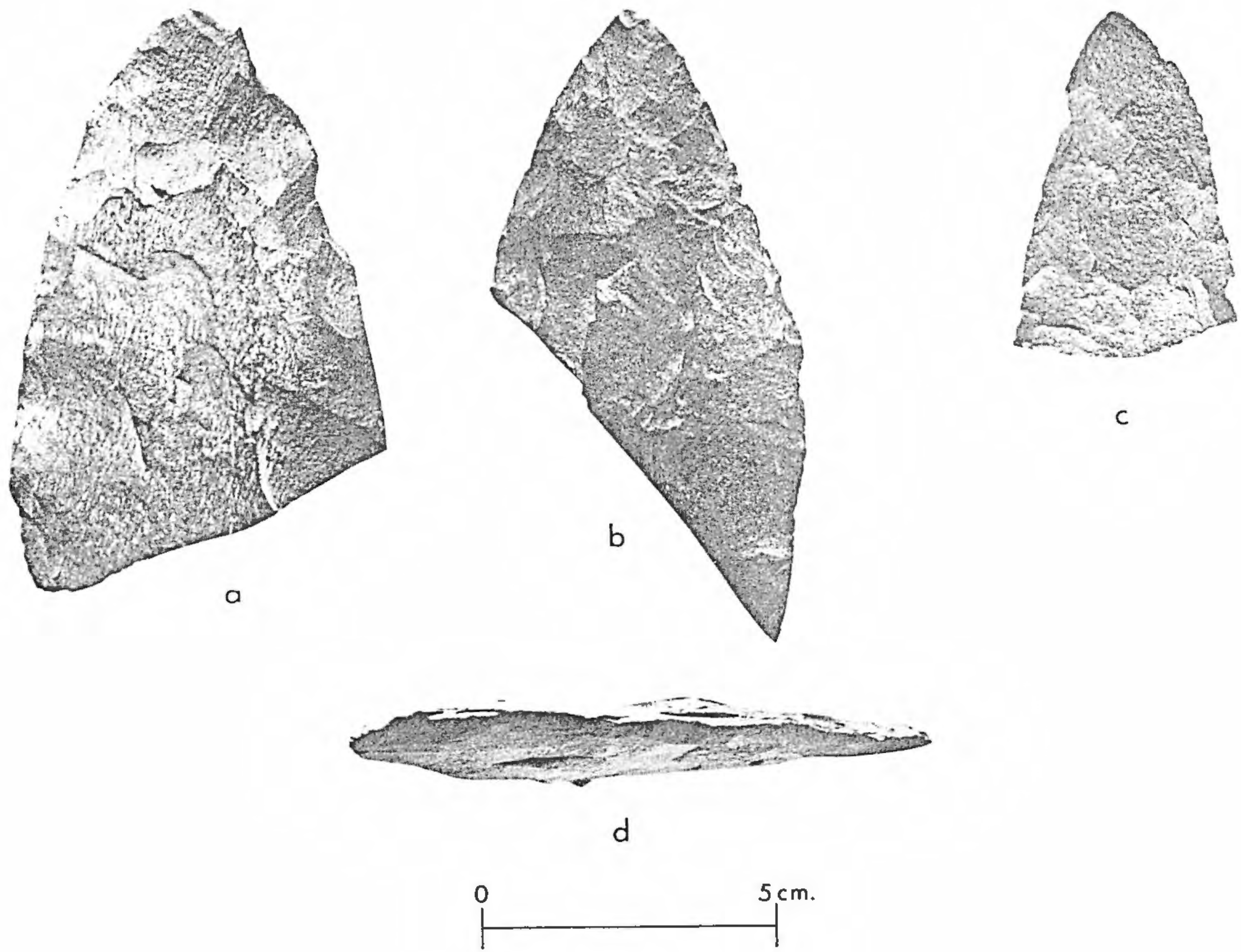


Fig. 7

*Dimensions of stage III knife preforms:*

| | *Range* | *Mean* |
|---|---|---|
| Length | 80 mm - 200 mm | 118 mm |
| Width | 26 mm - 78 mm | 45 mm |
| Thickness | 7 mm - 16 mm | 11 mm |

*Plane view:* Relatively symmetrical biconvex margins. Points of bifaces tend to be more acute than in stage II. Generally lanceolate in outline.

Description of stage III projectile point preforms (Fig. 8, 9):

*No. of specimens:* 17

*Dimensions of stage III projectile point preforms:*

| | *Range* | *Mean* |
|---|---|---|
| Length | 48 mm - 74 mm | 63 mm |
| Width | 20 mm - 34 mm | 28 mm |
| Thickness | 6 mm - 10 mm | 8 mm |

*Plane view:* Relatively symmetrical biconvex to triangular to parallel margins. Points are rounded to acute. Bifaces are both triangular and lanceolate in outline.

*Mean thickness to width ratio:* 1:5

*Longitudinal section:* In section view, the margin is no longer sinuous and is parallel to the longitudinal axis of the biface.

*Cross section:* Generally symmetrical biconvex to plano-convex and thinner than stage II.

*Flake scar pattern:* Irregularly flaked. Usually flaked over the entire surface of both faces.

*Flake scar morphology:* Shallow expanding flake scars possessing salient negative cones of force. Few flake scars terminate in step or hinge fractures. Flake scars are shallower and more diffuse than in stage II.

Fig. 8.--Lanceolate Projectile Points

*a-c* Stage III lanceolate projectile point preforms

*d-g* Stage IV lanceolate projectile points

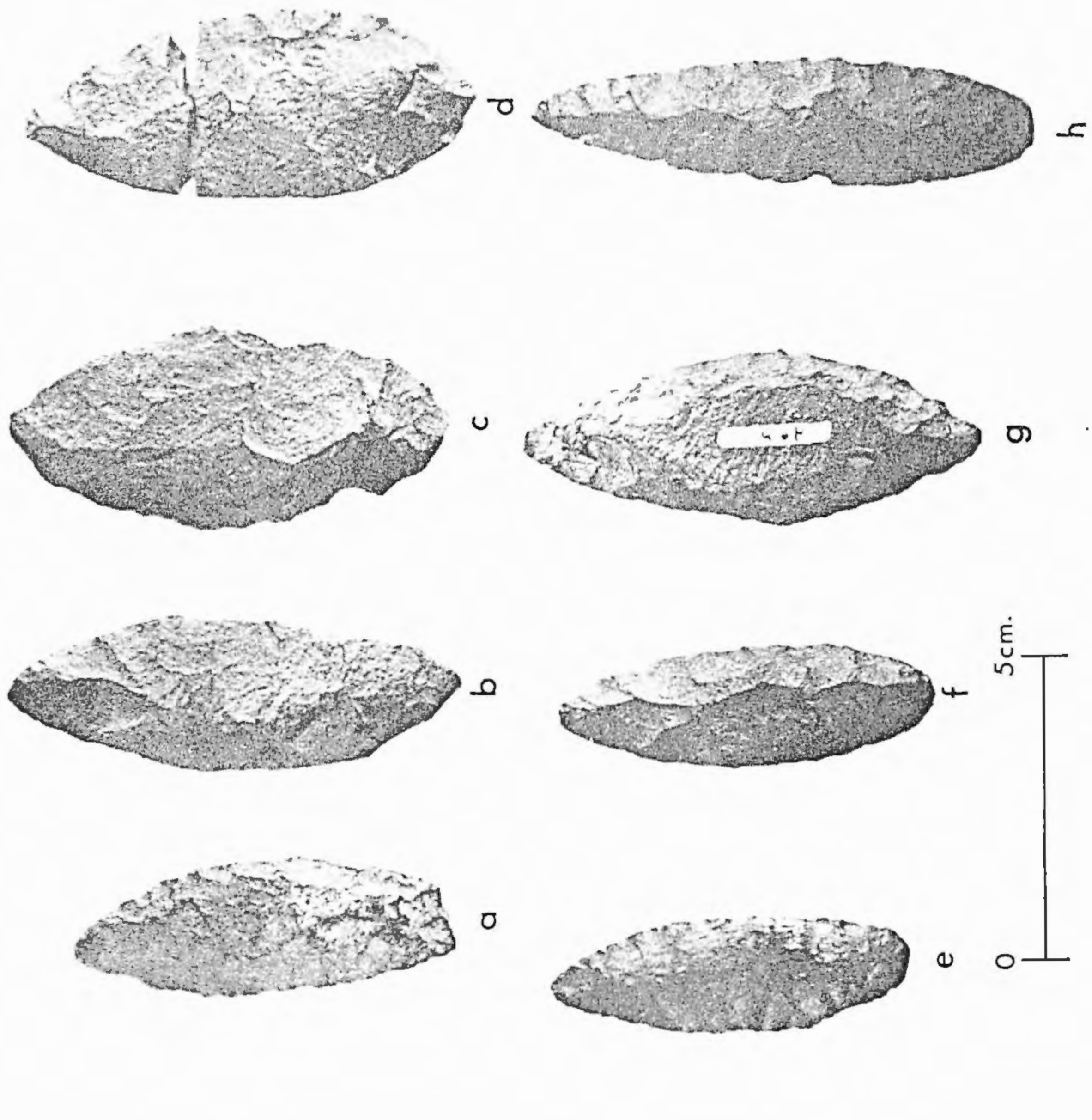


Fig. 8

Fig. 9.--Triangular Preforms and Side-Notched Projectile Points

*a-e* Stage III triangular preforms

*f-i* Stage IV triangular side-notched projectile points

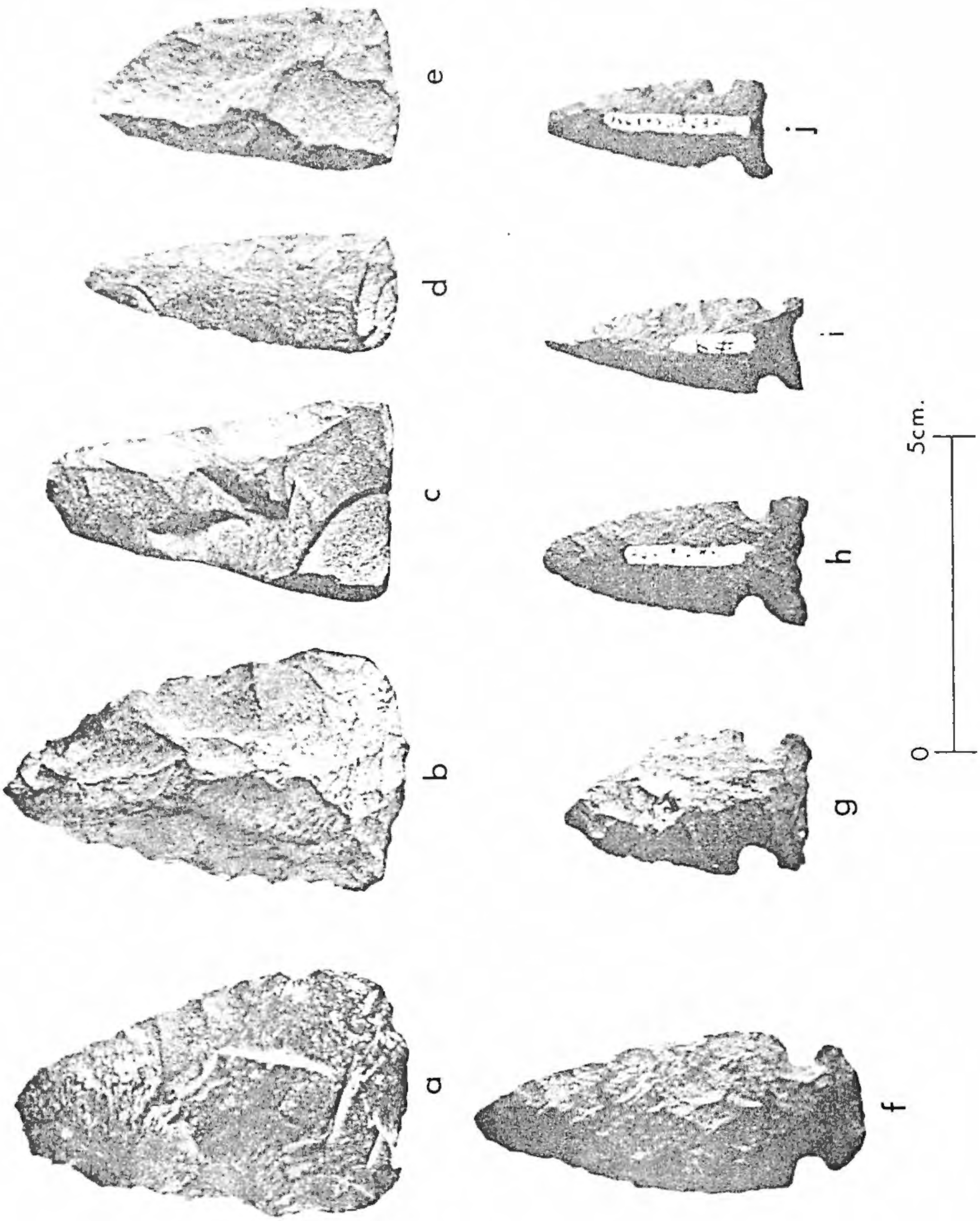


Fig. 9

*Presence or absence of cortex:* Stage III bifaces do not possess cortex.

Discussion of stage III bifaces:

Stage III bifaces closely approximate finished implements with the exception of final thinning, retouch, and sometimes the addition of haft element. As with stage II, the majority of the stage III bifaces appear to have been broken in manufacture rather than rejected. Sixty-one percent of the broken stage III bifaces possess end shock fractures while 39% possess perverse fractures. When compared to stage I this represents an 8% drop in the number of end shock fractures and an 8% increase in the number of perverse fractures. This may be a result of changes in the angle of incidence which occurs during final thinning operations. Examination of three entire stage III bifaces broken during manufacture suggests that the percussor was aimed directly into the edge of the bifaces. Fracture appears to have been initiated at the point of impact on the edge of the biface. All three bifaces were perversely fractured.

Stage III bifaces are classified as preforms, the larger bipointed lancelot bifaces as knife preforms and the smaller lancelot and triangular bifaces as projectile point preforms. Preform is used with stage III bifaces because the intended size and shape and final form of the end product is indicated by the biface.

The division of stage III bifaces into knife preforms and projectile point preforms is somewhat arbitrary. Stage III bifaces over 75 mm in length have been classified as knife preforms and those under 75 mm in length have been classified as projectile point preforms. This is simply a means of classification and does not imply function. The division is made at 75 mm to make the descriptions and measurements of the bifaces more objective.

Description of stage IV bifaces - knives and knife fragments (Fig. 10):

*Material:* Basalt

*No. of specimens:* 2 complete knives
16 knife fragments

*Dimensions of knife fragments:*

| | Range | Mean |
|---|---|---|
| Length | 42 mm - 106 mm | 90 mm |
| Width | 32 mm - 74 mm | 52 mm |
| Thickness | 6 mm - 12 mm | 9 mm |

Knife fragments are represented by tips of knives, knives broken through the midsection, knives lacking both tips, and one large stemmed, haft element.

*Types of fractures occurring on stage IV knife fragments:*

| | | |
|---|---|---|
| End shock fractures | 6 | 38% |
| Perverse fractures | 10 | 62% |

*Dimensions of complete knives:*

| | Length | Width | Thickness |
|---|---|---|---|
| No. 1 | 68 mm | 154 mm | 9 mm |
| No. 2 | 30 mm | 92 mm | 7 mm |

*Plane view:* Symmetrical biconvex to parallel margins. Tips of knives are subrounded to acute. Lanceolate outline and generally more symmetrical in outline than stage III lanceolate preforms.

*Mean thickness to width ratio:* 1:6

*Longitudinal section:* In sectional view, stage IV knives possess straight sharp edges.

*Cross section:* Symmetrical, biconvex cross section, thinner than stage III.

*Flake scar pattern:* Irregularly flaked. Usually flaked over the entire surface of both faces. Stage IV knives may possess a series of small

Fig. 10.--Stage IV Biface Fragments

*a-c* Plane views

*d* Longitudinal section view

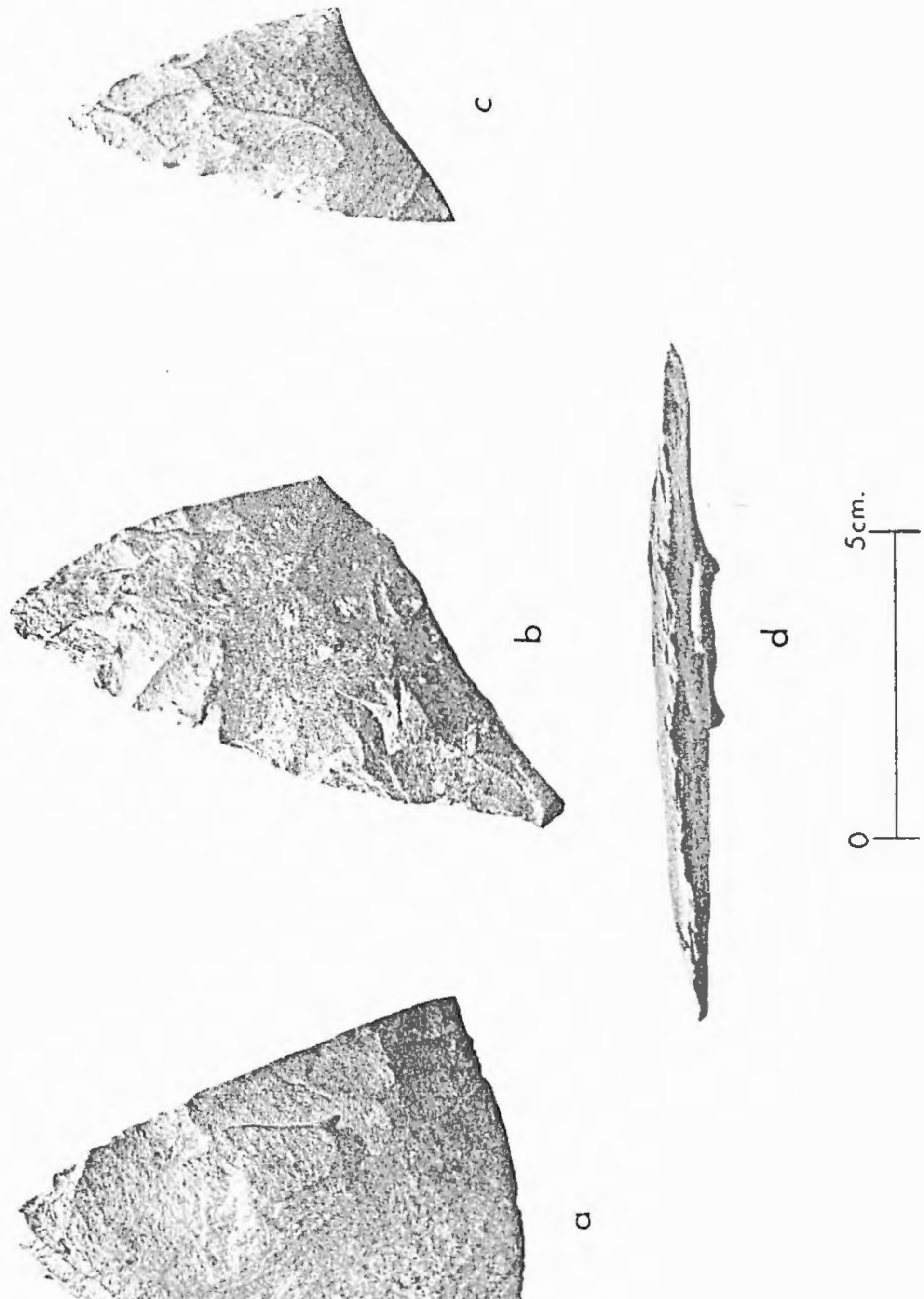


Fig. 10

parallel flake scars along the edge. The small parallel scars are restricted to the margins and do not travel more than a few mm towards the center of the biface.

*Flake scar morphology:* With the exception of the small parallel scars along the margin of some stage IV knives there is little change in flake scar morphology.

*Presence or absence of cortex:* An isolated remnant of cortex occurs on one surface of one stage IV knife.

Leaf-shaped lanceolate projectile points (Fig. 8):

*Material:* Basalt

*No. of specimens:* 4 complete projectile points
1 projectile point fragment

*Dimensions of projectile points:*

Projectile point fragment lacking tip-

| | |
|---|---|
| Length | 50 mm |
| Width | 20 mm |
| Thickness | 6 mm |

Complete projectile points-

| | *Range* | *Mean* |
|---|---|---|
| Length | 51 mm - 75 mm | 64 mm |
| Width | 15 mm - 28 mm | 21 mm |
| Thickness | 5 mm - 8 mm | 6 mm |

*Plane view:* Biconvex to parallel margins, with the exception of one bi-pointed projectile point; bases are rounded, tips are acute.

*Cross section:* Biconvex to plano-convex

*Flake scar pattern:* Collateral parallel flake scars. Flake scars usually do not converge in the center of the biface. The small parallel flake scars occurring on the edge of these bifaces may be suggestive of pressure retouch.

Side notched projectile points (Fig. 8):

*Material:* 6 Basalt, 1 Ignimbrite

*No. of specimens:* 6 complete side notched projectile points
1 side notched projectile point fragment

*Dimensions of side notched projectile points:*

Projectile point fragment lacking tip-

| | |
|---|---|
| Length | 58 mm |
| Width | 21 mm |
| Thickness | 6 mm |

Complete side notched projectile points-

| | *Range* | *Mean* |
|---|---|---|
| Length | 34 mm - 60 mm | 41 mm |
| Width | 15 mm - 25 mm | 19 mm |
| Thickness | 4 mm - 8 mm | 5 mm |

*Plane view:* Generally triangular in outline, however blade section is slightly excurvate.

*Haft element:* Side notched, notches are lunate approximately as deep as they are wide. Three specimens possess indented bases; two specimens possess relatively straight bases; and one specimen possesses a convex base.

*Cross section:* Biconvex to plano-convex

*Flake scar pattern:* Irregularly flaked, usually flaked over entire surface of one face and marginally flaked on the other face. These projectile points show no evidence of pressure retouch to the edge.

Basal notched lanceolate projectile point lacking tip:

*Material:* Basalt

*No. of specimens:* 1

*Dimensions:*

Length 42 mm

Width 30 mm

Thickness 5 mm

*Plane view:* Lanceolate in outline

*Haft element:* Indented base, basally thinned

*Cross section:* Plano-convex

*Flake scar pattern:* Randomly flaked; flaked over the entire surface of one face and marginally flaked on the other; very fine retouch along the margins.

Discussion of stage IV bifaces:

When the biface manufacture reaches the stage IV state in the manufacturing trajectory, the desired plane, longitudinal and cross sectional outline appears to have been obtained. Stage IV bifaces possess thin cross sections, symmetrical outlines, and straight, sharp edges. In some instances pressure retouch has been applied to the edge. Pressure flaking on these bifaces is evidenced by a series of systematically removed parallel flake scars. Pressure flaking appears to have been used in sharpening and straightening the edge.

Stage IV bifaces are represented by one large complete bipointed knife, fragments of large knives, and one large haft element. These large knives and knife fragments represent the end of the large biface continuum at the Stockhoff site. Large knives in a more advanced state of reduction have not been recovered at the site. Stage IV bifaces are also represented by leaf-shaped points and triangular side notched points, as well as point fragments. The lanceolate projectile points appear to have been reduced from small stage III lanceolate preforms, and the triangular projectile points from small stage III triangular preforms. Projectile points are placed within stage IV because they represent completed implements.

There are fewer artifacts in stage IV than any of the preceding stages. Excluding projectile points, there are only 16 biface fragments and 2 complete bifaces. The hypothesis which best explains this decrease is transportation of stage III bifaces away from the site. Stage III bifaces closely approximate finished implements, possess relatively sharp working edges, and could have served as functional knives or scrapers. Many stage III bifaces could have been, and probably were removed from the quarry prior to further reduction. It is my belief that stage III bifaces, rather than stage I, II, or IV bifaces, represent the optimum transport product. Large stage I and II bifaces would be too bulky and heavy for economical transport of more than a few specimens. Large bifaces in these early stages of manufacture usually do not occur in sites along the Snake or Columbia Rivers. Stage III bifaces or knives on the other hand are much reduced in size and weight, are functional implements, and still possess enough mass so that they may be repeatedly sharpened after use. As stage III bifaces are further sharpened they will also provide the user with usable flakes. Stage IV bifaces or knives have been reduced to the point that further sharpening would be difficult without fracturing the biface, nor would they yield usable flakes.

I have personally examined basalt knives recovered from Marmes Rock Shelter (45FR50) and Wexpusnime (45GA61). These bifaces in both collections are technologically and morphologically similar to stage III Stockhoff basalt knives, and if included within the Stockhoff biface assemblage would be classified as stage III bifaces. These bifaces are considered to be finished implements as evidenced by the high degree of edge polish, due to use. Bifaces reduced to stage IV stage may have been used to perform subsistence tasks while at the Stockhoff site, they may also represent extremes in the reduction sequence.

Sixty-two percent of the knife fragments possess perverse fractures which are all diagonal to the long axis of the fragment. The fractures appear to have been initiated by a blow directed at the edge of the biface.

*Comparisons of Stage III and IV Bifaces*

With the exception of a slight reduction in cross section and edge retouch, stage III lanceolate knife and projectile point preforms are morphologically and technologically identical to stage IV lanceolate knives and projectile points. For comparative purposes they will be considered as a single unit.

*Comparisons:* Lanceolate knives and projectile points

Bense 1972, Fig. B.3*j, k, l*

Rice 1972, Fig. 22*b*

Leonhardy, Schroedl, Bense, and Beckerman 1971, Fig. 24*i, n, o*

Pavesic 1971, Fig. 15*b, h*

Nelson 1969, Fig. 43*a, b, c, d, g, h, i, j, k, l, m*

Rice 1969, Fig. 30*A-D*, Fig. 34*A-C*, Fig. 35*A-C*

Butler 1961, Fig. 3*A-H*

*Comments:* The lanceolate knives and projectile points recovered from the Stockhoff site are morphologically and technologically equivalent to Cascade projectile points and knives. Lanceolate knives and projectile points are stylistic indicators of Cascade components (Leonhardy and Rice 1970:9). The Cascade Phase is generally dated between 8000 and 4500 B.P. (Leonhardy 1975).

*Comparisons:* Stage III triangular preforms

Yent 1976, Fig. 33*F, i, j, l*

Leonhardy, Schroedl, Bense, and Beckerman 1971, Fig. 24 and 9

Nelson 1969, Fig. 44*i, j, l, m;* Fig. 45*d, f, m*

*Comments:* Leonhardy (1970:9) notes that triangular knives are characteristic of Cascade components. Triangular preforms or knives also occur in post-Cascade components. As previously stated, the triangular implements may have served as preforms for the manufacture of triangular side notched projectile points found at the site.

*Comparisons:* Stage IV triangular side notched projectile points

Yent 1976, Fig. 31*m, o*

Bense 1972, Fig. B2*b, d, e, j, l, m*

Pavesic 1971, Fig. 16*c*

Leonhardy and Rice 1970, Fig. 4*e, f*

Rice 1969, Fig. 6*b*

Waren, Sims, and Pavesic 1968, Fig. 8*i, k, l*

*Comments:* Large side notched projectile points when they occur in conjunction with lanceolate projectile points are often considered to be diagnostic of the Cold Springs Horizon (Butler 1961:33). The Cold Springs Horizon marks a later subphase of Cascade Phase and usually dates between 6600 and 4400 B.P. (Rice 1970:91).

*Comparisons:* Stage IV basal notched lanceolate projectile point

Rice 1972, Fig. 10*d*

*Comments:* Projectile points of this type have been found in Windust components dating to approximately 9400 B.P. (Rice 1972:134).

*Discussion of Stage III and IV Bifaces*

The majority of the diagnostic implements recovered from the Stockhoff site are bipointed leaf-shaped projectile points and knives. Bipointed leaf-shaped implements are characteristic of various archaeolcgical phases within the southern Columbia Plateau. They are characteristic of the Vantage Phase of Middle Columbia River 8900-4900 B.P. (Swanson 1962; Nelson 1969), the

Cascade Phase of Lower Snake River 8000-4500 B.P. (Leonhardy and Rice 1970) and the Hells Canyon Creek Phase of the Middle Snake River 7400-6400 B.P. (Pavesic 1971).

The bipointed leaf-shaped projectile points and knives from the Stockhoff site share the greatest degree of similarity with those of the Cascade Phase of the Lower Snake River region. This does not mean that the bipointed implements from the Stockhoff site represent an extension of the Cascade Phase, which is geographically limited to the Lower Snake River region. The point to be made is that there is a strong degree of technomorphological similarity between the Cascade assemblages of the Lower Snake River and the Stockhoff site, suggesting that there may be a relationship.

# CHAPTER 4

# DESCRIPTION AND ANALYSIS OF CHIPPING WASTE

## *Description*

During surface collection and excavation 3900 basalt waste flakes were recovered from the Stockhoff site (Table 1). Based on morphological and technological attributes five classes of flakes have been formulated.

TABLE 1.--Class Totals and Percentages of Flakes

| *Flake Classes* | *Total No. Flakes per Class* | *% of Total No. Flakes* |
|---|---|---|
| Class 1 Decortication flakes | | |
| A. Primary decortication flakes | 80 | 2 |
| B. Secondary decortication flakes | 495 | 12 |
| Class 2 Thinning flakes | 123 | 3 |
| Class 3 Biface thinning flakes | | |
| A. Flaked platforms | 568 | 14 |
| B. Flaked abraded platforms | 224 | 6 |
| Class 4 Multiple removal flakes | 205 | 5 |
| Class 5 Nondiagnostic shatter | 2210 | 56 |
| Total flakes | 3900 | |

Class 1 Decortication flakes (Fig. 11):

*Description:*

A. Primary decortication flakes-

*No. of specimens:* 80 = 2% of sample

Primary decortication flakes exhibit cortex either on the platform remnant or on the entire dorsal surface of the flake.

B. Secondary decortication flakes-

*No. of specimens:* 495 = 12% of sample

Secondary decortication flakes exhibit cortex only on part of the dorsal surface of the flake, and do not posses cortex on the platform remnant.

*Platform remnant morphology:* Decortication flakes usually do not show evidence of platform preparation. Signs of crushing and repeated impacts are often evident on platform remnants. The impact marks may be as much as 35 mm from the margin of the flake.

*Ventral surface morphology:* May possess salient accuminate bulbs of force, distinct undulations, striations, and erailure scars.

Class 2 Thinning flakes (Fig. 12):

*No. of specimens:* 123 = 3% of sample

*Description:* Non-cortexed relatively large thick flakes showing no evidence of platform preparation.

*Platform remnant morphology:* Platform remnants are usually thick, show signs of crushing and repeated impacts. Impact marks may be as much as 20 mm from the margin of the flake.

*Ventral surface morphology:* May possess salient accuminate bulbs of force, distinct undulations. radial striations and erailure scars.

Fig. 11.--Class 1 Decortication Flakes

*a-c* Primary decortication flakes

*d-h* Secondary decortication flakes

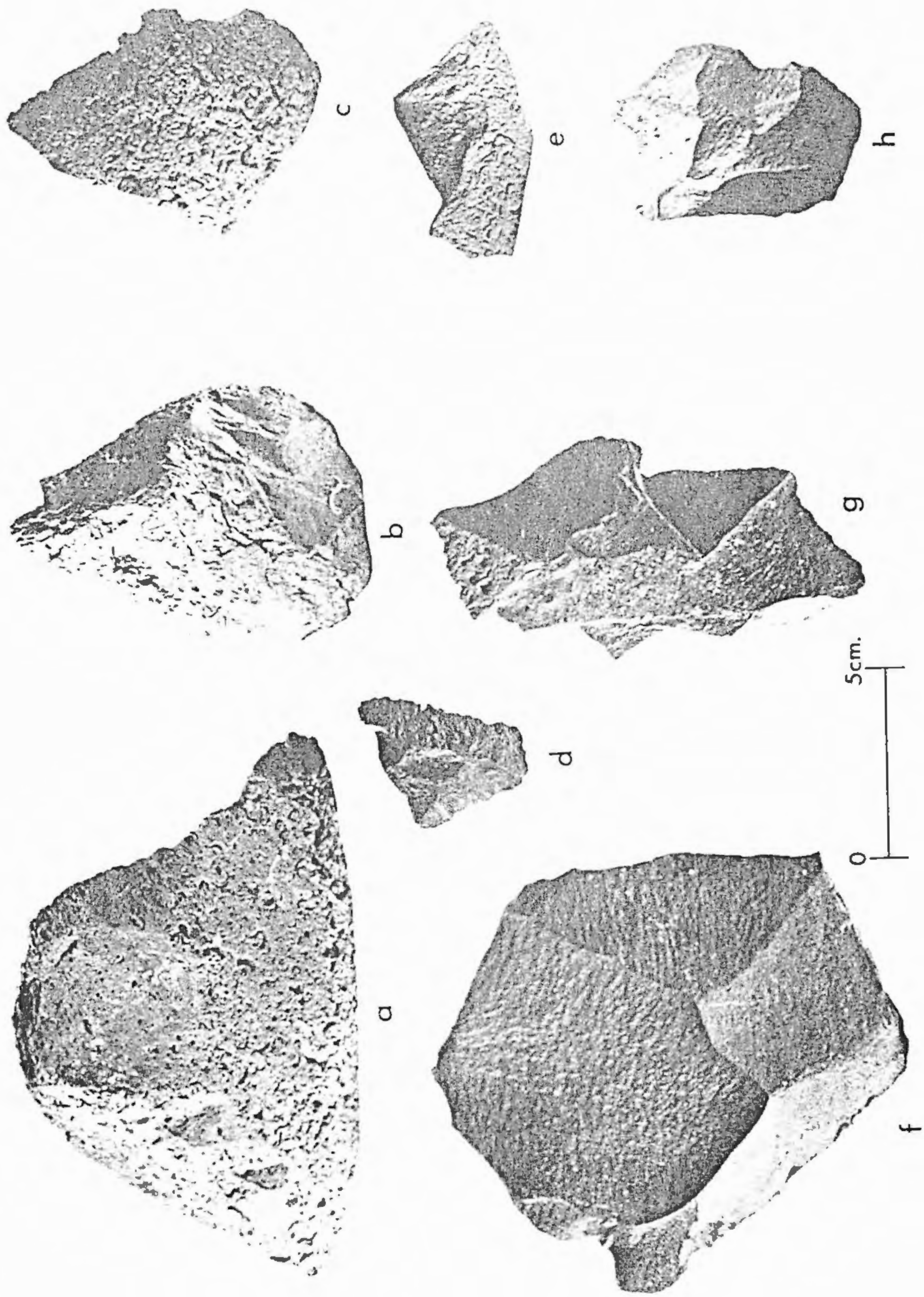


Fig. 11

Fig. 12.--Class 2 Thinning Flakes. Note salient accuminate bulbs of force and radial striations.

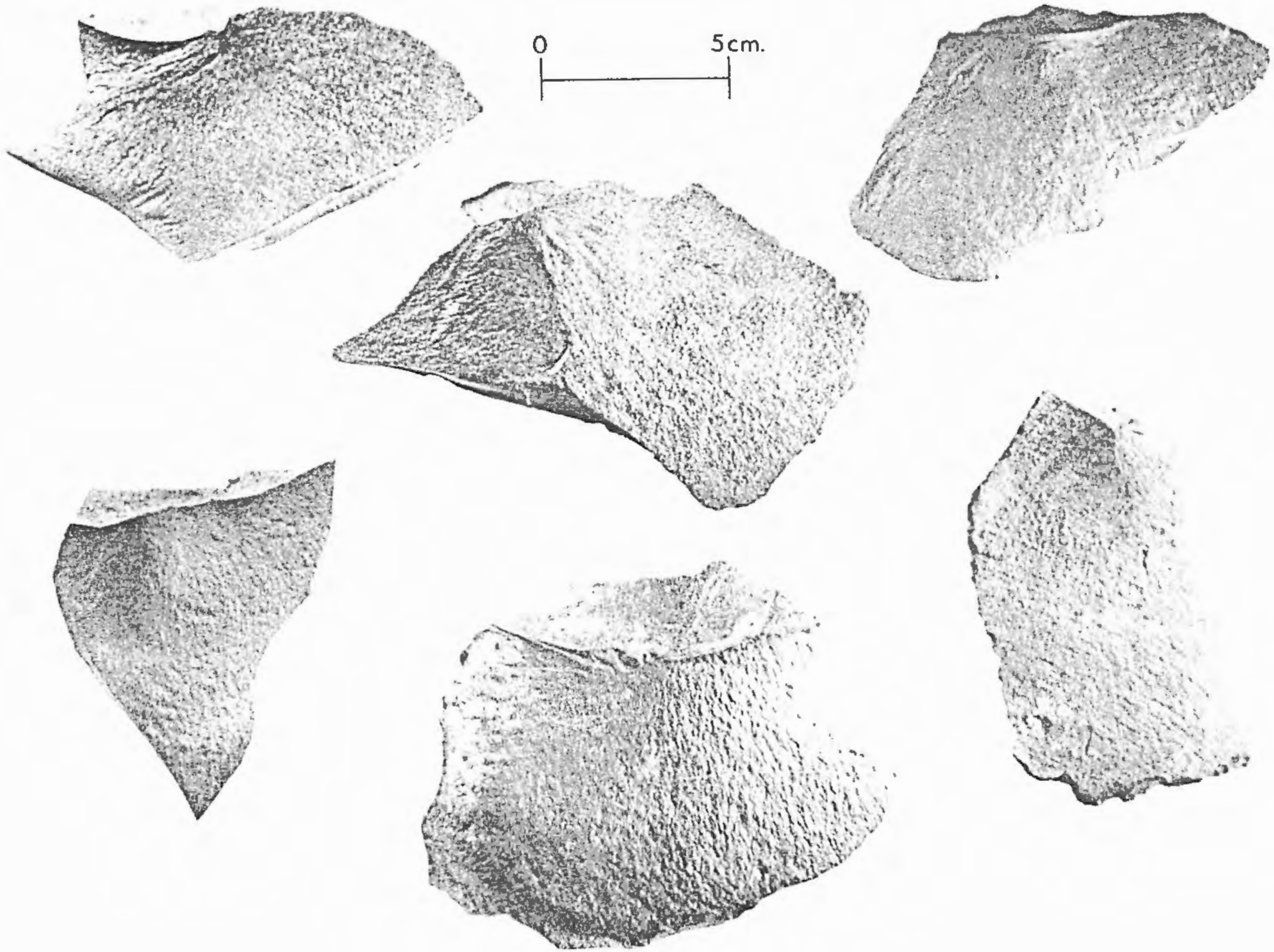


Fig. 12

*Comment:* The ventral surface morphology of decortication flakes and thinning flakes closely approximates the flake scar morphology of stage I bifaces. The technological attributes occurring on the ventral surface of these flakes is suggestive of hard hammer percussion.

Class 3 Biface thinning flakes (Fig. 13 and 14):

*Description:*

A. Flaked platforms-

*No. of specimens:* 568 = 14% of sample

B. Flaked abraded platforms-

*No. of specimens:* 224 = 6% of sample

There are a total of 792 Class 3 biface thinning flakes. Biface thinning flakes exhibit characteristics indicating that they were removed from a bifacially reduced object. These characteristics include a curved longitudinal section, a platform remnant which is a segment of a biface edge, a dorsal surface which shows flake scars resulting from previous thinning flake removals from the same margin and opposite margins. Biface thinning flakes are generally much thinner than Class 1 or 2 flakes, however they may be as large in dorsal or ventral surface area.

*Platform remnant morphology:* Biface thinning flakes exhibit flaked or flaked, abraded, platform remnants. The flaking appears to be the result of beveling or removing a series of small flakes in order to achieve the desired platform angle. Following beveling operations, grinding or abrading further strengthened the platform. Crabtree (1967:8) notes that platforms collapse more easily on coarse textured materials such as basalt. Coarse textured materials therefore require the construction of stronger platforms.

Fig. 13.--Class 3 Biface Thinning Flakes, Dorsal Surfaces

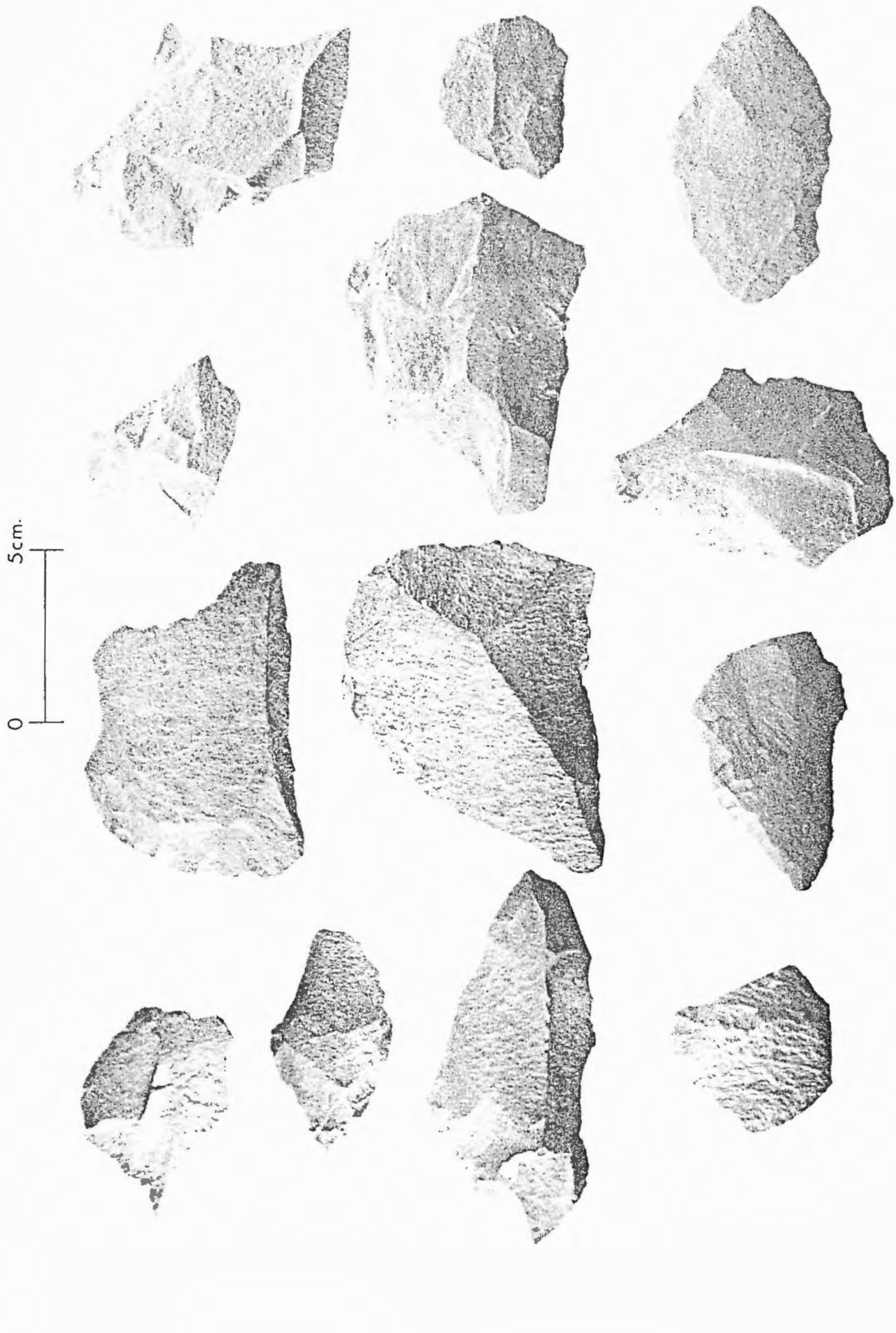


Fig. 13

Fig. 14.--Class 3 Biface Thinning Flakes, Ventral Surface. Note diffuse bulbs of force.

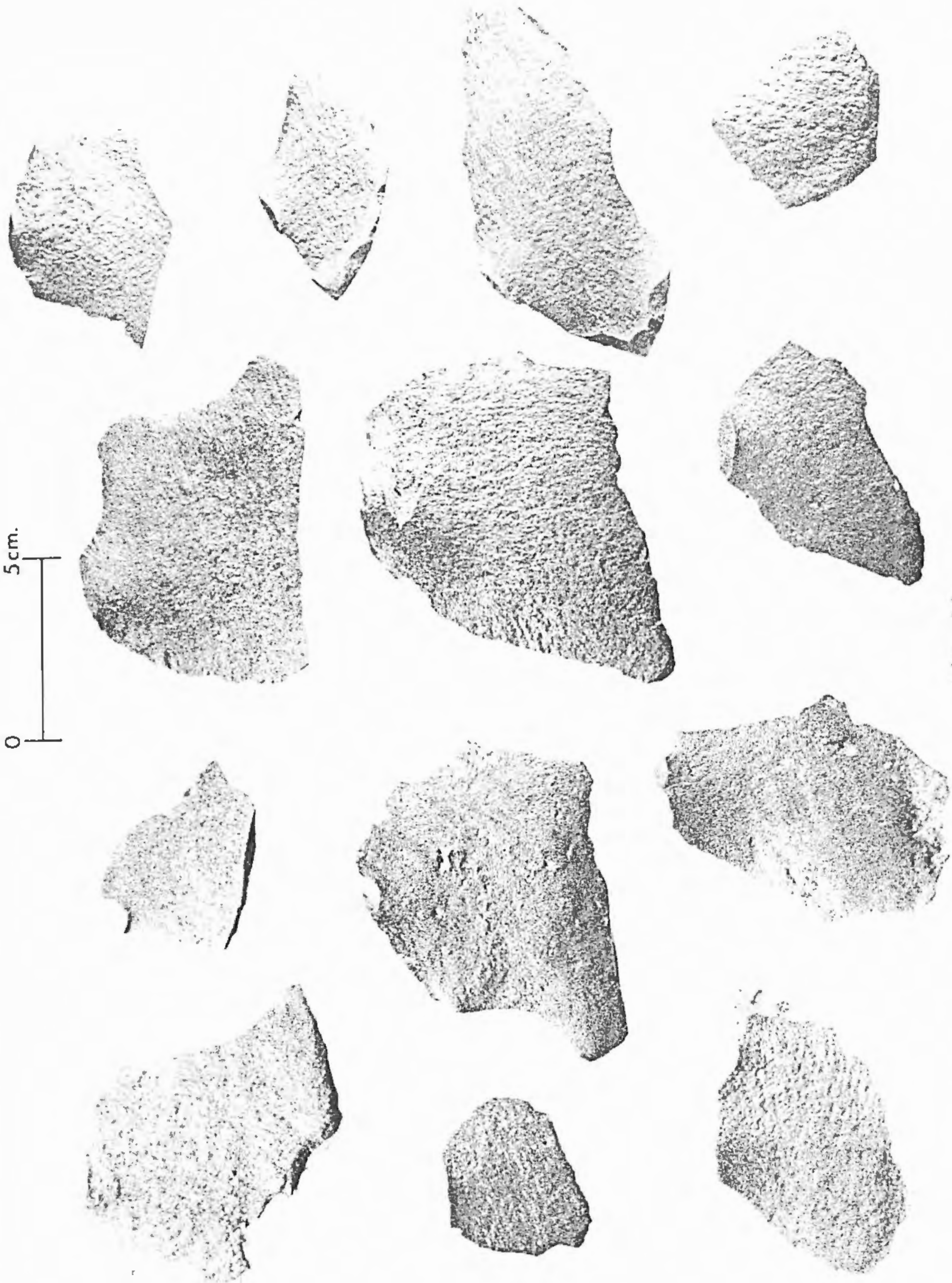


Fig. 14

*Ventral surface morphology:* Biface thinning flakes usually exhibit diffuse bulbs of force and lipping on the proximal end of the ventral surface of the flake. They usually do not exhibit scars.

*Comment:* The ventral surface morphology exhibited by these flakes closely approximates the morphology of flake scars occurring on stage II, III, and IV bifaces. The technological attributes exhibited on the ventral surface of biface thinning flakes are suggestive of soft hammer percussion.

Class 4 Multiple removal or recovery flakes (Fig. 15):

*No. of specimens:* 205 = 5% of sample

*Description:* Multiple removal or recovery flakes exhibit a positive bulb of force on the ventral surface on the flake, and a negative bulb of force superimposed on the dorsal surface of the flake. These flakes are usually quite small and may or may not possess cortex. According to Jelinek, Bradley, and Huckell (1971) flakes of this nature may be produced in two ways: (1) a single impact of the percussor can remove a primary flake and a second smaller flake from the dorsal surface of the primary flake simultaneously, and (2) removing a small flake but failing to remove the desired mass. A second blow delivered to the same area but slightly further in on the margin removes a flake with the primary flake scar on its dorsal surface.

Class 5 Nondiagnostic shatter:

*No. of specimens:* 2210 = 56% of sample

*Description:* Nondiagnostic shatter consists of fragments which do not exhibit bulbs of force or platform remnants visible to the naked eye, or cortex. These fragments appear to be distal and medial flake fragments.

## *Discussion*

The technomorphological attributes exhibited by decortication flakes and Class 2 thinning flakes suggest that these flakes may be attributed to the

Fig. 15.--Multiple Removal Flakes

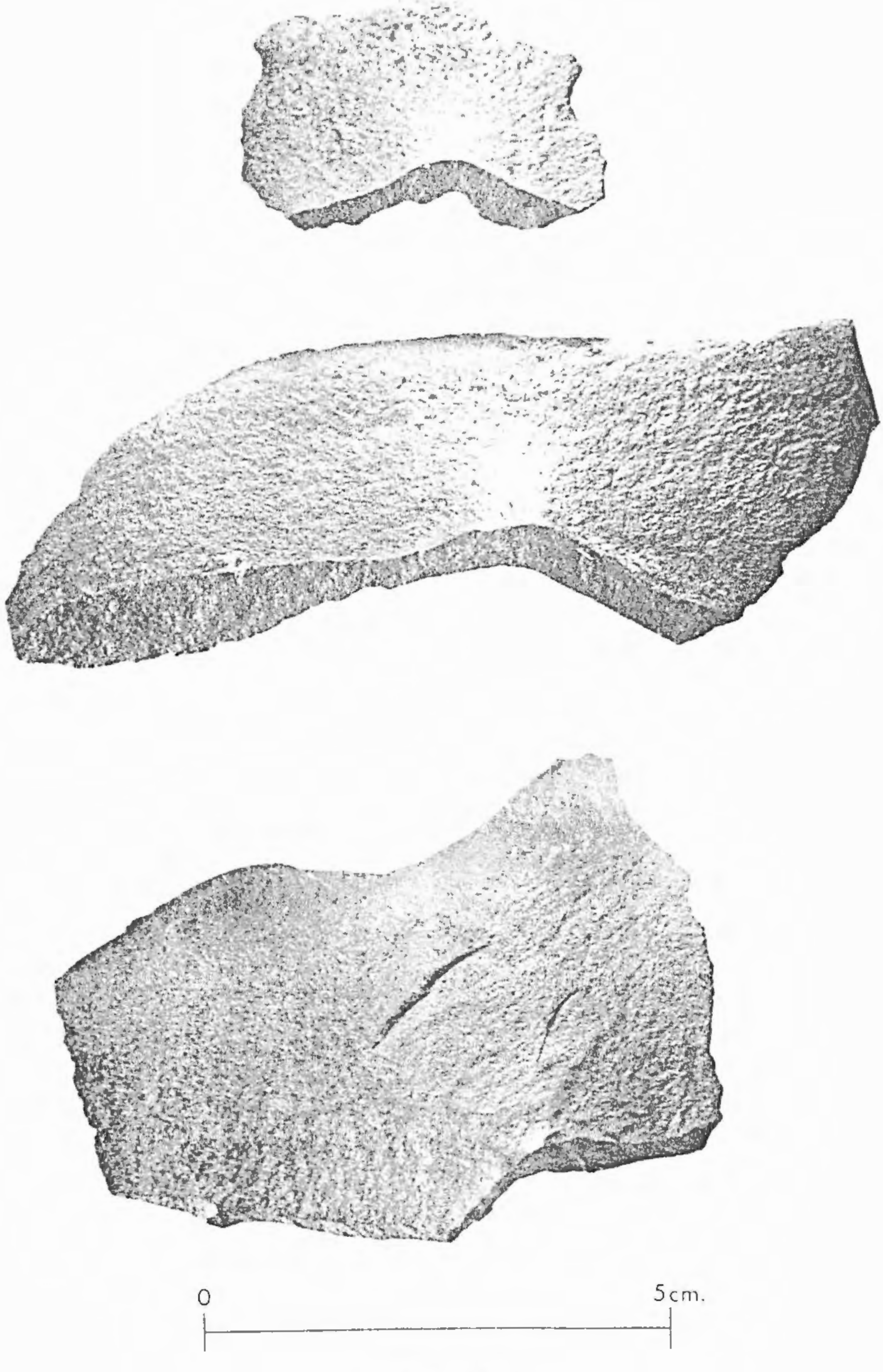


Fig. 15

the manufacture of stage I bifaces. This argument tends to be supported by the fact that the ventral surface morphology of these flakes closely approximates the flake scar morphology of stage I bifaces. The technological attributes exhibited on the ventral surface of these flakes and in the flake scars of stage I bifaces are suggestive of hard hammer percussion.

The technomorphological attributes exhibited by Class 3 biface thinning flakes indicate that these flakes were produced during the later stages of biface manufacture. The ventral surface morphology of Class 3 biface thinning flakes closely approximates the morphology of the flake scars exhibited by stage II, III, and IV bifaces. The technological attributes exhibited on the ventral surface of these flakes and in the flake scars of stage II, III, and IV bifaces are suggestive of soft hammer percussion.

*Obsidian Chipping Detritus Recovered in Surface Collection*

*No. of specimens:* 90

*Comments:* Obsidian chipping detritus represents less than two percent of the entire flake assemblage recovered in both surface collection and excavation. This would suggest that the reduction of obsidian at the site was limited to the maintenance and manufacture of relatively few implements. Only one obsidian implement, a small side notched projectile point, was recovered from the site.

The obsidian chipping detritus appears to have been derived from the reduction of small irregular nodules or pebbles. The flakes are generally small, blocky, thick in cross section, and sometimes exhibit a rough weathering cortex. The curvature seen in the longitudinal section of many flakes indicates they have been detached from a relatively small nucleus.

The technomorphological attributes exhibited on the dorsal and ventral surface of the flakes suggest that they were either produced by inexperienced flintknappers or knappers unfamiliar with obsidian. The platform remnants on the majority of the flakes show signs of repeated battering and platform collapse, resulting in stacked step fractures on the dorsal surface of the flake. On the ventral surface the flakes exhibit pronounced salient bulbs of force, undulations and radial striations, suggesting that they were detached with excessive force. The application of the basalt oriented technology characteristic of the Stockhoff site to the much more vitreous material, i.e., obsidian, could result in the production of obsidian flakes similar to those found at the site.

— One of the Dooley Mt. sources

*Discussion:* In the summer of 1975, Dr. George Mead and I were involved in a land clearance survey for the U.S. Forest Service near Baker in northeastern Oregon. During the survey a rather extensive obsidian resource area was encountered. The source is located approximately 24 km southeast of Baker and approximately 64 km south-southeast of the Stockhoff site, T11S, R41E, sections 20 and 21 of the French Gulch Oregon Quadrangle (Fig. 1).

The obsidian occurs as small pebbles rarely exceeding 4 or 5 cm in diameter. The pebbles exhibit a rough cortex and may possess a silvery weathering patina.

At the time of the survey Dr. R. E. Nelson of Simon Frazier University was characterizing obsidian flows in the Pacific Northwest through the use of X-ray fluorescence analysis. Samples collected from various locations in the source area by Dr. George Mead and I were sent to Simon Frazier for analysis. The Baker obsidian source was previously unknown.

Surface collection at the Stockhoff site yielded obsidian chipping detritus which possessed cortex similar to that of the Baker material. Because of the similarities in cortex and the close proximity of the Stockhoff site to the Baker obsidian source, five samples of obsidian recovered at Stockhoff were sent to Dr. D. E. Nelson in hopes that they could be identified as to source. X-ray fluorescence analysis revealed that all five of the samples were derived from the Baker obsidian source. This indicates that either aboriginal folk exploiting the Stockhoff site were also exploiting the Baker source or trading with someone who did.

# CHAPTER 5

# BIFACE REPLICATION EXPERIMENT

In an attempt to gain further understanding of the aboriginal biface manufacturing process, a replication experiment was conducted. The experiment was carried out by Jeffrey Flenniken, Director of the Washington State University Lithics Laboratory, and myself. This involved the replication of a large stage IV biface.

## *Description*

The object of the experiment was to determine (1) whether or not a biface, in fact, passes through stages of manufacture similar to the four stages formulated by myself, (2) to determine whether or not a relationship exists between the various types of chipping waste and stages of biface manufacture, (3) to determine whether or not there is any relationship between the type of percussor used and ventral flake surface morphology, and (4) to determine the approximate number of flakes produced during the manufacture of a basalt biface.

Controlled variables:

*Lithic material:* Stockhoff Basalt

*Percussors:* Quartzite hammer stone or elk antler billet.

*Method of manufacture:* Flake reduction using direct freehand percussion.

*Stages of manufacture:* Halts in the manufacturing process were called by myself when the biface was thought to approximate both morphologically and technologically the four sequential stages of manufacture formulated for the aboriginal bifaces.

The goal was to manufacture the largest complete stage IV biface possible from a flake 340 mm in length, 150 mm in width, and 40 mm in thickness. The flintknapper was familiar with each of the four stages of manufacture, but made no direct attempt at replicating each of the four stages. Halts in the manufacturing process were called as the biface progressed morphologically and technologically from stage to stage. Using a large canvas, all chipping waste was collected separately for each stage of manufacture. The chipping waste recovered from the quarry was collected in ¼ in mesh screen or collected by hand. For this reason the chipping waste recovered during the experiment was put through ¼ in mesh screen prior to classification and counting. The material which passed through the ¼ in mesh was then dry-sieved through 1mm mesh so as to gain further quantitative data.

A flake 340 mm in length, 150 mm in width and 40 mm in thickness, produced a complete stage IV biface measuring 270 mm in length, 68 mm in width, and 13 mm in thickness. In progressing from the original flake to the final form the biface did in fact pass through stages of manufacture closely approximating those formulated in analyzing the Stockhoff bifacial material. Two other bifaces broken during the experiment passed through similar stages prior to fracture. This tends to support the application of the reduction stage concept to the Stockhoff bifacial materials.

Chipping waste was collected separately for each stage of reduction in order to gain a better understanding of the relationship of these flakes to stages of biface manufacture. Those flakes which did not pass through ¼ in mesh screen were placed in five classes similar to those used in classification of the aboriginal flake sample.

The data gained in analysis of the chipping detritus generated during the biface replication experiment suggest that there are relationships between the types and numbers of flakes detached and stages of biface manufacture. These relationships are expressed in the following tables (Tables 2-3).

TABLE 2.--Total Number of Flakes in Each Flake Class

| *Flake Classes* | | *Total* | *% Total All Flakes* |
| --- | --- | --- | --- |
| Class 1 | Decortication flakes | 128 | 10.27 |
| Class 2 | Thinning flakes | 64 | 0.26 |
| Class 3 | Biface thinning flakes | 98 | 7.87 |
| Class 4 | Multiple removal or recovery flakes | 49 | 3.93 |
| Class 5 | Nondiagnostic shatter | 796 | 63.88 |
| Total all flakes | | 1246 | |

*Discussion*

The numbers and types of flakes produced during the manufacture of a basalt biface may vary with the skill of the flintknapper, the method of manufacture and the types of fabricators used. Even so, data of this kind provide the investigator with a better understanding of the manufacturing process, and is useful in making rough correlations when the same types of lithic materials are involved. For example, a basalt workshop area exhibiting chipping waste predominated by decortication flakes, Class 2 thinning flakes, and nondiagnostic shatter would be suggestive of the earliest stages of biface manufacture. If few biface thinning flakes were present, one could assume that the bifaces were being removed in a state approximating a stage I biface. If the chipping waste was characterized by large biface thinning flakes and few decortication flakes, one might suspect that stage I bifaces were being

TABLE 3.--Replication Experiment Flake Data

| | Flake Classes | Number of Specimens | % of Total Flakes in Each Class | % of Total Flakes per Stage of Reduction | % of Total Flakes |
|---|---|---|---|---|---|
| | | | *Flake to Stage I Biface* | | |
| C-1 | Decortication flakes | 118 | 92.19 | 19.93 | 9.47 |
| C-2 | Thinning flakes | 64 | 100.00 | 10.81 | 0.06 |
| C-3 | Biface thinning flakes | 4 | 4.08 | 0.68 | 0.32 |
| C-4 | Multiple removal or recovery flakes | 26 | 53.06 | 4.39 | 2.08 |
| C-5 | Nondiagnostic shatter | 380 | 47.74 | 64.19 | 0.31 |
| | Total flakes | 592 | | | 47.52 |
| | | | *Stage I to Stage II Biface* | | |
| C-1 | Decortication flakes | 8 | 6.25 | 2.45 | 0.64 |
| C-2 | Thinning flakes | 0 | - | - | - |
| C-3 | Biface thinning flakes[a] | 48 | 48.98 | 14.72 | 3.85 |
| C-4 | Multiple removal or recovery flakes | 20 | 40.82 | 6.14 | 1.60 |
| C-5 | Nondiagnostic shatter | 253 | 31.78 | 77.61 | 20.31 |
| | Total flakes | 326 | | | 26.16 |

TABLE 3.--*Continued*

| | | | | | |
|---|---|---|---|---|---|
| | *Stage II to Stage III Biface* | | | | |
| C-1 | Decortication flakes | 1 | 0.78 | 0.72 | 0.08 |
| C-2 | Thinning flakes | 0 | - | - | - |
| C-3 | Biface thinning flakes[b] | 26 | 26.53 | 18.71 | 2.09 |
| C-4 | Multiple removal or recovery flakes | 2 | 4.08 | 1.44 | 0.16 |
| C-5 | Nondiagnostic shatter | 110 | 13.82 | 79.13 | 79.14 |
| | Total flakes | 139 | | | 11.16 |
| | *Stage III to Stage IV Biface* | | | | |
| C-1 | Decortication flakes | 1 | 0.78 | 1.33 | 0.08 |
| C-2 | Thinning flakes | 0 | - | - | - |
| C-3 | Biface thinning flakes[b] | 20 | 20.41 | 26.67 | 1.61 |
| C-4 | Multiple removal or recovery flakes | 1 | 2.04 | 1.33 | 0.08 |
| C-5 | Nondiagnostic shatter | 53 | 6.66 | 70.67 | 4.25 |
| | Total flakes | 75 | | | 6.02 |

[a]Class 3 biface thinning flakes generated during this phase were as thin, but larger than, those produced in either the preceding or succeeding phases of manufacture.

[b]Biface thinning flakes are generally smaller and thinner than in any of the preceding stages.

brought to the workshop and reduced to stage II or III bifaces. A campsite or workshop exhibiting chipping waste dominated by small biface thinning flakes could be indicative of final thinning and shaping of stage III bifaces. As previously stated, these are only rough generalizations and are based on data collected during the replication of a single biface. While they are admittedly tentative, inferences such as these can provide the investigator with a better understanding of the manufacturing process.

A quartzite hammer stone and elk antler billet were used in replicating the stage IV biface. The quartzite hammer stone was used for the following reasons: (1) quartzite hammer stones have been recovered at the Stockhoff site, (2) many of the Stockhoff decortication flakes, Class 2 thinning flakes and stage I bifaces, exhibit technological attributes which are suggestive of the use of hard hammers. The elk antler billet was used for the following reasons: (1) antler billets are known to have been used by aboriginal populations in the manufacture of stone tools (Holmes 1919:93), (2) antler would have probably been available to aboriginal populations utilizing the quarry, and (3) most of the recovered biface thinning flakes and stage II, III, and IV bifaces exhibit technomorphological attributes which are suggestive of the use of soft hammers.

The hammer stone was used in reducing the flake to a stage I biface. The antler billet was used in reducing the stage I biface to the stage IV state. Chipping waste was systematically collected for each type of percussor used. Five hundred and ninety-two flakes were collected for hard hammer percussion and 739 for soft hammer percussion. The flakes produced by the hammer stone and the antler billet were analyzed and the technomorphological attributes exhibited on the platform remnants and ventral surface of each type of flake were compared. The results are as follows.

*Results*

There does appear to be a relationship between the type of percussor used and the technomorphological attributes exhibited on the platform remnant and ventral surface of these basalt flakes. Flakes produced by the hammer stone are generally more massive, exhibit salient bulbs of force, erailures, radial striations, undulations, and impact marks on the platform remnant. Flakes produced by the antler billet are generally thinner, exhibit diffuse bulbs of force, and lipping of the platform remnant. They usually do not possess impact marks on platform remnants, erailure scars, distinct undulations or marginal fissures. It is important to note that not every flake produced by the hammer stone or the antler billet exhibits all of the above stated attributes. These are generalizations and cannot be applied to single flakes. Generalizations of this nature are relevant only when dealing with populations of flakes.

My intention has not been to solve the hard versus soft hammer problem, but to show that while antler billets are not represented in the archaeological record at the site, there is a fair amount of evidence to support their use in the manufacture of stage II, III, and IV bifaces. The use of antler billets and the technological attributes associated with them are widely known in the literature (Crabtree 1967, 1970, Muto 1971; Bucy 1973).

At the Stockhoff site, as at most other archaeological sites, chipping waste was collected in ¼ in mesh screen and by hand. Thus during the replication experiment chipping waste was similarly screened before counting. Twelve hundred and forty-six flakes were collected in this manner. This total roughly approximates the number of flakes produced in the manufacture of a single basalt biface which could be collected in an actual archaeological situation using ¼ in mesh screen. The chipping waste which passed through this screen was then dry sieved through 1 mm mesh in order to more closely approximate the number of flakes produced during replication of the biface. The flakes caught in the 1 mm screen weighed 472 grams. A four gram sample was selected and counted and from the four gram sample the total number of flakes caught in the 1 mm screen was extrapolated. Approximately 15,694 flakes passed through ¼ in mesh and were caught in the 1 mm sieve. Disregarding the material which passed through the 1 mm sieve, 16,940 flakes were produced in the manufacture of a single basalt biface. This suggests that in screening operations approximately 7% of the total flakes produced would be collected for analysis and then only if the entire biface were reduced in the same spot. In a similar experiment involving the replication of handaxes from flint nodules, Newcommer (1973) collected only 4000 flakes using a 1 mm sieve. The 16,940 flakes generated in the manufacture of the basalt biface resulted from the reduction of a single flake. This suggests that basalt is much more susceptible to shatter during manufacture than are the more vitreous materials such as flint.

I do not mean to suggest that archaeologists use 1 mm mesh when screening cultural deposits, nor am I suggesting that every single flake produced during the manufacture of an aboriginal biface need be recovered. The purpose of this portion of the replication experiment is to demonstrate that large quantities of chipping detritus can result from the manufacture of a single implement, especially when the lithic material is basalt or one of the less vitreous materials. This portion of the experiment is particularly relevant to Plateau archaeology, especially when one considers that a large percentage of the lithic implements produced during the Cascade Phase were manufactured from basalt. It is my belief that this replication experiment has helped to establish the existence of a biface reduction system at the Stockhoff site. I also feel that this experiment has demonstrated the value of lithic replication.

# CHAPTER 6

# THE EXCAVATION

The excavation is located on a small terrace at the base of a south-facing slope approximately 4 m above, and less than 20 m north, of a small perennial stream (Fig. 16). The terrace on which the excavation is located appears to be the ancestral flood plain of the existing perennial stream. The ancestral flood plain or terrace consists of approximately 3 m of relatively fine overbank sediments overlying well-rounded alluvial gravels and cobbles. A complex soil profile has developed within these deposits (Table 4, Fig. 17). Cultural materials, namely basalt implements and chipping waste, have at times been deposited on the pre-existing weathered surfaces by aboriginal folk exploiting the lithic resources of the site.

Before turning to the natural stratigraphy it is first necessary to consider a time stratigraphic marker revealed in the excavation. At a depth of approximately 80 cm a light colored band of soil was encountered. Preliminary analysis of the light colored soil material revealed the presence of volcanic ash.

The ash was submitted to the Washington State University Department of Soils and Agronomy for further analysis and identification. The analysis was conducted by Rose Okazaki, laboratory technician for the Department of Soils and Agronomy. According to Mrs. Okazaki, the glass shard morphology, refractive index, and phenocryst suite of the sample are highly indicative of Mazama ash. The presence of silts and clays mixed with the ash indicates that

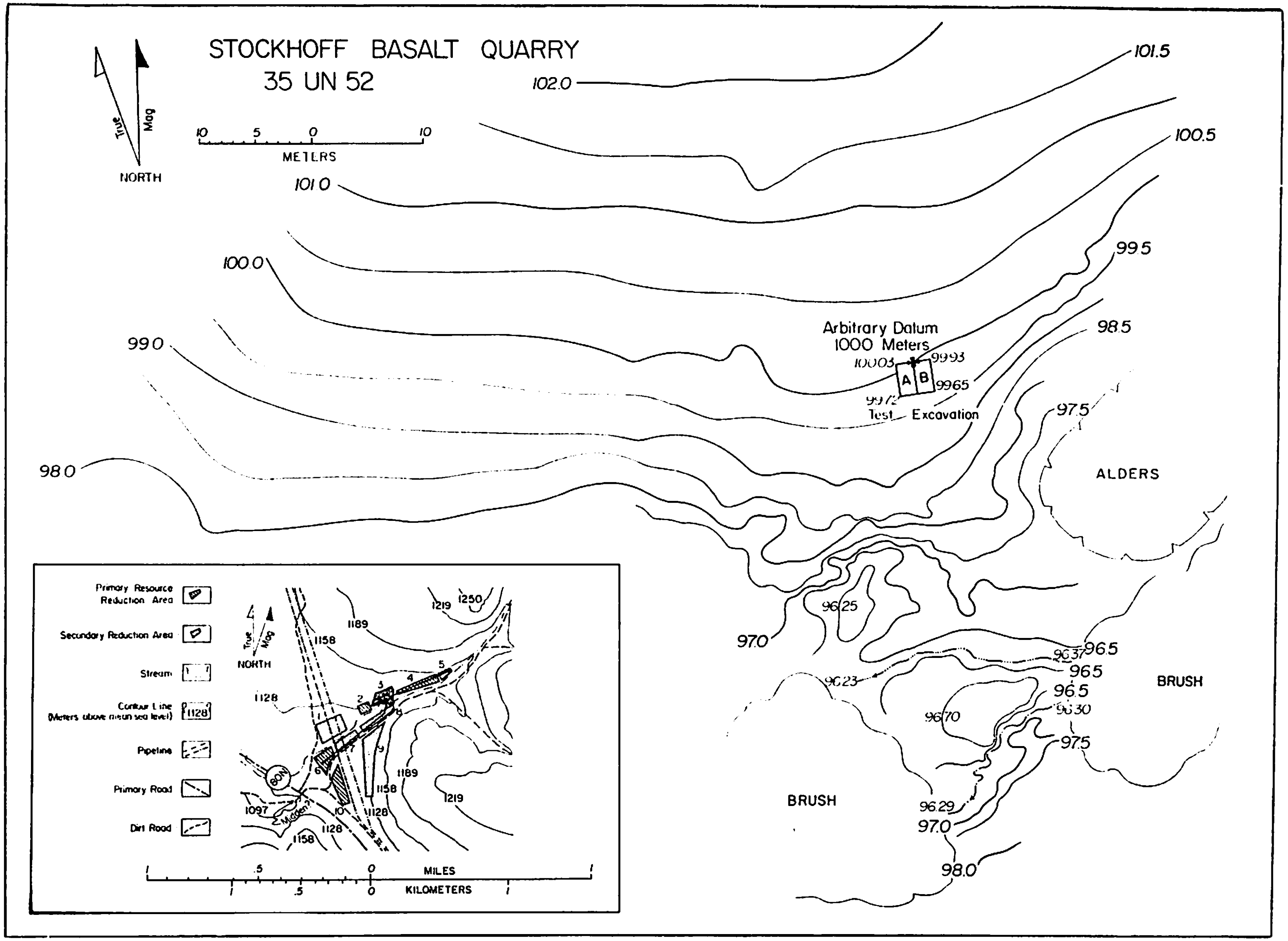


Fig. 16.--Excavation Area Map. Contour map equals Area 3 on Site map insert. Contour elevations based on 100 m arbitrary datum.

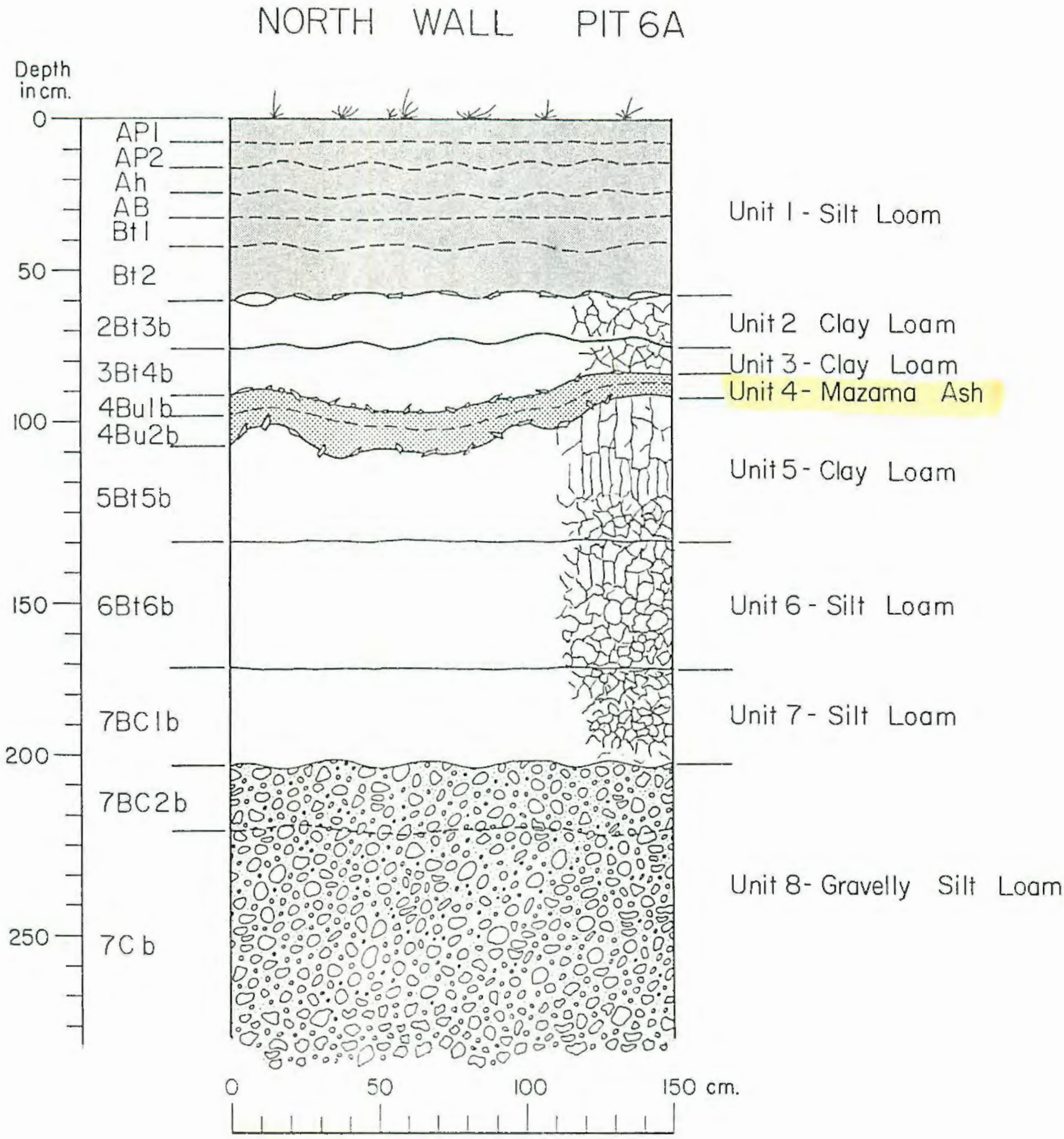


Fig. 17.--Profile Drawing North Wall Pit 6-A

TABLE 4.--Natural Stratigraphy of the Stockhoff Site

| *Geological Units* | *Depth cm* | *Description* |
|---|---|---|
| 1 | 0 - 60 | Black, silty loam grading to silty clay loam near base of unit, unit 1 is developing in an antecedent meadow soil, well developed Ah horizon, very abrupt wavy boundary marked by basalt flakes oriented parallel to boundary; to |
| 2 | 60 - 75 | Dark brown, clay loam exhibiting increase in clay content and structural grade; slight increase in weathered basaltic sand; very abrupt wavy boundary; to |
| 3 | 75 - 86 | Very dark grayish brown clay loam, highly developed argillic B horizon, approximately 50% clay, approximately 3% fine to coarse weathered basaltic sand; abrupt wavy boundary marked by basalt flakes oriented at various angles; to |
| 4 | 86 - 102 | Very pale brown, silt loam, and volcanic ash lying on erosional unconformity; very abrupt wavy boundary; to |
| 5 | 102 - 133 | Very dark brown, clay loam; distinct continuous clay coats on peds; extremely well developed argillic B horizon, 50-60% clay; approximately 2-3% fine to coarse weathered basaltic sand, basalt flakes, and pebbles uniformly distributed throughout unit; abrupt smooth boundary; to |
| 6 | 133 - 176 | Dark brown, silt loam; decreasing clay content and structural grade; 3-4% fine to coarse weathered basaltic sand; abrupt smooth boundary; to |
| 7 | 176 - 208 | Dark grayish brown, silt loam; very weak structural grade; clear smooth boundary; to |
| 8 | 208 - 285 | Dark brown, gravelly silt loam; structure is massive; base of unit marked by well rounded alluvial gravels and cobbles. |

it has been redeposited. Mt. Mazama erupted and spread volcanic ash over much of the Pacific Northwest approximately 6700 years ago (Kettleman 1973:2959).

The stratigraphic position of the volcanic ash in the soil monoliths taken from the excavation indicates that it was redeposited shortly after initial airfall deposition (Dr. Henry W. Smith, personal communication). In the excavation, the volcanic ash forms an abrupt contact with an underlying erosional unconformity. According to Hammatt (1976:81) primary deposits of Mazama ash are most often found directly overlying paleoerosional surfaces. The occurrence of the redeposited Mazama ash directly overlying a paleoerosional surface is highly suggestive of redeposition shortly after initial airfall. The Mazama tephra layer can therefore serve as a time stratigraphic marker for both the natural and cultural stratigraphy. The deposits above the ash can be considered to be younger than 6700 years old while those below the ash can be considered to be older than 6700 years.

### *Natural Stratigraphy*

The following discussion of the natural stratigraphy is generalized from excavation profiles at the Stockhoff site. For a detailed profile description refer to Appendix B. With the exception of the laboratory analysis of the volcanic ash, this discussion is based primarily on Dr. Frank C. Leonhardy's field observations and Dr. Henry W. Smith's observations of soil monoliths taken from the excavation.

The natural stratigraphy is best understood by discussing the inferred sequence of events which appear to be responsible for the stratigraphic formation. The sequence begins with the rounded alluvial gravels and cobbles which make up the lower unit exposed in the excavation. During this period of deposition sometime prior to 6700 B.P., the stream was much closer to the excavation than at present, as evidenced by the alluvial gravels and cobbles. Following the deposition of the alluvial gravels and cobbles the stream appears to have moved laterally, probably south in the direction of its present location. The stream then began to agrade, depositing relatively fine overbank sediments on the flood plain during periods of high runoff. The flood plain also appears to have received alluvial and colluvial additions in the form of slope wash from the adjacent south-facing slope. During periods of relative stability, soils formed in the overbank sediments and cultural materials were deposited on their surfaces. The period of aggradation appears to have continued until approximately 6600 B.P., at which time there appears to have been a brief period of degradation and erosion of the flood plain forming the erosional unconformity on which the Mazama ash now lies. Erosion of the flood plain was intense enough to remove the A and E horizon exposing the Bt horizon of the pre-existing soil. The removal of the A and E horizons is evidenced by the occurrence of a glossic soil horizon in the upper portion of the Bt underlying the erosional unconformity (Dr. Henry W. Smith, personal communication). Glossic horizons form as a result of a downward translocation of E horizon material. In the excavation the glossic horizon is present, however the E horizon responsible for its formulation is lacking. Following the erosion of the flood plain aggradation again ensued beginning with the deposition of the Mazama ash at approximately 6700 B.P. The period between erosion of the flood plain and redeposition of overbank sediments appears to have been short, because no A horizon formed on the erosional unconformity. Aggradation continued long enough to deposit approximately 1 m of overbank sediments above the Mazama ash. Following this period of deposition the stream again began to degrade, cutting down to its present level approximately 4 m below the top of the terrace on which the excavation is located. Therefore, in a period of 6700 years the small tributary of Ladd Creek has aggraded the terrace 1 m and degraded it 4 m.

The reasons for these seemingly major changes are unknown, however they may be in some way related to changes in the base level of the stream. If the Grande Ronde Valley into which Ladd Creek drains was at one time occupied by a lake as Kocker (1926) suggests, then the base level of the creek would have been raised and aggradation would have occurred. As the lake dried up, the base level of the creek would lower and degradation would occur; the creek would cut down rather than build up its flood plain.

It should be understood that the preceding discussion has been somewhat hypothetical and much simplified. In any case this discussion should lead to a better understanding of the stratigraphy revealed in the excavation than would be possible with descriptions and diagrams alone.

*Cultural Stratigraphy*

One-hundred and three basalt implements were recovered in excavation at the Stockhoff site. Eighty-six of the implements are bifaces and biface fragments while the remaining seventeen are unifaces and uniface fragments. The implements from the excavation are technologically and morphologically identical to those recovered in surface collection.

For analytical purposes the implements were placed in pre-Mazama ash and post-Mazama ash assemblages. When the pre-ash and post-ash assemblages are compared they exhibit few morphological or technological differences (Fig. 18-21). The four stages of biface manufacture are represented in both pre-ash and post-ash assemblages. There are no major variations in the frequency of occurrence of any particular stage of reduction (Table 5). In general, the pre-ash and post-ash assemblages appear to represent a single lithic component.

The vertical distribution of artifacts in the excavation was relatively uniform with the exception of level 8, 105-120 cm (Table 6). Approximately 20 cm below the Mazama tephra layer in the base of level 8, 105-120 cm, a

Fig. 18.--Post-Mazama Implements

*a-f* bifaces and biface fragments

*g* lanceolate projectile point

*h* side notched projectile point

*i* drill

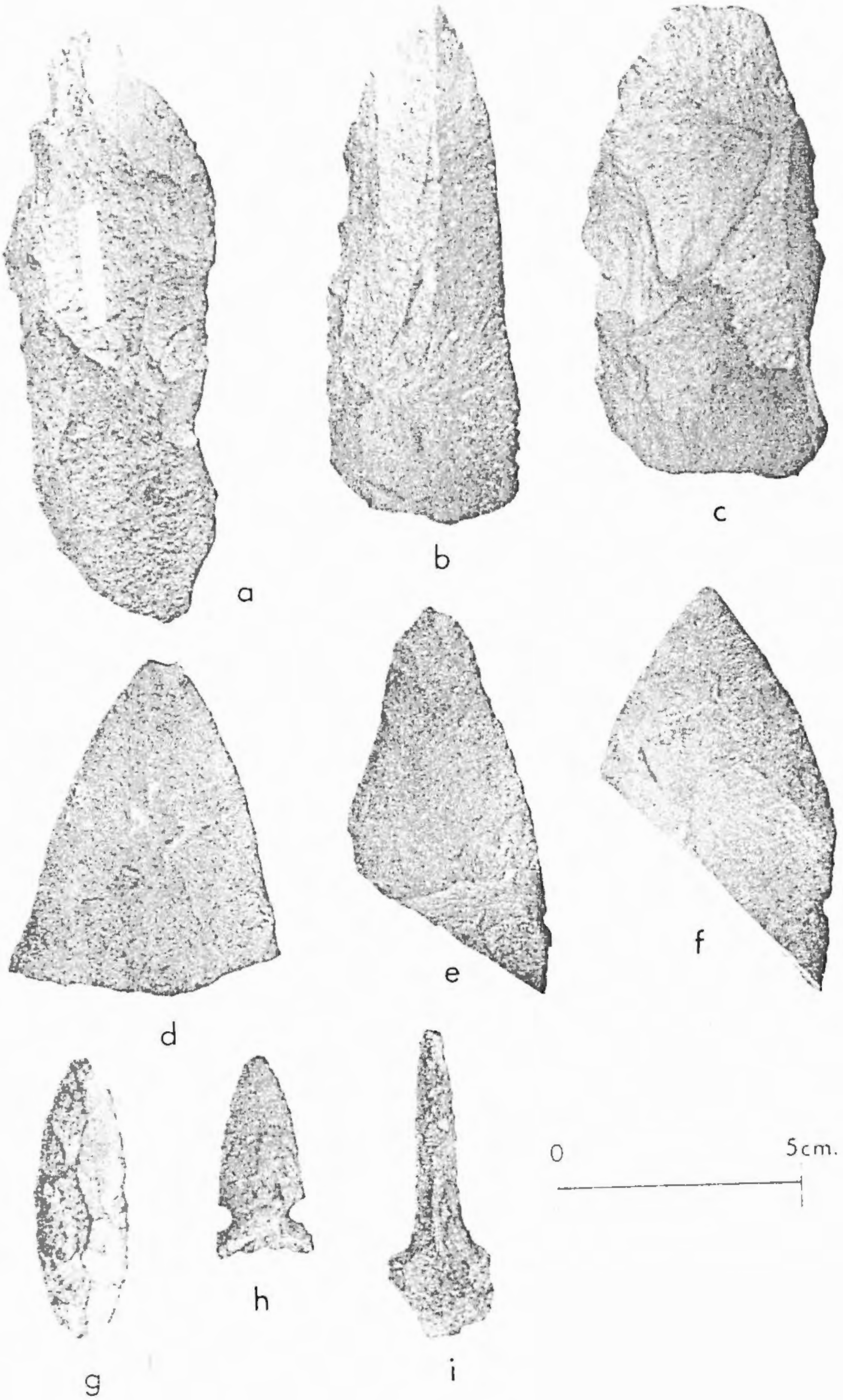


Fig. 18

Fig. 19.--Post-Mazama Unifacial Implements

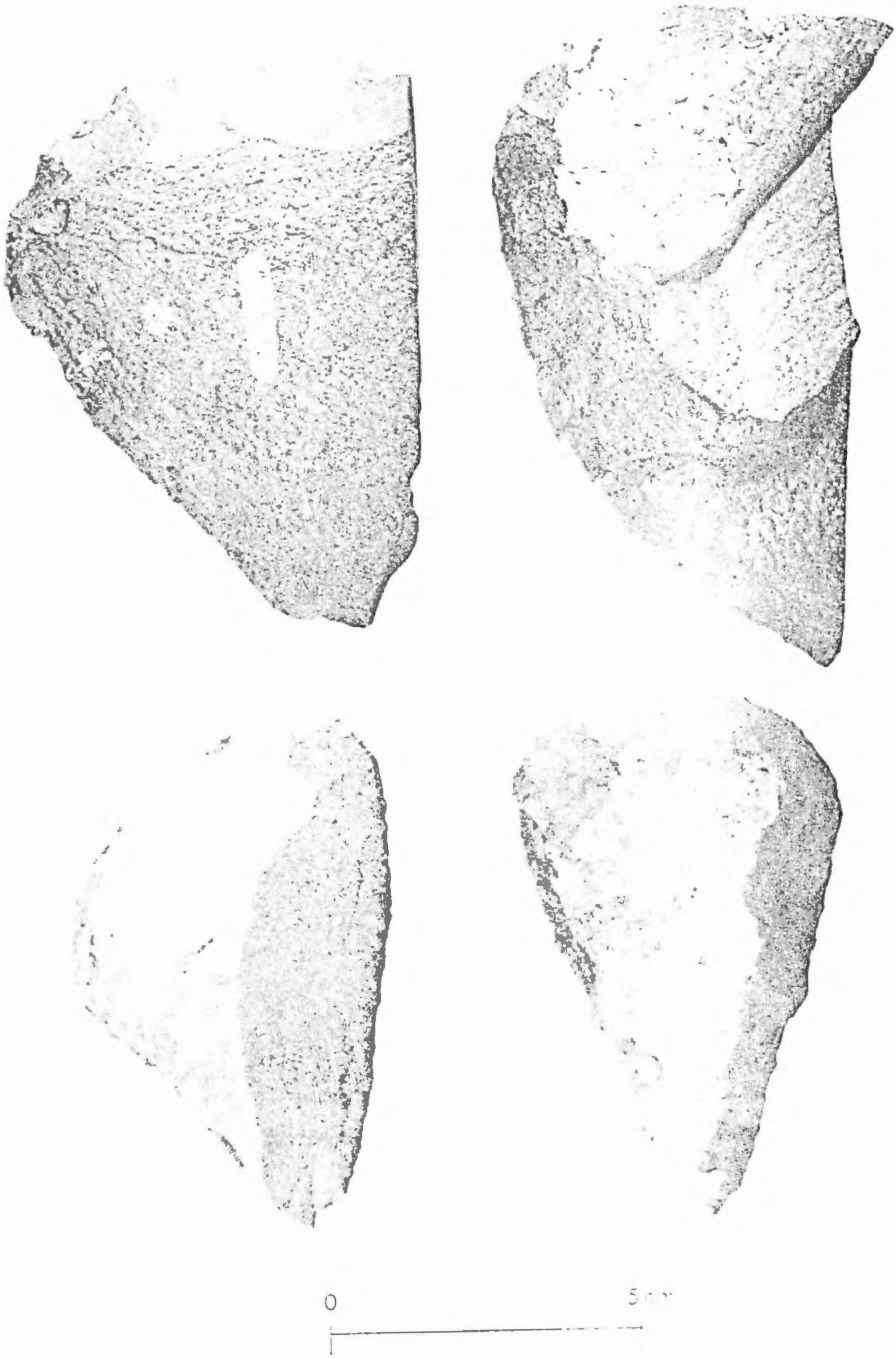


Fig. 19

Fig. 20.--Pre-Mazama Implements

*a-e* bifaces and biface fragments

*f* lanceolate knife

*g-i* lanceolate knives or projectile points

*j* basal notched knife or projectile point fragment

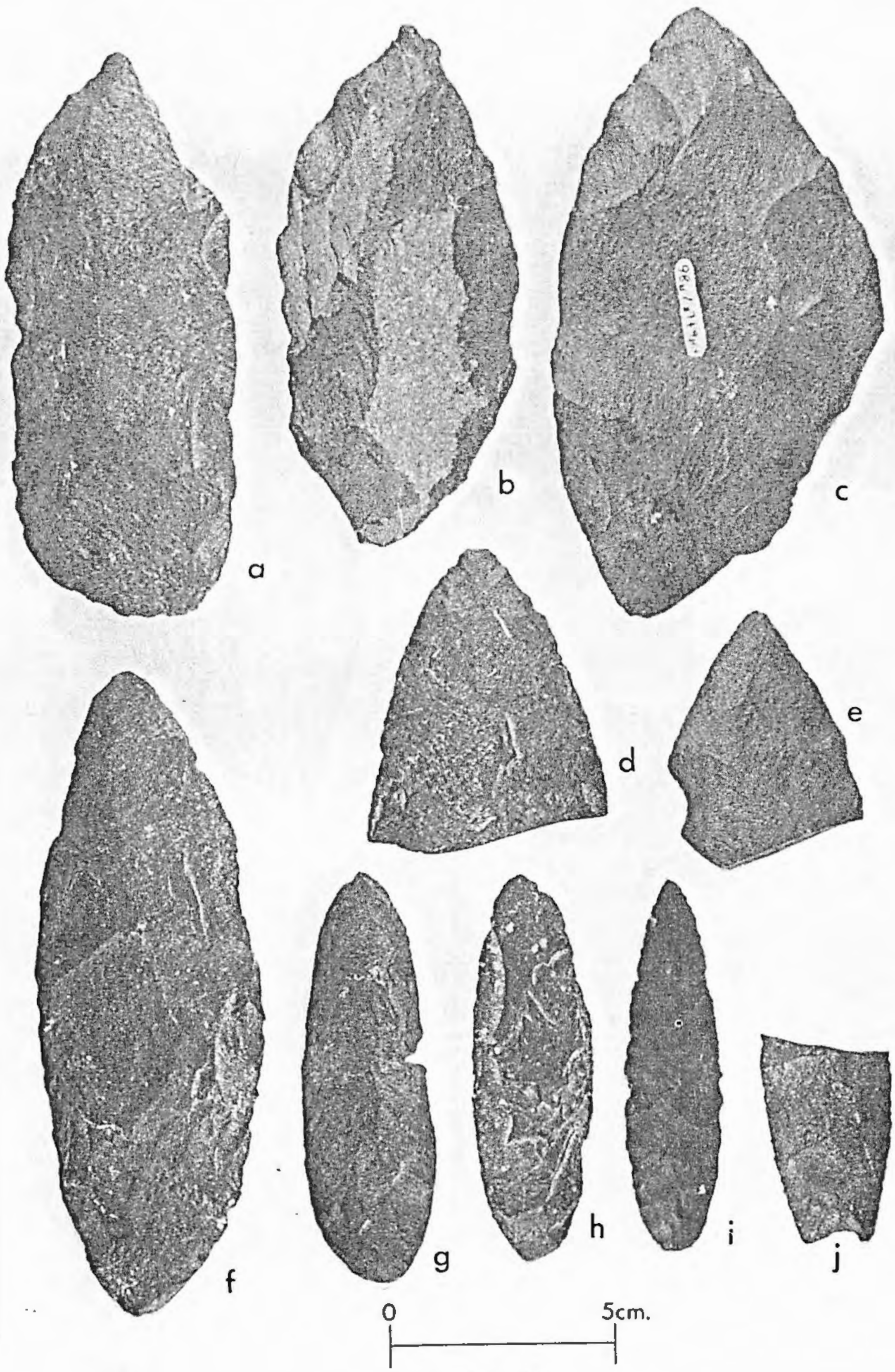


Fig. 20

Fig. 21.--Pre-Mazama Unifacial Implements

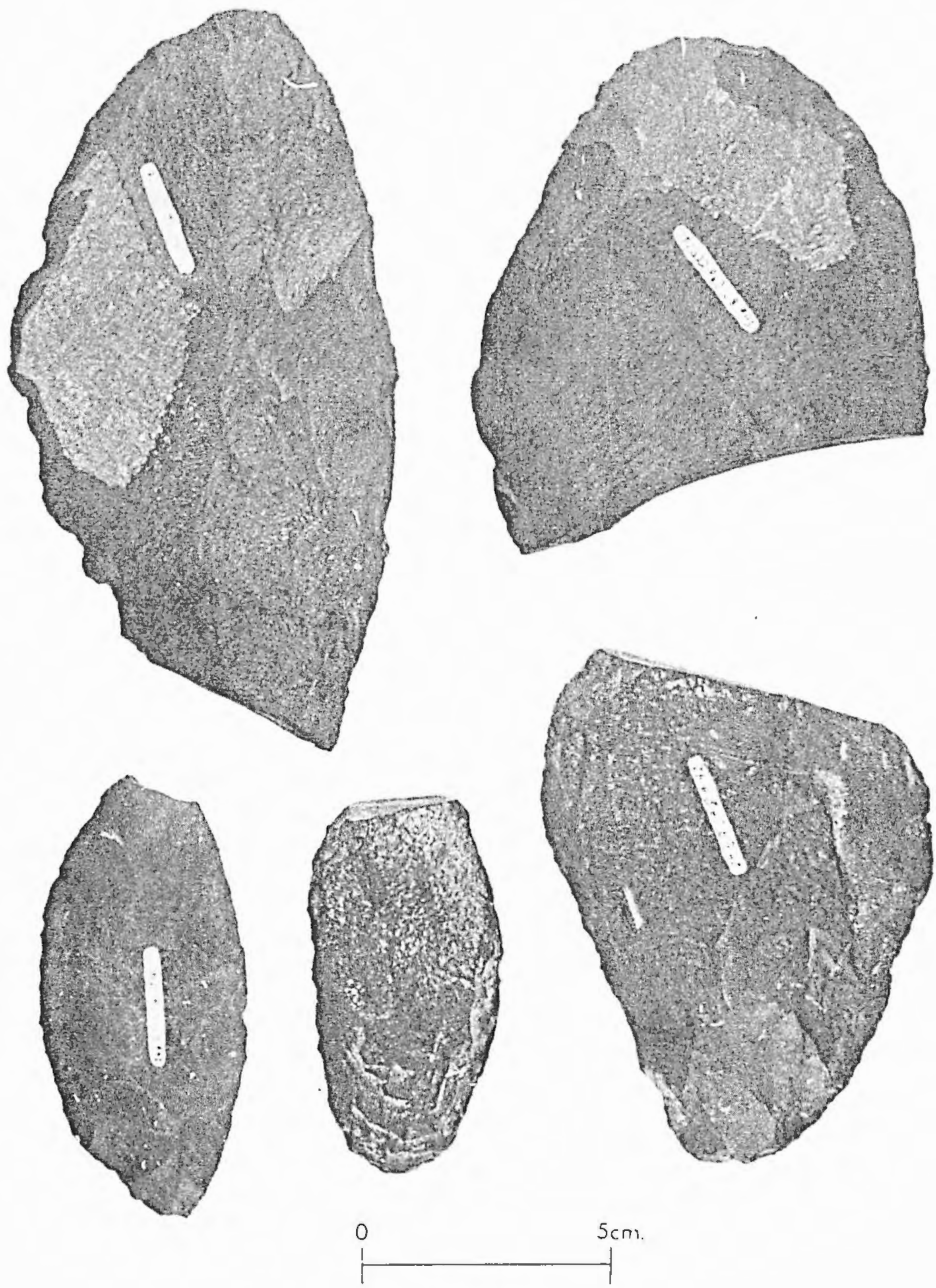


Fig. 21

TABLE 5.--Post-ash and Pre-ash Biface Totals and Percentages by Stage of Manufacture

| *Stage* | *Number of Specimens* | *% of Total Bifaces in Post-ash Unit* | *% of Total Bifaces in Excavation* |
|---|---|---|---|
| | | *Post-ash* | |
| Stage I | 13 | 30.9 | 15.1 |
| Stage II | 11 | 26.1 | 12.7 |
| Stage III | 12 | 28.5 | 13.9 |
| Stage IV | 6 | 14.2 | 6.9 |
| Total | 42 | | |
| | | *Pre-ash* | |
| Stage I | 10 | 23.8 | 11.6 |
| Stage II | 12 | 27.2 | 13.9 |
| Stage III | 11 | 25.0 | 12.7 |
| Stage IV | 11 | 25.0 | 12.7 |
| Total | 44 | | |

TABLE 6.--Implement Distribution by 15 cm Levels

| Levels | Depth in cm | Stage I Bifaces | Stage II Bifaces | Stage III and IV Bifaces: Lanceolate Knives and Fragments | Stage III and IV Bifaces: Diagnostic Projectile Points: Side Notched | Stage III and IV Bifaces: Diagnostic Projectile Points: Lanceolate | Stage III and IV Bifaces: Diagnostic Projectile Points: Basal Notched | Unifaces |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 - 15 | | | | | | | |
| 2 | 15 - 30 | 3 | 3 | | | | | 2 |
| 3 | 30 - 45 | 3 | 4 | 3 | | | | 2 |
| 4 | 45 - 66 | 2 | 0 | 3 | 1 | | | 2 |
| 5 | 60 - 75 | 4 | 2 | 6 | | | | 2 |
| 6 | 75 - 90 | 0 | 3 | 2 | | 1 | | 0 |
| 7 | 90 - 105 | 3 | 1 | 4 | | 1 | | 4 |
| 8 | 105 - 120 | 3 | 5 | 14 | | 2 | | 4 |
| 9 | 120 - 135 | 4 | 3 | 2 | | 1 | | 1 |
| 10 | 135 - 150 | 1 | 1 | 0 | | | 1 | 4 |
| Totals | | 23 | 22 | 33 | 1 | 6 | 1 | 22 |

relatively undisturbed pre-existing weathering surface was encountered. Of the 54 artifacts recovered from the pre-ash unit, 76% were found in association with the surface. In the northern end of pit 6-A, 8 large biface fragments were found lying directly on the surface (Fig. 22). The other 2 fragments were found directly underlying them. The 8 fragments can be fitted together to form 4 large lanceolate knives (Fig. 23). All four knives appear to have been broken in manufacture and discarded on the pre-existing surface sometime prior to 6700 B.P.

Twenty-nine hundred and sixty-three basalt flakes and 126 obsidian flakes were recovered in excavation. The basalt chipping waste was distributed throughout the excavation. The obsidian chipping waste occurred only in the post-Mazama unit. This suggests that obsidian may not have been utilized by the aboriginal folk exploiting the site until after 6700 B.P. The obsidian waste recovered in the excavation appears to be derived in sharpening or re-touching obsidian implements. The majority of the basalt chipping waste appears to have been derived from the reduction of the 86 bifaces and fragments broken or rejected during manufacture.

The basalt chipping waste found in the excavation indicates that the terrace functioned primarily as a workshop area for the further reduction of Stage I and II bifaces. The aboriginal flintknappers appear to have roughed out the bifaces in the primary reduction resource areas along the south-facing slope, and on the southern end of the alluvial fan. The bifaces were then transported to secondary reduction areas along the creek for further reduction (Fig. 2). This is evidenced by the numbers and types of flakes found in the excavation, particularly decortication flakes (Table 7). During the replication experiment, 126 decortication flakes were produced in the manufacture of a single biface. A total of 86 bifaces and biface fragments in various stages

Fig. 22.--Large Basalt Bifaces Shown Lying on a Pre-Existing Weathering Surface Beneath Mazama Ash

Fig. 23.--Biface Fragments Found on Pre-Existing Weathering Surface Shown Fitted Together

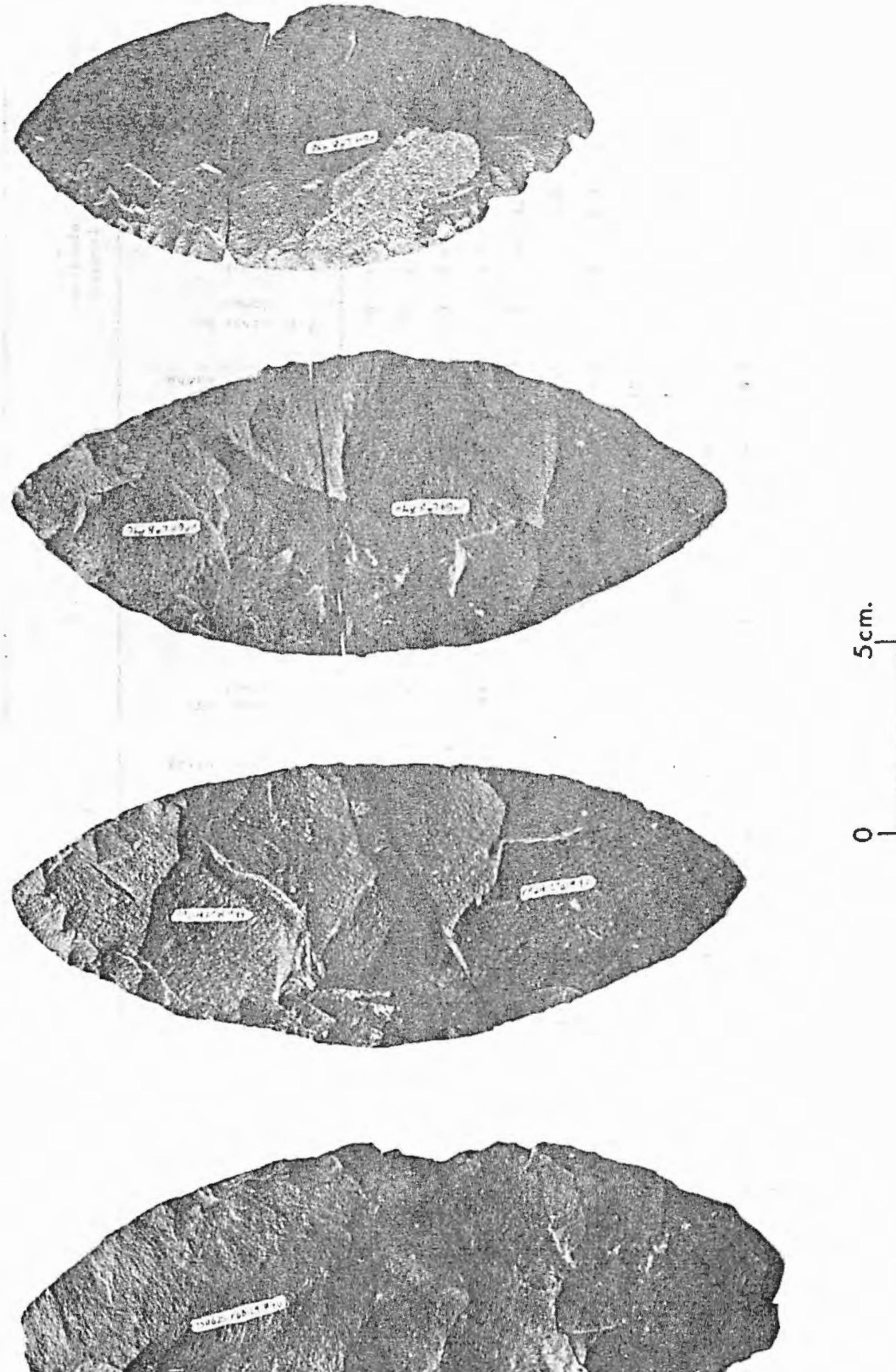


Fig. 23

TABLE 7.—Excavation Flake Distribution Summary

| *Levels* | | | *C-1 Decortication A Primary B Secondary* | | | | | | *C-2 Thinning* | | | *C-3 Biface Thinning A Flaked Platform B Flaked Abraded Platform* | | | | | | *C-4 Multiple Removal* | | | *C-5 Nondiagnostic Shatter* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Level number* | *Levels in cm* | *Level totals* | *# in class by level* | *% of level* | *% of total class* | *# in class by level* | *% of level* | *% of total class* | *# in class by level* | *% of level* | *% of total class* | *# in class by level* | *% of level* | *% of total class* | *# in class by level* | *% of level* | *% of total class* | *# in class by level* | *% of level* | *% of total class* | *# in class by level* | *% of level* | *% of total class* |
| 1 | 0–15 | 182 | 2 | 1.1 | 2.1 | 11 | 6.0 | 2.7 | | | | 24 | 13.1 | 5.7 | 2 | 1.0 | 1.0 | 9 | 4.9 | 2.1 | 134 | 73.6 | 8.40 |
| 2 | 15–30 | 484 | 21 | 5.2 | 21.0 | 64 | 13.2 | 15.9 | 13 | 2.6 | 11.7 | 8 | 14.0 | 16.1 | 20 | 4.1 | 10.5 | 27 | 4.1 | 6.5 | 140 | 28.9 | 8.70 |
| 3 | 30–45 | 387 | 1 | 0.2 | 1.0 | 49 | 12.6 | 12.2 | 8 | 2.0 | 7.2 | 62 | 2.0 | 14.7 | 25 | 6.4 | 13.2 | 23 | 6.4 | 5.5 | 200 | 51.6 | 12.50 |
| 4 | 45–60 | 310 | 1 | 0.3 | 1.0 | 28 | 9.0 | 6.9 | 1 | 0.3 | 0.9 | 49 | 15.8 | 11.6 | 7 | 2.2 | 3.7 | 9 | 2.9 | 2.1 | 224 | 72.2 | 14.00 |
| 5 | 60–75 | 244 | 3 | 1.4 | 3.1 | 24 | 9.8 | 5.9 | 4 | 1.6 | 3.6 | 24 | 9.8 | 5.7 | 9 | 3.6 | 4.7 | 9 | 3.6 | 2.1 | 163 | 66.8 | 10.20 |
| 6 | 75–90 | 226 | 1 | 0.4 | 1.0 | 11 | 4.8 | 2.7 | 7 | 3.0 | 6.3 | 25 | 11.0 | 5.9 | 6 | 2.6 | 3.1 | 9 | 3.9 | 2.1 | 156 | 69.0 | 9.70 |
| 7 | 90–105 | 342 | 4 | 1.1 | 4.1 | 43 | 12.5 | 10.7 | 17 | 4.9 | 15.3 | 31 | 9.0 | 7.3 | 30 | 8.7 | 15.8 | 29 | 8.4 | 6.9 | 182 | 53.2 | 11.40 |
| 8 | 105–120 | 467 | 17 | 3.6 | 5.8 | 63 | 13.4 | 15.7 | 16 | 3.4 | 14.4 | 37 | 7.9 | 8.7 | 37 | 7.9 | 19.5 | 27 | 5.7 | 6.5 | 240 | 51.3 | 15.00 |
| 9 | 120–135 | 347 | 5 | 1.4 | 5.2 | 81 | 23.3 | 20.2 | 24 | 6.9 | 21.6 | 54 | 15.5 | 12.8 | 32 | 9.2 | 16.9 | 13 | 3.7 | 3.1 | 142 | 40.9 | 8.90 |
| 10 | 135–150 | 125 | 3 | 2.4 | 3.1 | 20 | 16.0 | 4.9 | 14 | 11.2 | 12.6 | 35 | 28.0 | 6.3 | 13 | 10.4 | 6.8 | 10 | 8.0 | 2.4 | 7 | 5.6 | 0.40 |
| 11 | 150–165 | 30 | 4 | 13.3 | 4.1 | 4 | 13.3 | 0.9 | 5 | 16.6 | 4.5 | 7 | 23.3 | 1.6 | 8 | 26.6 | 4.2 | | | | 1 | 3.3 | .06 |
| 12 | 165–180 | 9 | 2 | 11.1 | 2.1 | 3 | 33.3 | 0.7 | 2 | 22.2 | 1.8 | 5 | 55.5 | 1.1 | | | | | | | 4 | 44.4 | 0.20 |
| Totals | | 2963 | 96 | | | 401 | | | 111 | | | 421 | | | 189 | | | 415 | | | 1593 | | |

of reduction were found in the excavation and only 641 decortication flakes were recovered. Level 8, 105-120 cm yielded 24 bifaces and fragments and only 86 decortication flakes. No more than 86 decortication flakes were recovered from any of the 15 cm levels. This would seem to indicate that the majority of the bifaces brought to the terrace were already reduced to the Stage I or II state lacking most, if not all, of the cortex.

With the exception of a one-side notched projectile point found in level 4, 45-60 cm, and one basally notched projectile found in level 10, 135-160 cm, the diagnostic projectile points and knives are technomorphologically very similar to those from Cascade components along the Lower Snake River. In general, the entire assemblage recovered from the Stockhoff site is Cascade-like. With the exception of a few large side notched projectile points characteristic of the Cold Spring Horizon, artifacts diagnostic of later periods in Plateau prehistory, particularly the late prehistoric, are lacking at the Stockhoff site. The small stemmed, side and corner notched projectile points characteristic of the late prehistoric period in the Plateau were not found in either surface collection or excavation. They do not occur in the private collection of the previous owner, Gene Stockhoff, who collected on the site for fifteen years. These projectile points are widespread in the Plateau after approximately 4000 B.P. Their absence at the Stockhoff site suggests that either the site's function changed or that the site was no longer exploited after approximately 4000 B.P. The latter seems more likely when one considers that there is a marked decrease in the amount of basalt occurring in late prehistoric components. The small projectile points characteristic of the late prehistoric are made predominantly from cryptocrystalline silicates. The use of basalt is usually restricted to cobble implements and utilized flakes. It seems unlikely that late prehistoric Plateau folk exploiting the site would leave no sign. If the small projectile points were being manufactured at the site one would expect to find fragments of points broken in manufacture. Excavation and extensive surface collection as well as examination of private collections taken from the Stockhoff site failed to reveal the existence of late prehistoric cultural materials.

The cultural material revealed in the excavation appears to represent a single lithic component technomorphologically identical to the material recovered in surface collection. This suggests that throughout its occupation, the Stockhoff site was exploited by a relatively homogeneous population possessing a similar reductive stone technology. The occurrence of cultural material below Mazama ash indicates that the site was being exploited at least as early as 6700 B.P. The Cascade-like assemblage recovered from the site is suggestive of occupation by 8000 B.P. as is the case with radiocarbon dated Cascade sites along the Snake and Columbia Rivers. The apparent lack of prehistoric cultural material at the site suggests that utilization terminated by approximately 3000 B.P.

# CHAPTER 7

## CASCADE TECHNIQUE FLAKE AND BLADE FORMS AND IMPLEMENTS

### *Introduction*

During surface collection and excavation at the Stockhoff site 50 basalt artifacts were recovered which bear a morphological and technological resemblance to implements and flakes characteristic of the "Cascade Technique" (Muto 1976). The Cascade Technique is a complicated reduction system which resembles the Levallois Technique of the Old World. Before dealing with the Levallois-like artifacts recovered from the Stockhoff site, a discussion of the Cascade Technique (Muto 1976) and the Old World Levallois Technique (Bordes 1968) is in order. The existence of a Levallois-like reduction system in the southern Plateau was first reported by Leonhardy and Muto (1972). According to Muto,

> The Cascade Technique is a Levallois-like reduction system characteristic of early (ca. 10,000-4500 B.P.) archaeological phases in the Lower Snake River region, southeastern Washington, This New World Levallois-like technique produced end products morphologically identical to products of the Old World Levallois Technique. The two differ in one respect. In the Old World system different cores were for flakes, blades or points. In the New World System all products were produced from the same cores through modification of the reduction trajectory [Muto 1976:vi].

For a graphic description of the Cascade Technique, see Fig. 24.

The Levallois-like material recovered from the Stockhoff site is represented by what appear to be cores of various stages of reduction, as well as flake and blade forms. Also represented are implements which appear to have been manufactured on cores and flake and blade forms.

Fig. 24.--Cascade Technique Reduction System
Source: Reprinted from Muto (1976:130). Used with permission of Guy R. Muto.

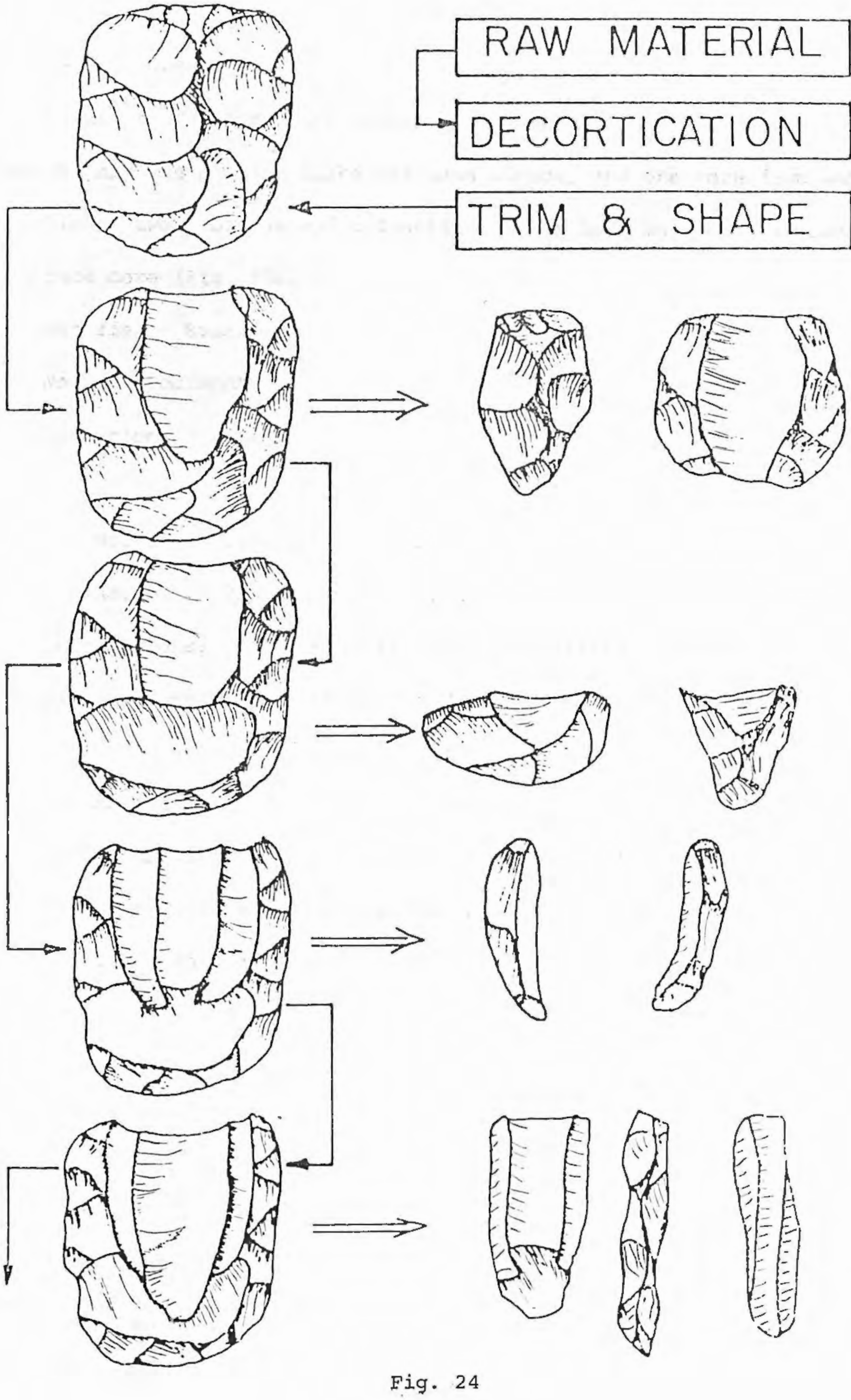


Fig. 24

## *Description of Cores*

Levallois-like cores:

Levallois like cores are represented by two unstruck cores, seven cores from which only the primary flake has been struck, and one core from which the primary flake, two A blades and a distal ridge truncation flake has been struck.

Unstruck core (Fig. 25*a*, *b*):

*Material:* Basalt

*No. of specimens:* 2

*Dimensions:*

| | *Length* | *Width* | *Thickness* |
|---|---|---|---|
| No. 1 | 180 mm | 120 mm | 45 mm |
| No. 2 | 210 mm | 126 mm | 55 mm |

*Descriptions:* The cores are irregularly flaked on both faces. Remnants of cortex are present on both faces of the two cores, indicating that they were manufactured on cobbles rather than flakes. Both cores resemble stage I bifaces, however they are thicker and wider in relation to length than are the majority of stage I bifaces. Steeply inclined flake scars have resulted in the formation of a longitudinal ridge running down the medial portion of both cores.

*Comments:* I am somewhat hesitant to conclude that these are in fact unstruck cores. No diagnostic flake or blade forms have been detached, and there is no way of knowing whether or not the manufacturer intended to use them as Levallois cores. The cores may be anomalous stage I bifaces. The only statement which the data will support is that these artifacts resemble unstruck Levallois cores.

Cores from which only a primary flake has been detached (Fig. 25 and 26):

*Material:* Basalt

*No. of specimens:* 7

Fig. 25.--Levallois-Like Cores

*a-b* possible unstruck core, plane and longitudinal section views

*c* large core from which a single primary flake has been removed

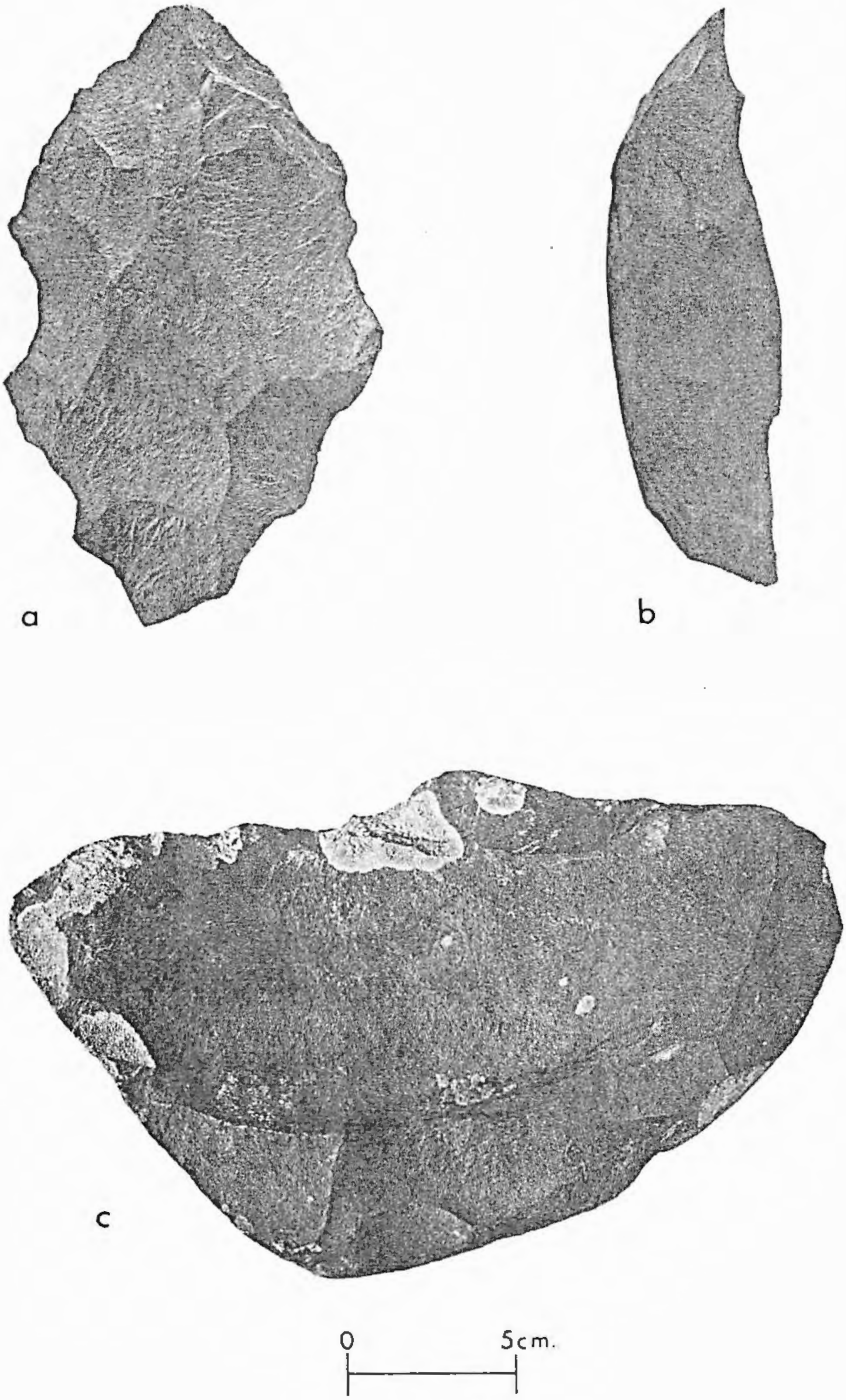


Fig. 25

Fig. 26.--Additional Levallois-Like Cores

*a-c* further cores from which a single primary flake has been detached

*d* core from which the primary flake, to A blades, and a distal ridge truncation flake appears to have been removed

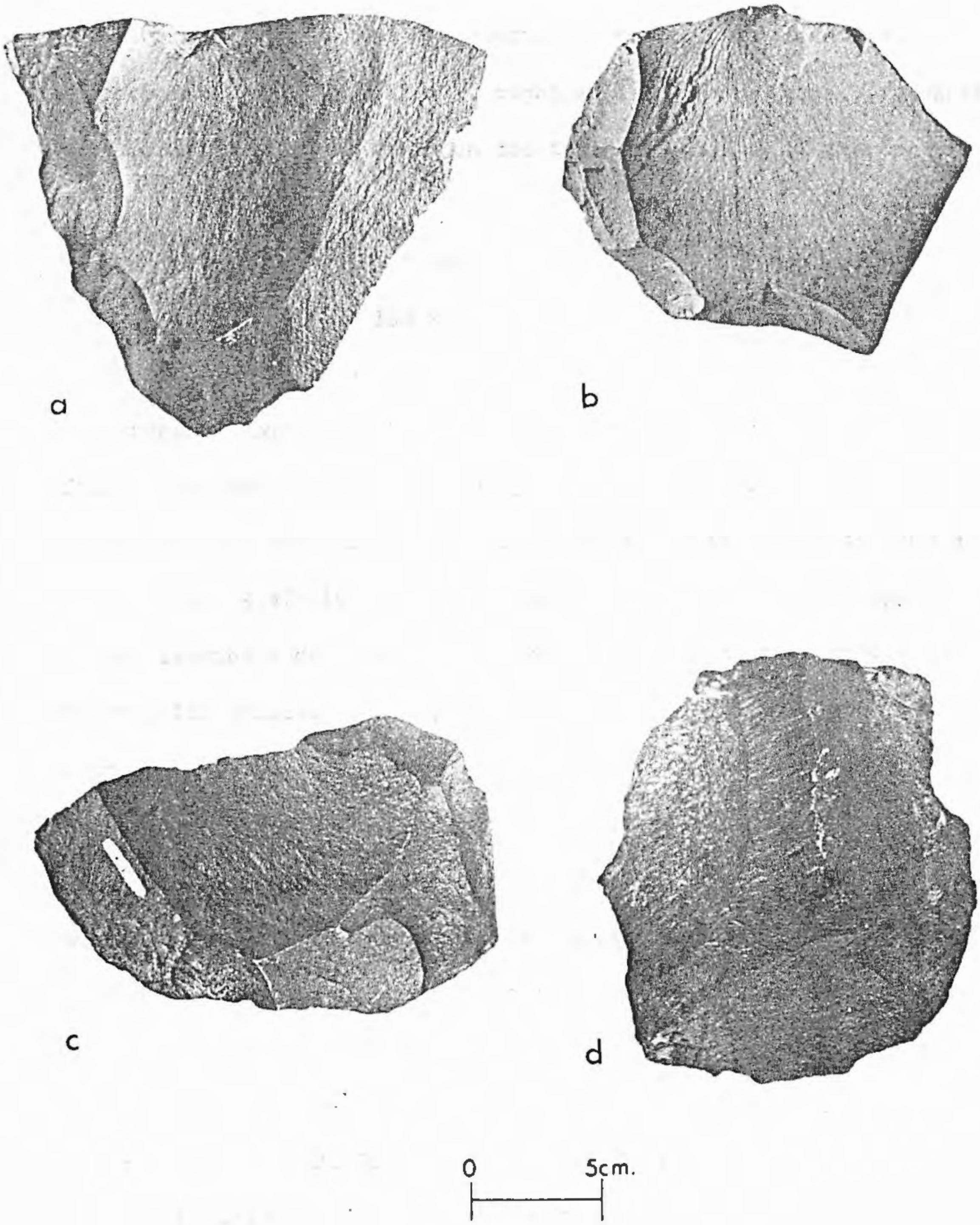


Fig. 26

*Dimensions:* Length measurements have been taken along an imaginary line beginning at the point of impact and projected through the center of the primary flake scar and continuing through the core. Width measurements have been taken at right angles to this line. Thickness measurements have been taken on the thickest portion of the core.

| | *Range* |
|---|---|
| Length | 110 mm - 150 mm |
| Width | 90 mm - 190 mm |
| Thickness | 32 mm - 85 mm |

*Description:* Cores of this type are represented by both cobbles and flakes from which a single primary flake has been detached. The cobbles appear to have been prepared by removing a series of flakes from along one margin. A single large flake was then struck from the opposite margin leaving a deep expanding flake scar almost covering one face of the tabular cobble. Primary flakes also appear to have been detached from cores prepared on large flakes. The core appears to have been prepared by removing a series of flakes from around the margin of the core forming a ridge down the medial portion of the flake. The ridge would have then been used to guide the removal of the primary flake.

*Comment:* Of the eight cores from which flake or blade forms have been struck, seven appear to have been designed for the detachment of a single primary flake. With the exception of the primary flake, no other flake or blade forms were removed from these cores. The flint-knapper removed the desired primary flake and then discarded the core. This may be due to the emphasis placed on the manufacture of bifaces at the quarry. The primary flakes which were removed from the cores would have been biconvex in cross section, and would have been well-suited to the manufacture of bifaces.

Core from which a primary flake, two A blades and a distal ridge truncation flake have been detached (Fig. 26*d*):

*Material:* Basalt

*No. of specimens:* 1

*Dimensions:*

| | |
|---|---|
| Length | 102 mm |
| Width | 91 mm |
| Thickness | 44 mm |

*Description:* This core appears to have been manufactured on a large thick flake. A remnant of cortex is present on the dorsal surface of the core. The core exhibits flake scars left by the removal of the primary flake, two A blades and a distal ridge truncation flake. Following the removal of the flake and blade forms, the core was then modified into a scraper-like implement by steeply retouching the margins.

### *Description of Flake and Blade Forms*

Levallois-like flake and blade forms (Muto 1976:42-55):

Twenty-nine Levallois-like flake and blade forms were recovered from the Stockhoff site. With the exception of a "secondary flake" (Muto 1976:45) all flake and blade forms characteristic of the Cascade Technique appear to be represented. The Levallois-like flake and blade forms recovered from the Stockhoff site are morphologically very similar to those illustrated and described in Muto (1976:39-53). For this reason, descriptions of the flake and blade forms recovered from the Stockhoff site will be limited to dimensions and comments.

Measurements for all flake and blade forms were taken in the following manner. Length measurements were taken along the long axis of the flake regardless of the location of the platform remnant. Width measurements were taken at the widest point at right angles to the longitudinal axis. Thickness measurements were taken at the thickest point on the artifact.

Primary flakes (Fig. 27*a-d*):

*Material:* Basalt

*No. of specimens:* 3

*Dimensions of complete primary flakes:*

| | *Range* | *Mean* |
|---|---|---|
| Length | 46 mm - 90 mm | 68.67 mm |
| Width | 24 mm - 36 mm | 32.00 mm |
| Thickness | 6 mm - 8 mm | 6.33 mm |

*No. of specimens:* 1

*Dimensions of broken primary flake:*

| | |
|---|---|
| Length | 38 mm |
| Width | 48 mm |
| Thickness | 8 mm |

A blades (Fig. 27*e-i*):

*Material:* Basalt

*No. of specimens:* 11

*Dimensions of A blades:*

| | *Range* | *Mean* |
|---|---|---|
| Length | 54 mm - 100 mm | 78.00 mm |
| Width | 30 mm - 56 mm | 42.75 mm |
| Thickness | 6 mm - 12 mm | 8.58 mm |

*Comments:* The platform remnant is located on the proximal end of nine A blades indicating that they were struck from the proximal end of the core. The platform remnant is located on the lateral margin of two A blades indicating that they were struck from the lateral margin of core.

Fig. 27.--Cascade Technique Flake and Blade Forms

*a-d* primary flakes, platform remnant oriented to the top of the page

*e-i* A blades, platform remnants oriented to the top of the page

*j-l* B blades; *j* is a side struck B blade, platform remnant oriented to the right of the page; *k* and *l* lack platforms

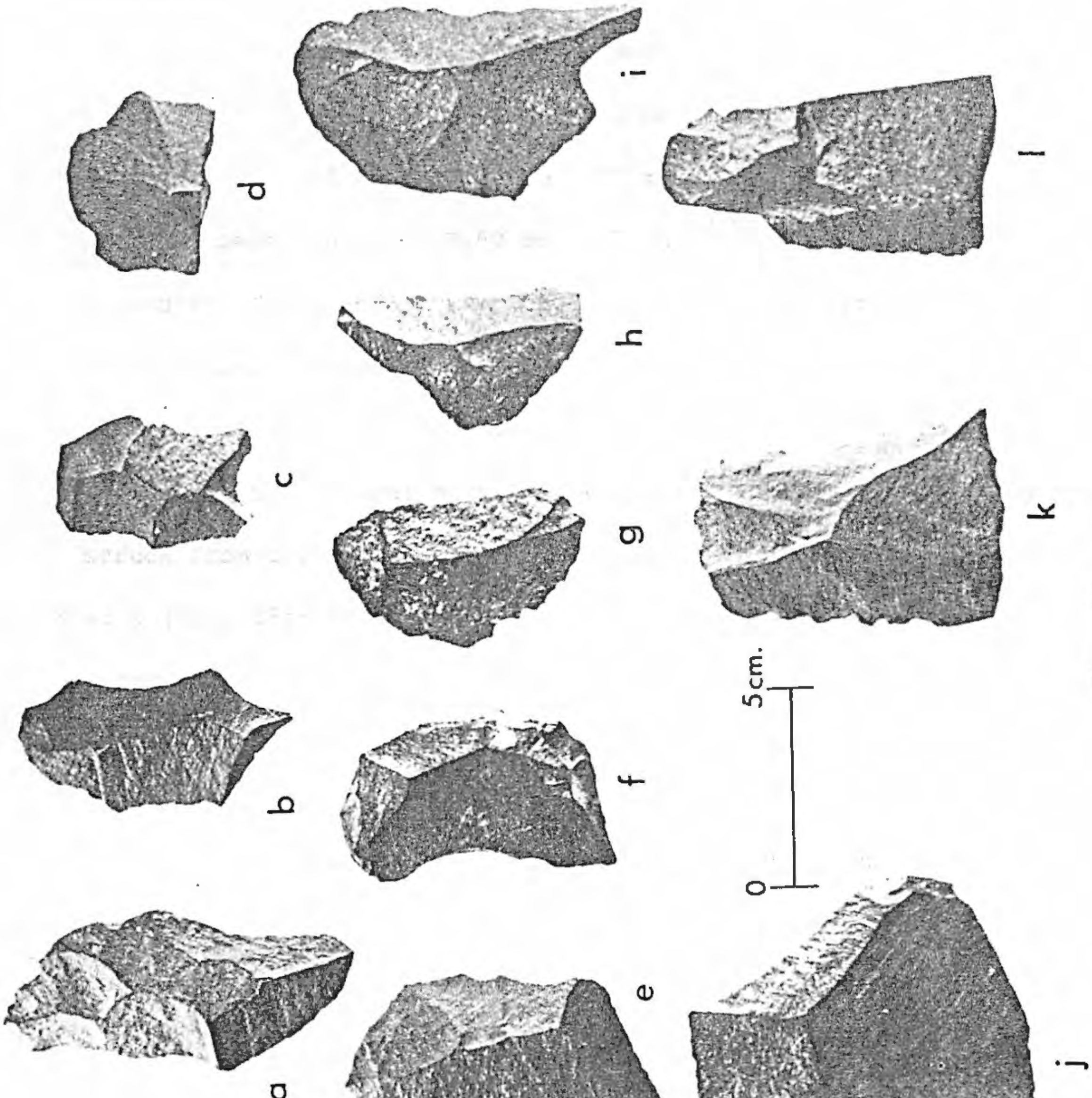


Fig. 27

Distal ridge truncation flakes (Fig. 28*h*-*k*):

*Material:* Basalt

*No. of specimens:* 2

*Dimensions:*

| | *Range* | *Mean* |
|---|---|---|
| Length | 76 mm - 82.00 mm | 79 mm |
| Width | 15 mm - 30.25 mm | 19 mm |
| Thickness | 6 mm - 8.50 mm | 7 mm |

*Comments:* The platform remnant is located on the proximal end of two distal ridge truncation flakes indicating that they were struck from the lateral margin of the core while two exhibit platform remnants located on the lateral margin of the flake indicating that they were struck from the distal end of the core.

B blades (Fig. 27*j*-*l*):

*Material:*

*No. of specimens:*

*Dimensions:*

| | *Length* | *Width* | *Thickness* |
|---|---|---|---|
| No. 1 | 108 mm | 88 mm | 11 mm |
| No. 2 | 78 mm | 56 mm | 11 mm |

*Comments:* The platform remnant is located on the lateral margin of one B blade indicating that it was struck from the lateral margin of the core. The other B blade has been modified and it is difficult to determine whether it is side or end struck.

Corner removal blades (Fig. 28*l*-*m*):

*Material:* Basalt

*No. of specimens:* 2

Fig. 28.--Additional Cascade Technique Flake and Blade Forms

*a-g* C blades, platform remnants oriented to the top of the page

*h-k* distal ridge truncation flakes; *h* and *i* platform remnants up; *j* and *k* platform remnants oriented to the left

*l-m* corner removal blades, platform remnants oriented to the left

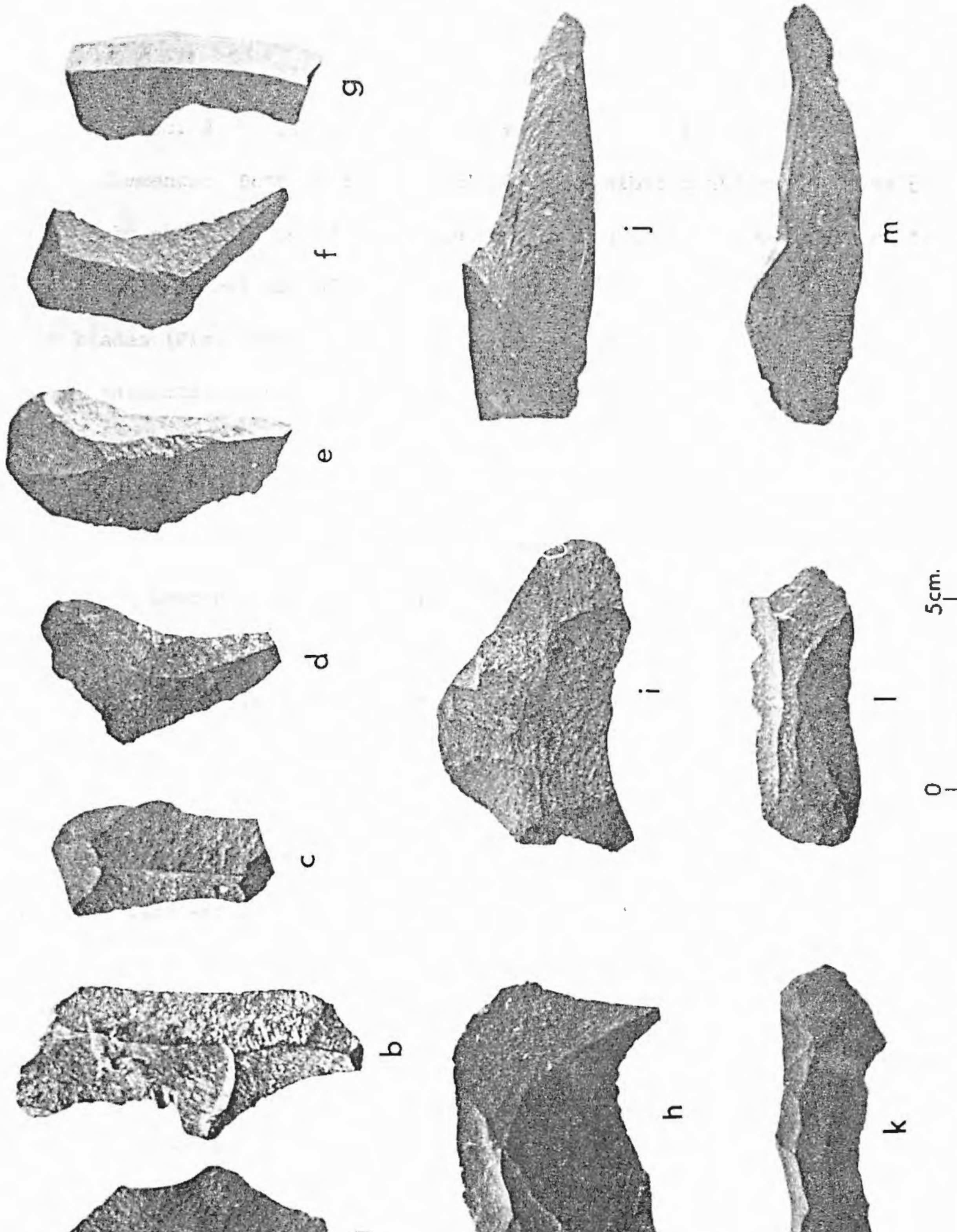


Fig. 28

*Dimension:*

| | Length | Width | Thickness |
|---|---|---|---|
| No. 1 | 112 mm | 44 mm | 17 mm |
| No. 2 | 112 mm | 34 mm | 12 mm |

*Comments:* Both corner-removal blades exhibit platform remnants on the proximal end of the blade, indicating that they were struck from the proximal end of the core.

C blades (Fig. 28*a*–*g*):

*Material:* Basalt

*No. of specimens:* 7

*Dimensions:*

| | Range | Mean |
|---|---|---|
| Length | 60 mm - 94 mm | 74.29 mm |
| Width | 28 mm - 40 mm | 31.71 mm |
| Thickness | 5 mm - 8 mm | 6.71 mm |

*Comments:* All seven C blades exhibit platform remnants located on the proximal end of the blade indicating that they were struck from the proximal end of the core.

Levallois-like artifacts which appear to have been manufactured on Cascade Technique flake and blade forms:

Unifacial implements (Fig. 29*a*–*c*):

*Material:* Basalt

*No. of specimens:* 6

*Dimensions:*

| | Range | Mean |
|---|---|---|
| Length | 62 mm - 123 mm | 87.16 mm |
| Width | 32 mm - 60 mm | 48.67 mm |
| Thickness | 5 mm - 18 mm | 14.83 mm |

Fig. 29.--Implements Which Appear To Have Been Manufactured on Cascade Technique Flake and Blade Forms

*a-c* unifacial implements which appear to have been manufactured on small primary flakes

*d-f* lanceolate projectile points which appear to have been manufactured on A or C blades

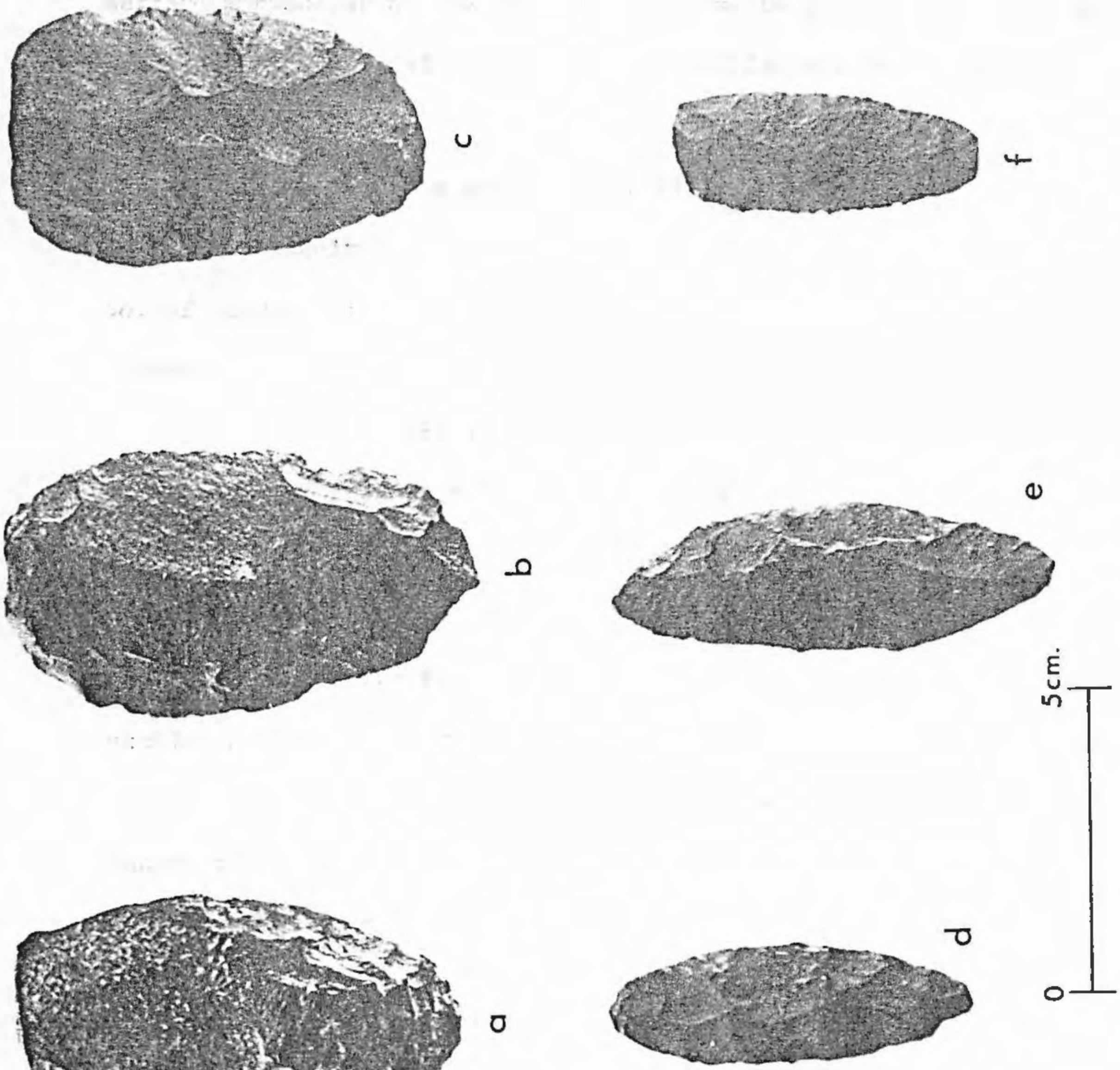


Fig. 29

*Comments:* Five of the six unifacial implements have been modified into scraper-like tools and lack platform remnants. Modification has been limited primarily to the margins and it is still possible to determine the approximate orientation of the platform. The dorsal and ventral surface morphology of the unifacial implements suggest that they may have been manufactured on relatively small Cascade Technique end struck primary flakes.

Small lanceolate projectile points (Fig. 29*d-f*):

*Material:* Basalt

*No. of specimens:* 3

*Dimensions:*

| | *Range* | *Mean* |
|---|---|---|
| Length | 52 mm - 74 mm | 58.66 mm |
| Width | 20 mm - 26 mm | 22.67 mm |
| Thickness | 5 mm - 6 mm | 5.33 mm |

*Comments:* The three small projectile points are triangular in cross section and exhibit a ridge running longitudinally down the medial portion of the implement. These small projectile points may have been manufactured on A or C blades which are also triangular in cross section and possess a ridge running longitudinally down the medial portion of the blade.

### *Discussion of the Levallois-like Lithic Assemblage Recovered from the Stockhoff Site*

The Levallois-like flake and blade forms recovered from the Stockhoff site are morphologically very similar to those characteristic of the Cascade Technique (Muto 1976). However, there are technological differences which must be discussed. The majority of the flake and blade forms recovered from the

Stockhoff site exhibit acute platform remnants which are technologically identical to the platform remnants occurring on biface thinning flakes discussed in Chapter 4. I have personally examined Levallois-like flake and blade forms recovered from Cascade components in a site along the Lower Snake River, namely 45WT31 (Leonhardy 1970), 45GA61 (Leonhardy et al. 1971) and 45WT108 (Hammet 1977). The platform remnants exhibited on the flake and blade forms recovered from these sites are much less acute than are the flake and blade forms from the Stockhoff site. In many instances the platform angle on the flake and blade forms from the river may approach 90°. The reasons for the differing platform morphologies are unknown. However, a hypothesis which might lead to an explanation of the variation observed between the assemblages follows.

According to Muto (1976:vi) the Cascade Technique is a definitive attribute of the Cascade Phase of the Lower Snake River region. The lithic raw material which was most readily available to Cascade flintknappers occupying sites along the Lower Snake River was relatively small basalt talus blocks and small basalt cobbles derived from alluvial gravels. The Levallois-like reduction system, the Cascade Technique was particularly well suited to the reduction of this type of lithic material. The desired products of this reduction system were the flake and blade forms from which implements were manufactured. Once the desired flake and blade forms were obtained the expended bifacially reduced core could be discarded or used an an implement. In any case, the bifacial core was secondary. At the Stockhoff site the opposite appears to have been the case. The large bifacial cores were the desired product, while smaller implements were secondary. Assuming that the aboriginals utilizing the lithic raw material at the Stockhoff site were Cascade folk knowledgeable in the Cascade Technique, one might expect the following: a redirection of the Cascade Technique to the manufacture of large bifaces while at the quarry. A redirection of the trajectory of the Cascade Reduction

System would require no major change in the technique itself. The redirection of the trajectory would simply involve a change in the emphasis of the flint-knapper from the flake and blade forms to the core or biface. The flintknapper would proceed as usual using the ridges produced by the removal of a primary or A blade to guide the removal of the next flake. By altering the platform angle to that of a biface thinning flake, and following the ridges produced by previous removals, the flintknapper could predictably remove large thin flakes. The resulting flake would possess the dorsal morphology of the Cascade Technique flake and blade forms, however, the platform remnant would resemble that of a biface thinning flake. The resulting flake and blade forms would be secondary to the biface, but could still be used in the manufacture of smaller implements.

According to Bense (1972:57) the Levallois-like, or Cascade Technique, is the characteristic lithic technology of the Cascade Phase. The forty-five Levallois-like cores, flake and blade forms, and implements recovered from the Stockhoff site represent less than 2% of the total lithic sample. If the Stockhoff site is, in fact, a Cascade site, as the data suggests, why is the Levallois-like assemblage so poorly represented at the site? An answer to this question cannot be given at this time; hcwever, a hypothesis is presented which might lead to an explanation of this problem. MacDonald (1971:34) notes that there are two types of lithic technologies, "restrictive" and "indulgent" technologies. According to MacDonald, groups of people at some distance from a lithic resource area engage in a restrictive technology, while those groups at or in close proximity to a lithic resource area would engage in an indulgent technology. Judge (1974:124), in discussing MacDonald's concepts in relation to Paleo Indian lithic technologies, notes that both restrictive and indulgent technologies can be engaged in by a single group of people at different points in space and time.

The Cascade Technique could in some way be considered a restrictive technology. While lithic raw material was available along the Lower Snake River, it does not appear to have been abundant, and what was available was small in size and of relatively poor quality. The small talus blocks and river cobbles were probably difficult to reduce. The Cascade Technique appears to have been particularly well-suited to the reduction of this material. The Cascade reduction system provided the Cascade flintknapper with a technique with which he could efficiently and economically exploit what might have otherwise been an unexploitable resource. In this sense, the Cascade Technique is a restrictive technology which was adapted to a particular lithic resource.

At the Stockhoff site high quality lithic raw material was extremely abundant. The large fine grained tabular cobbles characteristic of the site were and are technologically easy to deal with. No special core preparation is necessary in order to obtain large flakes. The flintknapper could simply strike one cobble against another until the desired flake or flakes were obtained. At the Stockhoff site the Cascade Technique would not have provided the flintknapper with a technological advantage; in fact, the time spent in core preparation would have been wasted if the desired flake could be obtained more easily using another technique such as block on block reduction (Crabtree 1972:48).

The data suggest that an "indulgent technology" unlike the normal Cascade Technique was used at the Stockhoff site. This does not mean that the Cascade Technique was not used at the quarry, for it is evidenced by the Levallois-like cores which were recovered. The point to be made here is that because of the nature of the Stockhoff site, the Cascade Technique was not needed. The Cascade Technique appears to have been used infrequently at the Stockhoff site and in some instances redirected towards the manufacture of large bifaces.

# CHAPTER 8

## DESCRIPTION OF NON-BIFACIAL IMPLEMENTS

Elongated unifacial implements (Fig. 30 and 31):

*Material:* Basalt

*No. of complete specimens:* 32

*No. of fragments:* 37

*Dimensions:* Length measurements were taken along the longitudinal axis. Width measurements were taken at right angles to the longitudinal axis. Thickness measurements were taken at the thickest point on the implements. Dimensions apply to complete implements only.

| | *Range* | *Mean* |
|---|---|---|
| Length | 90 mm - 258 mm | 139.29 mm |
| Width | 32 mm - 136 mm | 66.43 mm |
| Thickness | 8 mm - 41 mm | 18.14 mm |

*Description:* Plàne view and cross section. Eight of the elongated unifacial implements exhibit symmetrical biconvex outlines and symmetrical plano-convex cross sections. Twenty-four of the unifacial implements exhibit asymmetrical biconvex margins with one margin being more convex than the other. The cross sections exhibited by these unifaces are asymmetrical plano-convex. The asymmetrical cross section is due to the relatively steep retouch occurring along one margin of the uniface.

*Dorsal and ventral surface morphology:* The dorsal and ventral surface morphology exhibited by the unifacial implements indicates that they have been manufactured on large flakes.

Fig. 30.--Elongated Unifacial Implements

*a-c* dorsal survace view, polish occurs along both margins of these implements

*d-e* ventral surface view

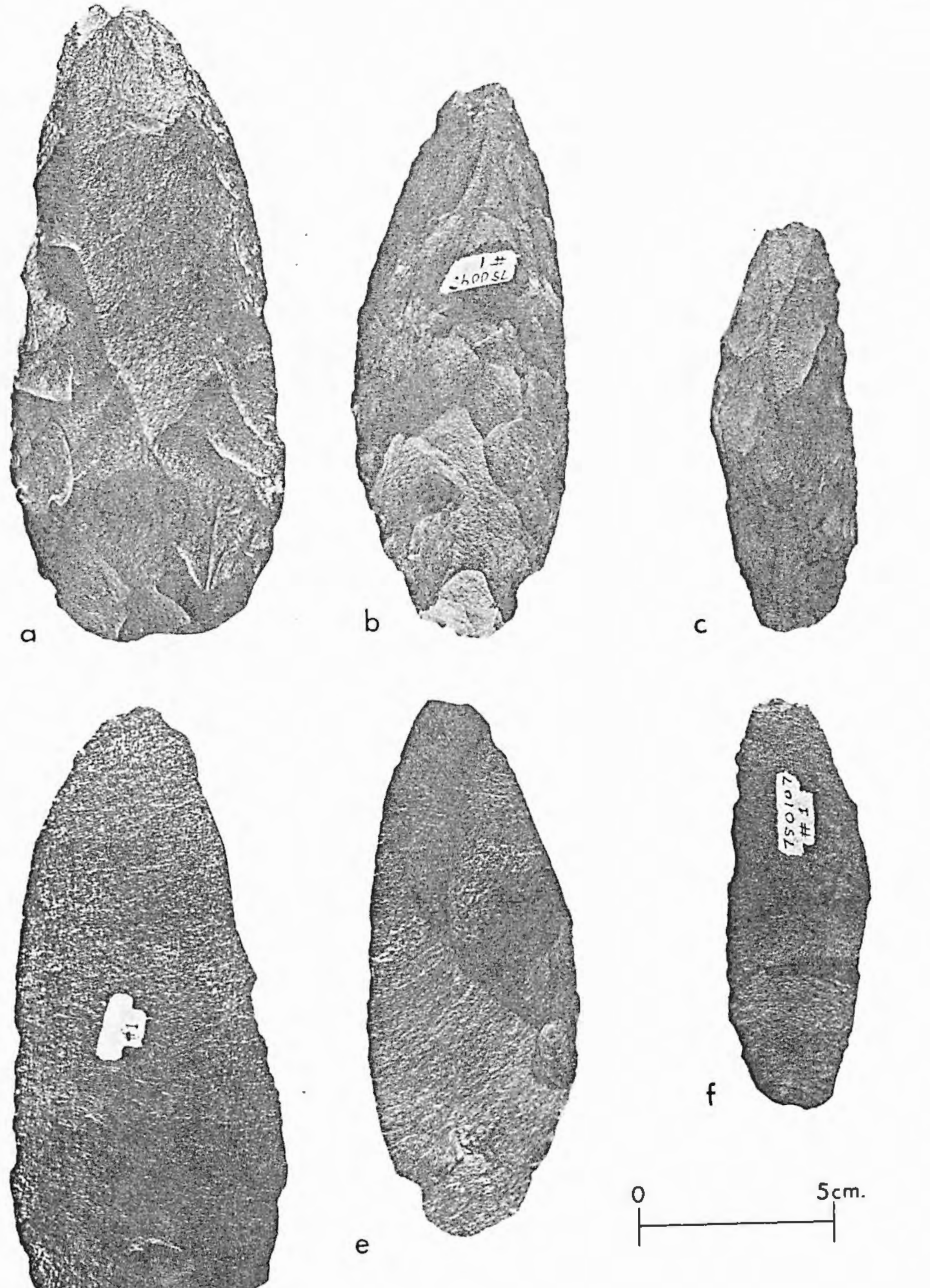


Fig. 30

Fig. 31.--Additional Elongated Unifacial Implements

*a-b* dorsal surface view, note cortex and steep retouch along right lateral margin of both implements. On these implements high point polish occurs primarily on the less steeply retouched margin.

*c-d* ventral surface views

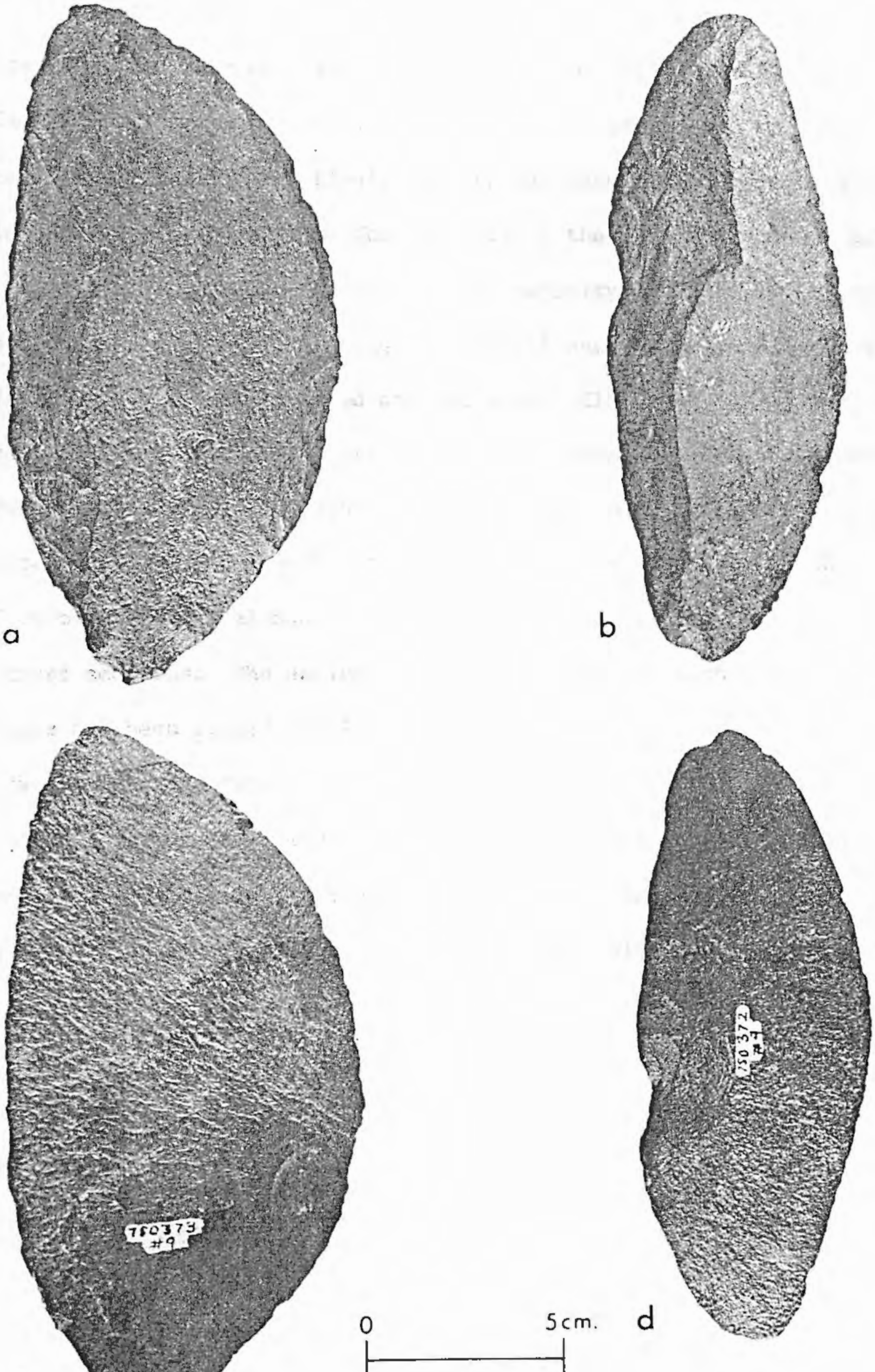


Fig. 31

*Ventral surface morphology:* The ventral surface of the majority of the elongated unifaces is relatively unmodified. Modification of the ventral surface when it occurs is usually limited to the removal of the bulb of force. Because of the relatively unmodified state of the ventral surface, it is possible to approximate the location of the platform remnant prior to removal. The platform remnants of the majority of these implements appear to have been located along the lateral margin, suggesting that the unifaces have been manufactured on side struck flakes.

*Dorsal surface morphology:* Cortex covers approximately 40% of the dorsal surface of 18 of the 24 elongated unifacial implements exhibiting asymmetrical outlines and cross sections. Cortex does not occur on the dorsal surface of the eight elongated unifaces exhibiting symmetrical outlines and cross sections. The entire dorsal surface of the eight symmetrical unifaces has been flaked, while only the margins of the dorsal surface of the twenty-four asymmetrical unifaces has been modified. The asymmetrical elongated unifaces have been steeply retouched along one margin and only minimally retouched along the other margin. What appears to be fine retouch occurs on one or both margins of asymmetrical unifaces and 7 symmetrical unifaces. Under 1x magnification polish is evident on arrises created by the small intersecting retouch flake scars. Polish occurs on 6 symmetrical unifaces and on 7 asymmetrical unifaces. The polish occurs along portions of both margins of the symmetrical unifaces. The asymmetrical unifaces also exhibit polish on both margins, however it occurs only sporadically along the steeply retouched margins. On both symmetrical and asymmetrical unifaces, the majority of the polish occurs on the dorsal portion of the margin.

*Comments:* Semenov (1970:83-91) notes that polish can result from both cutting and scraping activities. The morphology and edge angles exhibited by both activities. The morphology and edge angles exhibited by both symmetrical and asymmetrical unifaces suggest that they would be functional as either scrapers or knives and could have, and probably did, function as both. Regardless of the exact function of the unifaces, the polish indicates that they have been used. The unifaces probably were used by the Cascade folk in carrying out daily subsistence activities while at the Stockhoff site.

*Comparison:*

Ruebelmann 1971, Fig. 22*b–d;* Fig. 23*e–h*

Waren et al. 1971, Fig. 9*e–h;* Fig. 10*a–d*

Edge-ground cobbles and hammer stones (Fig. 32):

Nine cobble implements were recovered in surface collection at the Stockhoff site. Eight specimens appear to have functioned both as grinding or abrading implements and hammer stones, and are dealt with here under a single heading. The ninth implement shows signs of battering but shows no evidence of edge modification.

*Material:* Alluvial cobbles of quartzite and andesitic basalt.

*No. of specimens:*

| | |
|---|---|
| Quartzite | 3 specimens |
| Andesitic basalt | 5 specimens |
| Green stone | 1 specimen |

*Dimensions:* Length measurements were taken along the longitudinal axis, width measurements were taken at right angles to the longitudinal axis, thickness measurements were taken at thickest point on the cobble.

| | *Range* | *Mean* |
|---|---|---|
| Length | 122 mm - 206 mm | 149.00 mm |
| Width | 66 mm - 118 mm | 95.7 mm |

Fig. 32.--Edge-Ground Cobbles and Hammer Stones

*a-b* hammer stones and edge modified cobbles

*c* hammer stone only

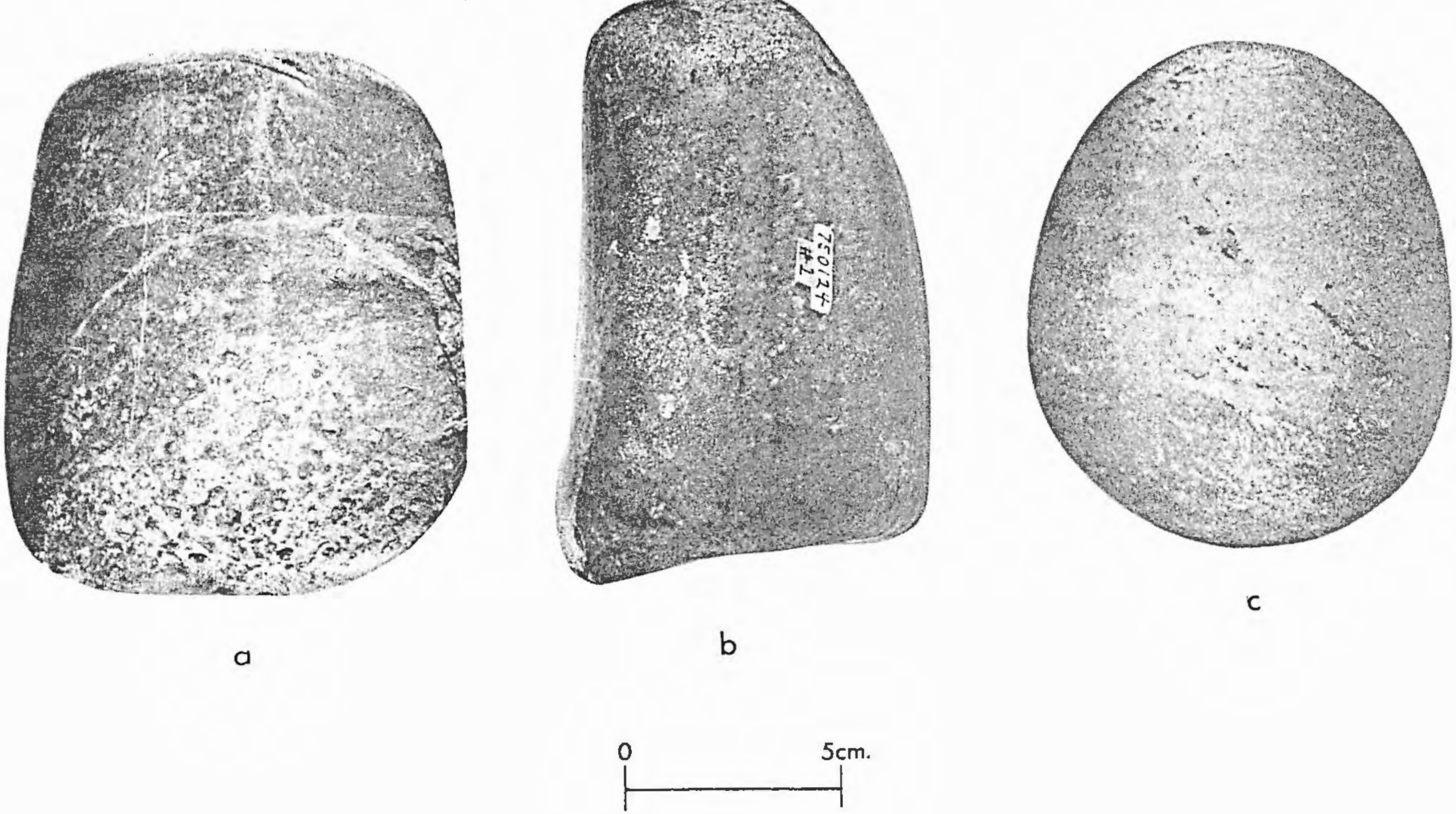


Fig. 32

*Dimension (cont.):*

| | *Range* | *Mean* |
|---|---|---|
| Thickness | 30 mm - 51 mm | 40.0 mm |
| Weight | 123.4 g - 400.4 g | 837.7 g |

*Description:* One of the specimens exhibits signs of battering only and does not appear to have been used in grinding or abrading operation. The remaining eight specimens exhibit signs of both grinding or abrading and battering. Signs of grinding are limited to the edges of the cobbles. With one exception grinding has not been extreme on any of the cobble implements. The exception is a quartzite cobble exhibiting extensive grinding and polishing along one margin.

Signs of battering occur on the ends of the cobbles, along the edges in conjunction with grinding, and on their faces near the margin as well as in the center of the face of the cobble. Signs of battering are most extreme when they occur on the edges of the cobbles.

*Comments:* Cobbles and hammer stones are composed of material well-suited for the initial stages of biface manufacture. The cobbles are relatively heavy and as hard or harder than the lithic raw material occurring at the Stockhoff site. Decortication and initial reduction of flakes and cobbles would require the use of hammer stones such as these.

*Discussion:* According to Leonhardy (1970:9) edge-ground cobbles are one of the hallmark artifacts of the Cascade Phase. The occurrence of edge-ground cobbles in association with Cascade components is well documented in the written prehistory of the Plateau; however, the function of edge-ground cobbles in Cascade components is less well understood. Numerous uses for edge-ground cobbles have been proposed, such as the preparation of root crops such as camas(Butler 1965:1127) and the preparation of hides

(Lewis 1944:336-8). At the Stockhoff site, edge-ground cobbles may have been used in a manner unlike either of those suggested above. The cobbles recovered from the Stockhoff site exhibit grinding as well as battering. They were recovered from the surface of lithic workshop areas in direct association with large amounts of basalt chipping waste. It is my belief that the grinding and battering exhibited by these cobbles can be attributed to the manufacture of the basalt bifaces characteristic of the Stockhoff site. The localized battering occurring on the cobbles is technologically identifical to the battering characteristic of hammer stones, both aboriginal and experimental. The grinding which occurs on the edges of the cobbles could be produced in grinding the striking platforms during biface manufacture. Many of the large Class 3 biface thinning flakes recovered from the Stockhoff site exhibit heavily ground platform remnants. Continued grinding on the edge of a large basalt biface could easily produce the ground edges occurring on the cobbles.

I do not mean to imply that all edge ground cobbles were used as platform abraders and hammer stones, only that the edge modified cobbles recovered from the Stockhoff site appear to have been used in this manner.

Anomalous implements (Fig. 33):

*Material:* Basalt

*No. of specimens:* 2

*Dimensions:*

| | *Length* | *Width* | *Thickness* |
|---|---|---|---|
| No. 1 | 370 mm | 94 mm | 31 mm |
| No. 2 | 150 mm | 60 mm | 19 mm |

*Description:* Both implements have been manufactured on flakes and exhibit cortex on approximately 40% of their dorsal surface. The initial ventral

Fig. 33.--Anomalous Implements

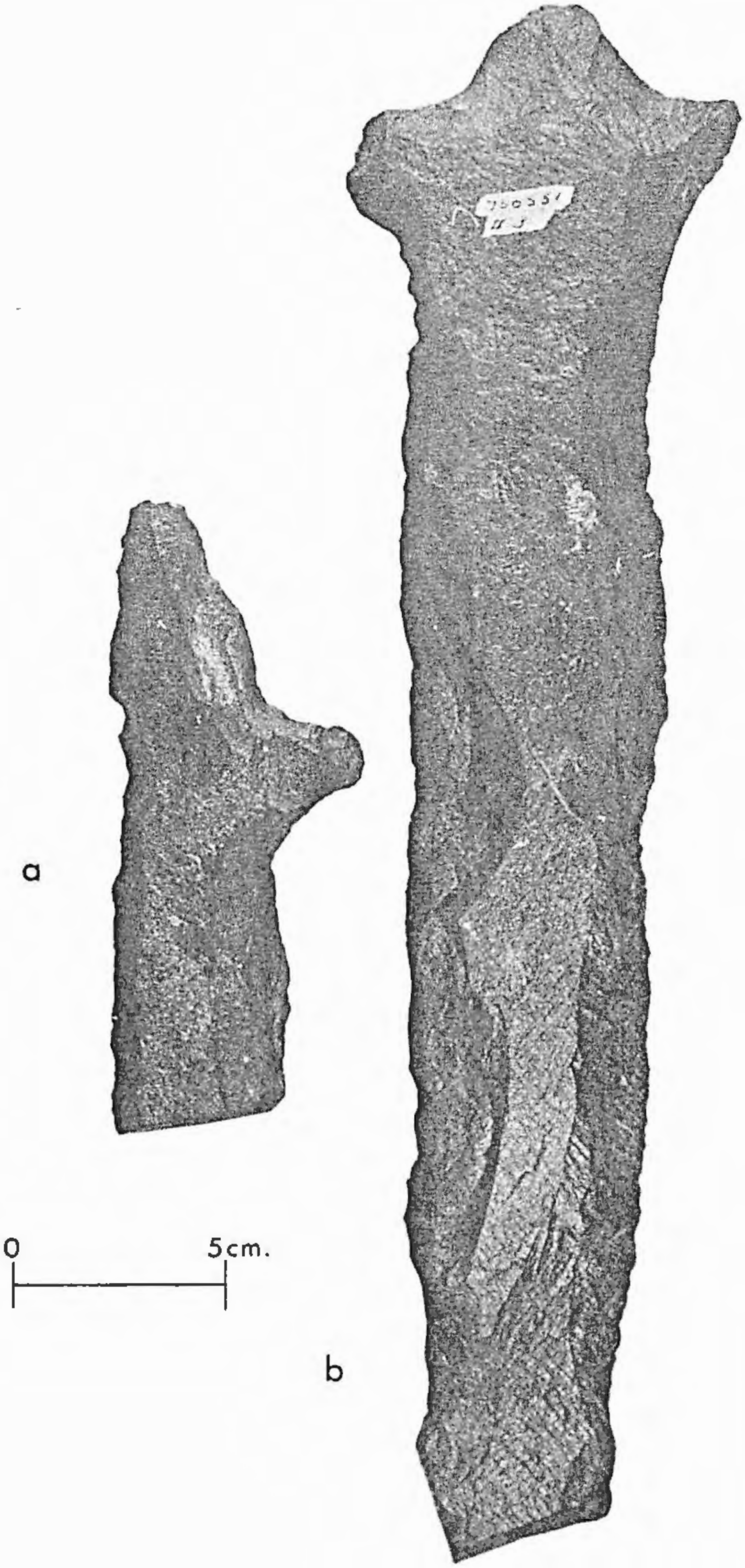


Fig. 33

face of the flake covers approximately 40% of the ventral surface of both implements. The outlines of the implements appears to have been obtained by steeply retouching the entire margin creating an edge characterized by a series stacked step fractures.

*Comments:* Implements such as these, while they do not fit into any known manufacturing system at the Stockhoff site, have been reported at other quarry sites (Holmes 1919:158). Whether these implements are meant to be tools or simply a form of doodling in stone is unknown at this time.

# CHAPTER 9

# CONCLUSIONS

The objective of this investigation was two-fold: (1) to place the Stockhoff site within the chronological framework of Plateau prehistory, and (2) to provide an adequate description of the technology reflected in the basalt implements and chipping detritus. It is my belief that this investigation has been successful in accomplishing these objectives.

Data gained in excavation and analysis of the implements and chipping detritus indicate that the Stockhoff site served as a major source of lithic raw materials for approximately 4000 years. The occurrence of Cascade-like implements below a Mazama tephra deposit suggests that the Stockhoff site may have been occupied by 8000 B.P. With few exceptions, the implements from both the surface and the excavation appear to represent a single homogeneous lithic component. This component bears a strong technomorphological resemblance to Cascade lithic components recovered from sites along the Lower Snake River, suggesting Cascade folk occupying the sites along the Snake River may have been responsible for the manufacture of Cascade-like implements occurring at Stockhoff site. The apparent lack of late prehistoric cultural materials in the excavation and on the surface suggests that utilization of the site's lithic resources ceased by approximately 4000 B.P.

Surface collection and excavation at the Stockhoff site resulted in the accumulation of 671 implements and over 4000 pieces of chipping detritus. Preliminary analysis revealed that 70% of the implements were bifaces representing various stages of manufacture in a biface reduction system. The application of the biface reduction stage concept to the Stockhoff biface materials resulted in the formulation of four stages of manufacture. A lithic replication experiment involving the replication of a large basalt biface revealed that a biface did in fact pass through four sequential stages of reduction technomorphologically similar to those formulated by myself. The biface replication experiment resulted in the production of chipping detritus technologically identical to that recovered in excavation and surface collection. This indicates that the chipping detritus recovered from the site was probably produced in the manufacture of bifaces. The experiment also revealed that chipping waste can be related to stages of biface manufacture. By comparing the chipping waste recovered in the excavation with that generated in the replication experiment, I was able to determine that the terrace on which the excavation is located served as a secondary reduction area.

The occurrence of Levallois-like core, and flake and blade forms indicates that the Cascade Technique was employed at the quarry. The relatively low frequency of occurrence of Cascade Technique materials in what appears to be a relatively homogeneous Cascade lithic component suggest that this technique is a restrictive technology. The Cascade Technique appears to be adapted to the reduction of the lithic material characteristic of the Lower Snake River region.

It is important to note that this investigation is by no means the final archaeological statement on the Stockhoff site. The excavation was limited to a very small portion of the site. Surface collection and site survey were limited to the property of the Wilson Cattle Company which by no means represents the true extent of the site.

The thesis represents a limited investigation of an area which is otherwise archaeologically unknown. The data gained in analysis of the lithic implements and chipping detritus and the placement of the Stockhoff site within the chronological framework of Plateau prehistory should represent a significant contribution to the written prehistory of the southern Columbia Plateau.

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# APPENDIX A

# GLOSSARY

# GLOSSARY[1]

| | |
|---|---|
| Acuminate: | Taper-pointed; tapering gradually to the tip, e.g., perforator, acuminate bulb. |
| Attribute of Technology: | Techniques having diagnostic values which show modes of manufacture, characteristic traits, and patterns of human behavior. Example - fluting. |
| Billet: | A club-like rod of material, other than stone, used to detach flakes from lithic material. Usually of wood or antler. See baton. |
| Blank: | A usable piece of lithic material of adequate size and form for making a lithic artifact - such as unmodified flakes of a size larger than the proposed artifact, bearing little or no waste material, and suitable for assorted lithic artifact styles. The shape or form of the final product is not disclosed in the blank. A series of objects in the early stages in the manufacturing process before the preform is reached. |
| Bulb of Applied Force: | The bulbar part on the ventral side at the proximal end of a flake. The remnant of a cone part, the result of the applica- of either pressure or percussion force. Commonly called the "bulb of percussion," however, this signifies only one group of specialized techniques. Since the bulb of force is produced by both pressure and percussion, the term "bulb of applied force" should be used until the manufacturing technique is verified. Synonym - Cone of Force. |
| Compression Rings: | Ripple rings radiating from the point of force. Can be both positive and negative - positive on the flake and blade; and negative on the core. Can be compared to ripples formed in a pool of still water after the dropping of a pebble. Compression rings are generally more prominent with percussion than with pressure. Direction of force. Wave motion. |
| Debitage: | Residual lithic material resulting from tool manufacture. Useful to determine techniques and for showing technological traits. Represents intentional and unintentional breakage of artifacts either through manufacture or function. Debitage flakes usually represent the various stages of progress of the raw material from the preform to the finished stage. Blank. Original form. |

[1]Definitions of terms taken from Muto (1971:123-126).

**Eraillure Flake:** An enigmatic flake formed between the bulb of force and the bulbar scar. Usually adheres to the core in the bulbar scar. The eraillure flake, itself, leaves no scar on the core. The dorsal side of the eraillure flake bears no compression rings but the ventral side of the eraillure flakes does bear compression rings that match the scar left on the bulb of force. The eraillure flake is convex, concave - example: Mendel lens. (Menicus)

**Fissures:** Lines of radii usually originating at the margins of the flakes on ventral face and directed toward the point of force. Fissures are not cracks, but are crests and troughs. The appearance of fissures on the bulb of force usually indicates that a percussion technique was used. Fissures are also known as hackles. Synonym - Groved shatter lines. (W. Mayer Oakes, Frechette)

**Flake:** Any piece of stone removed from a larger mass by the application of force - either intentional, accidentally, or by nature. A portion of isotrophic material having a platform and bulb of force at the proximal end. The flake may be of any size or dimension, depending on which technique was used for detachment. See spall, thinning flake, chips.

**Grinding:** A dual-purpose preparation technique. Weakens a plane surface and strengthens a rounded surface. Accomplished by grinding the platform, core top, or margins of artifacts with an abrasive stone.

**Lithic:** Derived from the Greek word "lithos" = stone. Pertaining to stone.

**Objective Piece:** Flake core or artifact being formed by various flaking techniques.

**Percussor:** An implement used for striking. Includes hammers, hammerstones, or billets.

**Platform:** The table, or surface area, receiving the force necessary to detach a flake or blade. Can be either natural or prepared. The truncation of the cone part.

**Platform Preparation:** The grinding, polishing, faceting, beveling, of that part of the platform to receive the applied force. Usually done to strengthen the platform in order to carry off a larger flake. See also, "turning the edge," grinding, polishing, faceting, beveling.

**Preform:** Pre = prefix denoting priority, first. Form, from the Latin "forma" = to shape. Preforming denotes the first shaping, i.e., blank. Preform is a unfinished, unused form of the proposed artifact. It is larger than, and without the refinement of, the completed tool. It is thick, with deep bulbar scars, has irregular edges, and no means of hafting. Generally made by direct percussion. Not to be confused with a "blank."

Step-fracture: A flake or flake scar that terminates abruptly in a right angle break at the point of truncation. Caused by a dissipation of force or the collapse of the flake.

Technological Attributes: Techniques which have diagnostic value showing modes of manufacture, characteristic traits, and patterns of human behavior.

Ventral: Plano side, or inner surface of flake or blade. The under surface.

Vitreous: Having the near luster and texture of glass.

# APPENDIX B

# SOIL PROFILE DESCRIPTION

# SOIL PROFILE DESCRIPTIONS[2]

| Geological Units | Horizon Designation | Description |
|---|---|---|
| 1 | Apl | 0-7 cm Black (10YR2/1, dry) silt loam, strong fine platy parting to very fine granular; slightly hard, slightly sticky, slightly plastic; many fine roots; abrupt smooth boundary; to |
| 1 | Ap2 | 7-13 cm Black (10YR2/1, dry) silt coatings on ped exterior, dark gray (10Hr4/1, dry) ped interiors, silt loam mixed with < 1% pebbles; fine subangular blocky, parting to fine granular; slightly hard, slightly sticky, slightly plastic; many fine roots; < 2% weathered basalts sand occurring as patchy intramatrix, morphons; patchy silt coating on morphons; abrupt wavy boundary; to |
| 1 | Ah | 13-20 cm Black (10YR2/1, moist) silt coatings on peds, dark gray (10YR4/1, dry) silt loam; fine angular blocky, friable, slightly hard, slightly sticky, slightly plastic; common fine roots; many, very fine tubular pores; patchy weathered basalt sand, pebbles, and cobble fragments; basalt flakes with long axis parallel to lower boundary; many black (10YR2/1, moist) worm casts; abrupt wavy boundary;to |
| 1 | AB | 20-28 cm Black (10YR2/1, moist) silt loam very dark gray (10YR4/1, dry) medium fine prismatic, parting to medium angular blocky; hard, firm, sticky, plastic; <5% flakes and cobble fragments; abrupt smooth boundary; to |
| 1 | Btl | 28-41 cm Black (10YR2/1, moist) silty clay loam very dark gray (10YR4/1, dry); strong fine prismatic, parting to strong fine angular blocky; hard, firm, sticky, plastic; few fine roots; few fine tubular |

[2]This profile description follows the conventions of the 1975 Soil Survey Manual.

| Geological Units | Horizon Designation | Description |
|---|---|---|
| | | and vesicular pores collectively; < 1% worm burrows 5 mm in diameter; < 1% fine to coarse basaltic sand evenly dispersed throughout soil, matrix; clear smooth boundary; to |
| 1 | Bt2 | 41-60 cm Black (10YR2/1, moist) ped surfaces, very dark gray (10YR3/1, dry) ped exteriors with patchy gray (10YR4.5/1, dry) coats, brown (10YR5/3, dry) ped interiors, silty clay loam; weak fine prismatic parting to medium fine subangular blocky; hard, firm, sticky, plastic; few fine roots, few fine tubular and vesicular pores collectively; < 3% fine basaltic sand evenly distributed throughout soil matrix; low boundary marked by flakes and pebbles oriented with longitudinal axis parallel to lower boundary; very abrupt wavy boundary; to |
| 2 | 2Bt3b | 60-75 cm Dark brown (10YR3/3, moist) ped exterior, brown (10YR5/3, moist) ped interior, light yellowish brown (10YR6/3, dry) ped exterior, very pale brown (10YR7/3, dry) ped interior, clay loam; strong, medium blocky parting to 25% strong fine angular blocky and 75% subangular blocky; hard, firm sticky plastic; few fine roots, few fine tubular pores; < 1% fine basaltic sand; 30% distinct common, thin, clay films coating ped surfaces and sand particles; very abrupt wavy boundary; to |
| 3 | 3Bt4b | 75-86 cm Very dark grayish brown (10YR3/2, moist) ped exterior, brown (10YR5/3, dry) ped exterior, clay loam; strong, medium, prismatic, parting to strong, medium and fine angular, blocky; hard firm sticky, plastic; very few, fine roots, adhering to ped surfaces; very few fine tubular pores; 3% fine to very coarse sand distributed throughout matrix; lower boundary marked by basalt flakes oriented at various angles; very abrupt wavy boundary; to |
| 4 | 4Bulb | 86-90 cm Very pale brown (10YR7/3, dry) Mazama volcanic ash, silt loam; strong fine and very fine angular blocky parting |

| *Geological Units* | *Horizon Designation* | *Description* |
|---|---|---|
| | | to weak, fine, platy; hard, friable, non-sticky, non-plastic; few very fine roots in cracks; few very fine tubular pores; ash tongues sporadically into underlying unit, very abrupt irregular, wavy boundary; to |
| 4 | 5Bu2b | 90-102 cm Dark yellowish brown (10YR3/4, moist) ped exterior, pale brown (10YR6/3, dry) ped exterior, clay loam; strong, medium, prismatic, parting to strong, fine angular, blocky, peds follow and are perpendicular to overlying unconformity; hard, firm, sticky plastic; very few, very fine roots adhering to ped surfaces, very few very fine tubular pores; 2-3% fine to coarse basaltic sand distributed throughout matrix; lower boundary marked by pebbles and basalt flakes oriented at various angles; abrupt wavy boundary; to |
| 5 | 5Bt5b | 102-133 cm Very dark grayish brown (10YR3/2, moist) ped exteriors, pale brown (10YR6/3, dry) distinct continuous clay coats on ped exteriors, clay loam; strong, medium, prismatic, parting to strong, fine, prismatic, parting to weak very fine angular blocky; hard, firm, sticky, plastic; few fine roots adhering to ped surfaces; 2-3% fine to coarse basaltic sand, basalt flakes, pebbles, and rocks uniformly distributed throughout unit; abrupt smooth boundary; to |
| 6 | 6Bt6b | 133-176 cm Very dark grayish brown (10YR3/2, moist) clay loam, pale brown (10YR6/3, dry); strong medium prismatic parting to strong fine and medium angularly blocky; very few very fine roots adhering to ped surfaces, very few very fine tubular pores filled with clay films; < 2% $MnO_2$ stains on ped surfaces; 2-3% fine to coarse basaltic sand uniformly distributed throughout unit; very abrupt smooth boundary; to |

| *Geological Units* | *Horizon Designation* | *Description* |
|---|---|---|
| 7 | 7BC1b | 176-190 cm Dark brown (10YR3/3, moist) silt loam, brown (10YR5/3, dry); weak, medium, prismatic, parting to weak, medium, fine subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; 10% fine, to very coarse, basaltic sand adhering to ped surfaces, all sand grains on ped surfaces coated by clay skins, medium to coarse sand in cracks not coated by clay skins; prismatic structure disappearing near lower boundary of unit; diffuse smooth boundary; to |
| 7 | 7BC2b | 190-208 cm Dark grayish brown (10YR4/2, moist) silt loam, pale brown (10YR6/3, dry); structureless to weak medium subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; very few very fine roots, many very fine tubular pores with silt filling pores; clear, smooth boundary; to |
| 8 | 7Cb | 208-285 cm end Dark brown (10YR3/3, moist) gravelly silt loam, pale brown (10YR6/3, dry); massive parting to weak, very fine, subangular blocks; slightly hard, friable, slightly sticky, slightly plastic; many fine pores; base of unit marked by 40-50% well-rounded gravels and cobbles collectively. |